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# Climate change and the Law of the Sea Convention

Master thesis  
30 credits (30 ECTS)

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Master's Programme in Maritime Law

Fourth Semester

# Contents

<b>SUMMARY</b>	<b>4</b>
<b>PREFACE</b>	<b>5</b>
<b>ABBREVIATIONS</b>	<b>6</b>
<b>1 INTRODUCTION</b>	<b>8</b>
<b>2 CLIMATE CHANGE</b>	<b>12</b>
2.1 Causes of climate change	13
2.2 Observed climate change	15
2.2.1 <i>Global warming</i>	15
2.2.2 <i>Sea level rise</i>	18
2.3 Projections on climate change	19
2.3.1 <i>Physical impact of sea level rise on island nations</i>	21
2.3.2 <i>Impact of sea level rise on State sovereignty</i>	23
2.4 Conclusion	26
<b>3 CLIMATE CHANGE AND THE LAW OF THE SEA CONVENTION</b>	<b>27</b>
3.1 Rules relevant to the application and interpretation of the Law of the Sea Convention	30
3.1.1 <i>Lex posterior and lex specialis</i>	30
3.1.2 <i>Climate change law and the doctrine of self-contained regimes</i>	31
3.1.2.1 The self-contained regime doctrine	32
3.1.2.2 Climate change law and the self-contained regime test	33
3.1.3 <i>Conclusion</i>	35
3.2 Interpretation of the definition of pollution of the marine environment in the context of climate change	35
3.2.1 <i>The sources of pollution of the marine environment</i>	36
3.2.1.1 Carbon dioxide	36
3.2.1.2 Thermal energy	37
3.2.2 <i>The effects of pollution of the marine environment</i>	39
3.2.2.1 From carbon dioxide	39
3.2.2.2 From thermal energy	40
3.2.3 <i>Conclusion</i>	41

<b>4</b>	<b>MITIGATING CLIMATE CHANGE THROUGH THE LAW OF THE SEA CONVENTION</b>	<b>42</b>
4.1	Obligations to prevent climate change	43
4.1.1	<i>The obligation to protect and preserve the marine environment</i>	43
4.1.2	<i>The “No-harm” rule</i>	44
4.2	Settlement of disputes	46
4.3	Jurisdiction and standing	49
4.4	Reparations	52
4.5	Conclusion	55
<b>5</b>	<b>CONCLUSION</b>	<b>57</b>
	<b>SUPPLEMENT A</b>	<b>61</b>
	<b>SUPPLEMENT B</b>	<b>62</b>
	<b>SUPPLEMENT C</b>	<b>63</b>
	<b>SUPPLEMENT D</b>	<b>65</b>
	<b>BIBLIOGRAPHY</b>	<b>66</b>
	<b>TABLE OF CASES</b>	<b>70</b>
	<b>TREATIES AND INTERNATIONAL INSTRUMENTS</b>	<b>72</b>
	<b>OTHER SOURCES</b>	<b>74</b>

# Summary

This thesis analyzes climate change from an international law perspective and seeks to demonstrate how the provisions pertaining to the protection and preservation of the marine environment embodied in the United Nations Law of the Sea Convention (“UNCLOS”), coupled with those relating to the compulsory settlement of disputes, can be of use in tackling the climate crisis.

We begin by presenting the science of climate change, in particular its causes, effects and the projections of the Intergovernmental Panel on Climate Change concerning carbon dioxide emissions, global warming and sea level rise. We continue with an analysis of the rules relevant to the interpretation and application of UNCLOS to climate change, with special attention given to the definition of pollution of the marine environment and how said definition relates to climate change. Finally, our research concludes with a study of the obligations said Convention imposes to avert anthropogenic interference with the climate system and what can be done to enforce them.

# Preface

## TUVALU AND GLOBAL WARMING<sup>1</sup>

*Jane Resture*

I hear the waves on our island shore  
They sound much louder than they did before  
A rising swell flecked with foam  
Threatens the existence of our island home.

A strong wind blows in from a distant place  
The palm trees bend like never before  
Our crops are lost to the rising sea  
And water covers our humble floor.

Our people are leaving for a distant shore  
And soon Tuvalu may be no more  
Holding on to the things they know are true  
Tuvalu my Tuvalu, I cry for you.

And as our people are forced to roam  
To another land to call their home  
And as you go to that place so new  
Take a little piece of Tuvalu with you.

Tuvalu culture is rare and unique  
And holds a message we all should seek  
Hold our culture way up high  
And our beloved Tuvalu will never die.

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<sup>1</sup> J Resture 'Tuvalu and Global Warming' available at [http://www.janeresture.com/oceania\\_warming1/index.htm](http://www.janeresture.com/oceania_warming1/index.htm) (last visited 8 February 2010).

# Abbreviations

°C	Degree Celsius
AOSIS	Association of Small Island States
CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon dioxide
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
COP15	15 <sup>th</sup> Conference of the Parties to the United Nations Framework Convention on Climate Change, held at Copenhagen from 7-19 December 2009
GDP	Gross Domestic Product
GESAMP	IMCO <sup>2</sup> /FAO/UNESCO/WMO/IAEA/UN Joint Group of Experts on the Scientific Aspects of Marine Pollution
GHG	Greenhouse gas
H <sub>2</sub> CO <sub>3</sub>	Carbonic acid
ICJ	International Court of Justice
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
ITLOS	International Tribunal for the Law of the Sea
GtCO <sub>2</sub> -eq	Giga ton of carbon dioxide equivalent

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<sup>2</sup> In 1982, the name of the Inter-Governmental Maritime Consultative Organization (“IMCO”) was changed to the International Maritime Organisation (“IMO”).

N <sub>2</sub> O	Nitrous Oxide
ppb	Parts per billion
ppm	Parts per million
SRES	Special Report on Emissions Scenarios published in 2000 by the IPCC
UN	United Nations Organisation
UNCLOS	United Nations Convention on the Law of the Sea
UNCLOS III	Third United Nations Conference on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	General Assembly of the United Nations Organisation
VCLT	1969 Vienna Convention on the Law of Treaties

# 1 Introduction

*“We don’t have hills or mountains. All we have is coconut trees. If the industrial countries don’t consider our crises, our only alternative is to climb up in the coconut trees when the tide rises.”*<sup>3</sup>

Back in 1972, when representatives of all nations met in Stockholm to discuss ways to protect and enhance the human environment, great political will permitted the adoption of a declaration which today embodies numerous principles of international environmental law and has served as inspiration in the drafting of treaties,<sup>4</sup> declarations<sup>5</sup> and judgments.<sup>6</sup> To date however, while we prepare to commemorate the 40<sup>th</sup> anniversary of the Stockholm Declaration,<sup>7</sup> pleas against environmental degradation from States such as Kiribati,<sup>8</sup> the Maldives<sup>9</sup> and Tuvalu<sup>10</sup> still dissipate into the atmosphere as if they were greenhouse gases.

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<sup>3</sup> K Talake, Former Prime Minister of Tuvalu, in RC Paddock ‘Tuvalu’s Sinking Feeling’ in *Los Angeles Times* (4 October 2002) available at <http://articles.latimes.com/2002/oct/04/world/fg-tuvalu4> (last visited 29 January 2010).

<sup>4</sup> Among others, the United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 10 November 1994) 1833 UNTS 3 (hereinafter referred to interchangeably as “UNCLOS” or the “Law of the Sea Convention”); United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) 1771 UNTS 107; Convention on Environmental Impact Assessment in a Transboundary Context (adopted 25 February 1991, entered into force 10 September 1997) 1989 UNTS 309.

<sup>5</sup> Examples include the Rio Declaration on Environment and Development (14 June 1992) in ‘Report of the United Nations Conference on Environment and Development’ (1 January 1993) A/CONF.151/26/REV.1 (VOL.I) 3 and the Charter of Economic Rights and Duties of States UNGA RES 3281 (XXIX) (12 December 1974).

<sup>6</sup> See, *inter alia*, *Legality of the Threat or Use of Nuclear Weapons Advisory Opinion* [1996] ICJ Rep 226; *Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court’s Judgment of 20 December 1974 in the Nuclear Tests (New Zealand v France) Case (Dismissal Order of 22 September 1995)* [1995] ICJ Rep 288; *Southern Bluefin Tuna Cases (New Zealand v Japan; Australia v Japan) (Provisional Measures Order of 27 August 1999)* ITLOS Cases Nos 3 and 4; *The ‘MOX Plant’ Case (Ireland v United Kingdom) (Provisional Measures Order of 3 December 2001)* ITLOS Case No 10; *Case concerning Land Reclamation by Singapore in and around the Straits of Johor (Malaysia v Singapore) (Provisional Measures Order of 8 October 2003)* ITLOS Case No 12.

<sup>7</sup> Declaration on the United Nations Conference on the Human Environment (16 June 1972) A/CONF.48/14/REV.1, 3 (hereinafter referred to as “Stockholm Declaration”).

<sup>8</sup> Office of the President of the Republic of Kiribati ‘Press Release Kiribati – the face of climate change’ (14 December 2009) available at <http://www.climate.gov.ki/Press%20release%20Government%20of%20the%20Republic%20of%20Kiribati%20-%20COP15%20-%202014%20December%202009.pdf> (last visited 1 February 2010); A Tong, President of the Republic of Kiribati, Statement at the General Debate of the 64<sup>th</sup>

In December 2009, one hundred and nineteen heads of state or government,<sup>11</sup> together with the delegations of all parties to the United Nations Framework Convention on Climate Change (“UNFCCC”), gathered in Copenhagen to discuss the drafting and adoption of a successor to the Kyoto Protocol.<sup>12</sup> Such an unprecedented attendance of world leaders was accompanied by thousands of representatives from non-governmental, intergovernmental and international organisations; city mayors; members of parliament; local government representatives; observers; students; reporters; “globalophobics”; environmental activists and citizens from all corners of the world. It was without a doubt the largest conference ever organized in Denmark and probably in the world, proving mankind is demanding serious government action against anthropogenic climate change.

Despite the long hours devoted by leaders such as Gordon Brown, José Manuel Barroso, Yvo de Boer, Felipe Calderón, Ban Ki-Moon, Luiz Inácio da Silva, Dmitry Medvedev, Angela Merkel, Fredrik Reinfeldt, José Luis Rodríguez Zapatero, Kevin Rudd and Nicolas Sarkozy, many believe “Hopenhagen” resulted rather in “Flophenhagen”, with the concerns of those States most affected by climate change left unattended. While the 15<sup>th</sup> Conference of the Parties to the UNFCCC (“COP15”) may have saturated the air in Copenhagen with hope, unlike the unhealthy concentrations of carbon dioxide in the atmosphere, the parts per million of optimism were rapidly scattered with the adoption of the non-legally binding and lax

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Session of the United Nations General Assembly (25 September 2009) available at [http://www.un.org/ga/64/generaldebate/pdf/KI\\_en.pdf](http://www.un.org/ga/64/generaldebate/pdf/KI_en.pdf) (last visited 1 February 2010).

<sup>9</sup> M Nasheed, President of the Maldives, Statement to the Joint High-level segment of COP15 and CMP5 in Copenhagen (16 December 2009) available at <http://www.presidentymaldives.gov.mv/4/?ref=1,6,2873> (last visited 29 January 2010).

<sup>10</sup> A Ielemia, Prime Minister and Minister of Foreign Affairs and Labour for Tuvalu, Statement at the General Debate of the 64<sup>th</sup> Session of the United Nations General Assembly (26 September 2009) available at [http://www.un.org/ga/64/generaldebate/pdf/TV\\_en.pdf](http://www.un.org/ga/64/generaldebate/pdf/TV_en.pdf) (last visited 29 January 2010).

<sup>11</sup> Secretariat of the UNFCCC ‘Press Release - Copenhagen United Nations Climate Change Conference ends with political agreement to cap temperature rise, reduce emissions and raise finance’ (19 December 2009) available at [http://unfccc.int/files/press/news\\_room/press\\_releases\\_and\\_advisories/application/pdf/pr\\_cop15\\_20091219.pdf](http://unfccc.int/files/press/news_room/press_releases_and_advisories/application/pdf/pr_cop15_20091219.pdf) (last visited 16 April 2010).

<sup>12</sup> The Kyoto Protocol sets the greenhouse gas reductions targets that the parties to it have to meet by the period from 2008 to 2012. No precise targets exist for after this period. See Kyoto Protocol to the United Nations Framework Convention on Climate Change (adopted 11 December 1997, entered into force 16 February 2005) 2303 UNTS 148.

Copenhagen Accord.<sup>13</sup> Although this Accord highlighted the importance of reducing carbon dioxide emissions, its wording, coupled with the moderate success of the Kyoto Protocol,<sup>14</sup> suggests that industrialized States are still hesitating to accept the catastrophic nature of the path which our quest for growth has carved and thus, grave consequences will be unavoidable. This results in great frustration for the islands most threatened by sea level rise, as they realize future generations will not be able to enjoy life on the land of their ancestors.<sup>15</sup> In fact, in 2002, conscious of the grim future of his island and in response to Australia and the United States' refusal to adhere to the commitments they pledged at Kyoto, the then Prime Minister of Tuvalu, Koloa Talake, announced he would seek climate justice at the World Court.<sup>16</sup>

Inspired by the Koloa Talake's position and in view of the insufficient efforts most States are taking to tackle the climate crisis, the thesis herein presented suggests taking the debate on climate change from the Conference of the Parties to the UNFCCC (COP) to a compulsory dispute settlement mechanism, hoping this way to encourage big polluters to act. We are confident that the principles of sovereign equality of States and good neighbourliness embodied in the Charter of the United Nations<sup>17</sup> and translated into provisions of environmental law in the 1982 Law of the Sea Convention,<sup>18</sup> set the legal base for obliging States to avert dangerous anthropogenic interference with the climate system and will demonstrate through this analysis why and what can be done to enforce them. We have

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<sup>13</sup> Copenhagen Accord (18 December 2009) Decision -/CP.15 available at [http://unfccc.int/files/meetings/cop\\_15/application/pdf/cop15\\_cph\\_auv.pdf](http://unfccc.int/files/meetings/cop_15/application/pdf/cop15_cph_auv.pdf) (last visited 3 February 2010).

<sup>14</sup> See M Jáen 'Protecting the Oceans from Climate Change: An Analysis of the Role of Selected International Instruments on Resources and Environmental Protection in the Context of UNCLOS' (2006) 21 *Ocean Yearbook* 91, 122.

<sup>15</sup> See British Broadcasting Corporation 'Greatest Debate on Earth' Intervention of Mohamed Nasheed, President of the Maldives (broadcasted 17 December 2010) available at <http://www.bbc.co.uk/programmes/p005czrj> (last visited 12 February 2010).

<sup>16</sup> Reuters 'Tiny Tuvalu Sues United States Over Rising Sea Level' (29 August 2002) available at <http://www.tuvaluislands.com/news/archived/2002/2002-08-29.htm> (last visited 29 January 2010).

<sup>17</sup> See Charter of the United Nations Organisation (adopted in San Francisco 26 June 1945, entered into force 24 October 1945) available at <http://www.un.org/aboutun/charter/> (last visited 10 May 2010) Preamble and Arts 1 and 2.

<sup>18</sup> See UNCLOS (n4) Part XII.

decided to focus on UNCLOS because it is a multilateral instrument of near global adherence concerned with, *inter alia*, the prevention, reduction and control of marine pollution and has the advantage of enshrining compulsory dispute settlement procedures that entail binding decisions.<sup>19</sup> However, we are also conscious that, on the one hand, scientific uncertainties pertaining to the effects of climate change<sup>20</sup> as well as issues relating to causality and attribution make a claim for damages difficult to construct, and on the other, that the United States of America is not a party to the Convention.

Despite the novelty and delicacies of the topic, much has already been written and it would only foment controversy or confusion to attempt to address all its obstacles. We shall therefore limit the scope of this research to presenting the facts on climate change and how UNCLOS can be interpreted and applied to it. We commence by presenting the science of climate change based on the findings of the Intergovernmental Panel on Climate Change (“IPCC”), in particular, the causes of climate change, its effects and the projections of the this panel concerning carbon dioxide emissions, global warming and sea level rise. The second part centres on the rules relevant to the interpretation and application of UNCLOS, with special attention given to the definition of *pollution of the marine environment* and how said definition relates to climate change. This thesis will thereby demonstrate that the provisions contained in the Law of the Sea Convention can and should be used to mitigate climate change, with the ultimate purpose of contributing to the work and arguments of the many international lawyers who might one day plead the case of a drowning nation at an international tribunal. To support this analysis we will use the sources of international law as enunciated in article 38 of the Statute of the International Court of Justice (“ICJ”).<sup>21</sup>

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<sup>19</sup> See UNCLOS (n4) Part XII and Part XV, Section 2.

<sup>20</sup> Considering that representatives of 194 States get together each year at the COP to discuss ways to mitigate and adapt to climate change and that these acknowledge the current climate change crisis to be a problem resulting from human activity, the thesis herein presented supposes moot the debate on whether it is a natural phenomenon or not. It accepts however, in unison with the Intergovernmental Panel on Climate Change, that much uncertainty exists concerning its specific consequences.

<sup>21</sup> Statute of the International Court of Justice (adopted in San Francisco 26 June 1945, entered into force 24 October 1945) available at <http://www.icj-cij.org/documents/>

## 2 Climate change

*“The threat is real and serious, and is of no difference to a slow and insidious form of terrorism against us.”<sup>22</sup>*

The fact that our planet has witnessed 4.5 billion years of climate change could lead one to wonder why the sudden commotion about it. In order to understand what is happening and why the issue of climate change requires urgent attention, a brief summary of the history of the Earth is helpful.

When our planet was born, surface temperatures were so high that rocks were liquid and water was only found in the atmosphere, along with the great quantities of carbon dioxide (“CO<sub>2</sub>”) constantly spewed by volcanoes.<sup>23</sup> The greenhouse effect<sup>24</sup> was more intense back then and by far compensated for the 30% weaker luminosity produced by the Sun at this early stage of its existence.<sup>25</sup> With time (seven hundred million years), the Earth cooled down and the first rocks formed, followed by the condensation of the atmosphere’s water vapour and a great deluge that flooded the Earth to a depth in the region of 3.2 kilometres.<sup>26</sup> Large quantities of CO<sub>2</sub> dissolved with the rain, thereby reducing the greenhouse effect. This was further accelerated around 3.5 billion years ago when life appeared, for among the first organisms were single-celled photosynthetic algae which, like plants today, transformed CO<sub>2</sub> into oxygen.<sup>27</sup> About a billion years later, as a result of the reduction of CO<sub>2</sub> concentrations in the atmosphere, much of the radiation from the Sun was allowed to escape back into space

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[index.php?p1=4&p2=2&p3=0](#) (last visited 16 April 2010). “Article 38 of the Statute of the ICJ is generally regarded as a complete statement of the sources of international law.” I Brownlie *Principles of Public International Law* (Oxford U Press New York 2003) 5.

<sup>22</sup> S Sopoanga, Former Prime Minister of Tuvalu, Statement at the 58th Session of the United Nations General Assembly (24th September 2003).

<sup>23</sup> See C Cumo ‘Earth’s Climate History’ in G Philander (ed) *Encyclopedia of Global Warming and Climate Change 1* (Sage Publications 2008) 337, 337.

<sup>24</sup> The greenhouse effect is a natural system that regulates the temperature on Earth, as the gases in the atmosphere trap the Sun’s radiation. An increase in heat trapping gases such as CO<sub>2</sub> and methane enhances this effect and thus warms the planet. See V Grover ‘Greenhouse effect’ in G Philander (ed) *Encyclopedia of Global Warming and Climate Change 2* (Sage Publications 2008) 470, 470.

<sup>25</sup> See C Cumo ‘Earth’s Climate History’ (n23) 338.

<sup>26</sup> See C Cumo ‘Earth’s Climate History’ (n23) 338.

<sup>27</sup> See C Cumo ‘Earth’s Climate History’ (n23) 338.

and thus, the temperatures on Earth dropped to produce the first ice age, a period which lasted roughly three hundred million years.<sup>28</sup> During the following billion years the Sun grew brighter and the glaciers retreated, bringing the Earth to a warm and temperate era which this time went into present day, albeit the numerous shorter cold and warm cycles during the last billion years.<sup>29</sup> We will not go into the details and causes of each cycle; suffice it to say that the various ice ages that ensued lasted usually in the order of tens of millions of years, with interglacial periods of over one hundred million years until the Cenozoic Ice Age (starting one million years ago), during which glaciations of one hundred thousand years alternated with warm cycles of ten thousand years.<sup>30</sup> Important to bear in mind, in addition to the length of these cycles, is that between a warm period and an ice age, temperature on Earth varied only between 4°C and 7°C,<sup>31</sup> thus hinting that not much is needed to drastically change life as we know it on our planet.

The above is crucial to underline the time the many transformations in our planet's climate system have taken. Climatologists speak of billions, millions and thousands of years, while the issue of global warming heralded today relates to a period spanning a bit over one century. And while climate change is usually a natural phenomenon owing to astronomical, atmospheric and terrestrial circumstances,<sup>32</sup> today's change, as we shall now turn to see, is mostly anthropogenic and is occurring at a rate that will not allow the world's fauna and flora to adapt.

## 2.1 Causes of climate change

The IPCC has conducted an extensive analysis on the causes and consequences of climate change. We base our study on the findings of the IPCC simply because they represent the “scientific truth about climate

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<sup>28</sup> See C Cumo 'Ice Ages' in G Philander (ed) *Encyclopedia of Global Warming and Climate Change 2* (Sage Publications 2008) 519, 519.

<sup>29</sup> See C Cumo 'Earth's Climate History' (n23) 338.

<sup>30</sup> See C Cumo 'Ice Ages' (n28) 520.

<sup>31</sup> See E Jansen *et al* '2007: Palaeoclimate' in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 433.

<sup>32</sup> See C Cumo 'Ice Ages' (n28) 519.

change.”<sup>33</sup> The IPCC does not conduct any scientific research of its own: the circa 25,000 scientists that form the Panel review all research conducted on the topic of climate change and produce combined syntheses of such research so that policymakers may make informed decisions.<sup>34</sup> Their analysis therefore also includes scientific studies that question the existence of climate change, its impacts or its relationship with human activities. We further acknowledge the importance of the work of the IPCC because governments, who are also the members of the Panel, endorse its findings.<sup>35</sup>

At the centre of the debate on climate change is whether it is an anthropogenic or natural phenomenon. The IPCC has reached the conclusion that it is to a larger extent product of human activities and directly linked to increased emissions of greenhouse gases (“GHG”).<sup>36</sup> Through observations of ice cores at the Earth’s poles, scientists have been able to obtain a picture spanning many thousands of years over the concentration of different GHGs in the atmosphere.<sup>37</sup> They found for example that concentrations of CO<sub>2</sub> were low during the ice ages (approximately 190ppm) while they increased during the interglacial periods (up to about 280ppm).<sup>38</sup> However, with industrialization global atmospheric concentrations of GHGs such as of CO<sub>2</sub>, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) have drastically increased. Related studies indicate that “[t]he rate of change is dramatic and unprecedented; increases in CO<sub>2</sub> never exceeded 30ppm in one thousand years, yet now CO<sub>2</sub> has risen by 30ppm in just the last 17 years.”<sup>39</sup>

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<sup>33</sup> R Verheyen *Climate Change Damage and International Law* (Martinus Nijhoff Boston 2005) 20.

<sup>34</sup> See IPCC ‘Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports’ (adopted 18 April 1999) available at <http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a.pdf> (last visited 9 February 2010) (hereinafter referred to as “IPCC Procedures”).

<sup>35</sup> See IPCC Procedures (n34) Art 4.

<sup>36</sup> International Panel on Climate Change ‘Climate Change 2007: Synthesis Report – Summary for Policymakers’ (17 November 2007) available at [www.ipcc.ch](http://www.ipcc.ch) (last visited 28 January 2010) (hereinafter referred to as “IPCC Summary for Policymakers”) 5.

<sup>37</sup> IPCC Summary for Policymakers (n36) 5.

<sup>38</sup> See E Jansen (n31) 449.

<sup>39</sup> KL Denman *et al* ‘2007: Couplings Between Changes in the Climate System and Biogeochemistry’ in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 499, 512.

The increase in CO<sub>2</sub> concentrations is not only a result of society's high dependency on, and consumption, of fossil fuels but also of deforestation, which reduces the Earth's ability to transform the CO<sub>2</sub> found in the atmosphere into oxygen (a non-greenhouse gas).<sup>40</sup> According to the Millennium Development Goals Report for 2009, approximately 13 million hectares of forest are cut down every year, an area roughly equivalent to the size of Bangladesh.<sup>41</sup> The excessive burning of fossil fuel and clearing of forests has intensified the greenhouse effect by increasing the atmosphere's capacity to absorb thermal radiation and, consequently, has initiated a transformation of our planet's climate system, which in turn will have profound effects on the Earth's geography.

## 2.2 Observed climate change

### 2.2.1 Global warming

*Global warming* refers to an increase in the average temperature of the Earth.<sup>42</sup> A warming trend is visible in temperature records derived from measurements taken daily on land and at sea, coupled with those obtained from satellites and scientific stations in Antarctica.<sup>43</sup> While these help to tag the climate crisis with numbers, rising temperatures are evident from looking at the increased average sea level; thawing of permafrost; widespread melting of snow and ice; retreat of glaciers; reduced duration of sea, river and lake ice; and overall diminished snow cover in the Northern Hemisphere.<sup>44</sup>

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<sup>40</sup> See H Le Treut *et al* '2007: Historical Overview of Climate Change' in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of the Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 93, 97 and 115.

<sup>41</sup> See United Nations Organisation 'The Millennium Development Goals Report 2009' available at [http://www.un.org/millenniumgoals/pdf/MDG\\_Report\\_2009\\_ENG.pdf](http://www.un.org/millenniumgoals/pdf/MDG_Report_2009_ENG.pdf) (last visited 12 February 2010) 43.

<sup>42</sup> See N Benson and R Palmer 'Global Warming' in G Philander (ed) *Encyclopedia of Global Warming and Climate Change 2* (Sage Publications 2008) 456, 456.

<sup>43</sup> See KE Trenberth *et al* '2007: Observations: Surface and Atmospheric Climate Change' in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 235, 252.

<sup>44</sup> See KE Trenberth (n43) 252 and P Lemke *et al* '2007: Observations: Changes in Snow, Ice and Frozen Ground' in S Solomon *et al* (eds) *Climate Change 2007: The Physical*

Alarming figures estimated by the IPCC indicate that in the last century, global surface temperature rose by an average of 0.74°C, with the years from 1995 to 2006 as the warmest since 1850.<sup>45</sup> Warmer conditions are evident with the earlier start of the spring season as well as with the migration of vegetation and animals towards greater latitudes.<sup>46</sup> Shifts in ranges not only affect land species, but also marine and freshwater systems.<sup>47</sup> With the changing ocean temperatures, off the coasts of Chile for example, swordfish, sea turtles and swarms of jellyfish previously unknown to these waters are now invading.<sup>48</sup>

As temperatures rise it is understandable that ice and snow melt. If we can understand that minute variations in temperature can change a “white Christmas” into a grey and rainy one, then it is easy to imagine why the 0.74°C rise has resulted in what satellite data available since 1978 shows to be a 2.7% decrease per decade in sea ice extent.<sup>49</sup> Global warming also provokes an increase of water vapour in the atmosphere, which not only enhances the greenhouse effect, but also affects precipitation patterns. Because precipitation relies on evaporation, which in turn depends on available moisture or water sources, the effects vary from one region to another. Therefore, the regions where the amount of rainfall has increased are usually where temperatures have also escalated most. Conversely, in drier regions the effects have been perhaps more troublesome, with a decrease in precipitation resulting in the heightened incidence and severity of droughts.<sup>50</sup> In fact, the extent of arid regions on Earth has more than

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*Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 337, 376-377.

<sup>45</sup> See KE Trenberth (n43) 252.

<sup>46</sup> See IPCC Summary for Policymakers (n36) 2 and KE Trenberth (n43) 252.

<sup>47</sup> See N Mimura *et al* ‘2007: Small islands’ in ML Parry *et al* (eds) *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press UK 2007) 687, 700; IPCC Summary for Policymakers (n36) 2 and UN MDGs (n41) 44.

<sup>48</sup> See K Go ‘New species moving into Chilean waters because of climate change’ in *Mercopress* (29 January 2010) available at <http://en.mercopress.com/2010/01/29/new-species-moving-into-chilean-waters-because-of-climate-change> (last visited 12 February 2010).

<sup>49</sup> See IPCC Summary for Policymakers (n36) 2.

<sup>50</sup> See KE Trenberth (n43) 262.

doubled since 1970.<sup>51</sup> A warmer climate has consequently increased both drought as well as flooding probabilities, depending on whether a region is dry or humid from the outset.<sup>52</sup>

In addition to the above deleterious effects of climate change, the IPCC also found that human activities have “*likely*”<sup>53</sup> contributed to changes in wind patterns, affecting extra-tropical storm tracks and temperature patterns, [while] *more likely than not*<sup>54</sup> increased risk of heat waves, area affected by drought since the 1970s and frequency of heavy precipitation events.”<sup>55</sup> As an example of the latter, the IPCC estimates that human influence more than doubled the risk of having a summer in Europe as hot as the one that claimed the lives of many in 2003.<sup>56</sup> Rising temperatures in sea surface have also made storms longer and more intense since the mid-1970s, thereby increasing the potential destructiveness of hurricanes and similar phenomena.<sup>57</sup>

If there appears to be scepticism concerning our planet’s warming trend, after seeing some of the concrete effects the IPCC has enumerated, according to some analysts, such scepticism can only stem from manufactured uncertainties sponsored by industries and politicians reluctant to change, reluctant to accept the “inconvenient truth”.<sup>58</sup> State practice shows, however, that the international community *has* accepted the harmful relationship between human activities and the climate system and that developed nations are responsible for the high concentrations of GHG in the atmosphere.<sup>59</sup> Our introduction to the environmental challenge we all face

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<sup>51</sup> See P Forster *et al* ‘2007: Changes in Atmospheric Constituents and in Radiative Forcing’ in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 129, 308.

<sup>52</sup> See KE Trenberth (n43) 262.

<sup>53</sup> With more than 66% probability. See “Supplement A”.

<sup>54</sup> With more than 50% probability. See “Supplement A”.

<sup>55</sup> IPCC Summary for Policymakers (n36) 6.

<sup>56</sup> See GC Hegerl *et al* ‘2007: Understanding and Attributing Climate Change’ in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press) 664, 696.

<sup>57</sup> See P Forster (n51) 308 and H Le Treut (n40) 105.

<sup>58</sup> See O Pilkey and R Young *The Rising Sea* (Island Press Washington D.C. 2009) 81.

<sup>59</sup> See UNFCCC (n4) Preamble and in general, the content of the debates at the COPs.

now turns to consider one of the most evident and threatening consequences of climate change: sea level rise.

## 2.2.2 Sea level rise

With the advances and retreats of ice, the average sea level has shifted to a greater or lesser extent ever since the great deluge gave birth to our oceans almost four billion years ago. The numerous ice ages made the sea level drop while their retreat moved the shorelines landward. Because the human populations that existed were nomadic, they could easily adapt to the varying tides (even if these were actually imperceptible to neighbouring generations) and were able to use them to their advantage as they migrated from Asia to the American continent, but also onto many of the Pacific islands, including modern Papua New Guinea and Australia.<sup>60</sup> With the rise of temperatures after Earth's last ice age, global sea level rose about 120 metres, and has remained comparatively stable since then.<sup>61</sup> The problem with sea level rise today is that, like the temperatures, it is rising at an unprecedented rate and this time, will directly affect all those living close to the coasts, who now represent more than half of the world's population.<sup>62</sup>

Global sea level variations are assessed from information compiled from coastal tide gauges as well as satellite observations.<sup>63</sup> The rise is not homogeneous throughout the planet and depends on salinity and changes in ocean circulation patterns.<sup>64</sup> For example, in waters closer to the ice caps salinity is reduced by the influx of fresh water, while in the tropics, as water evaporates salt is left behind increasing the density, at least on the surface.<sup>65</sup> Despite these differences, the studies considered in the IPCC's report do conclude that the sea level is rising, that it is consistent with global

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<sup>60</sup> See C Curno 'Ice Ages' (n28) 521-522.

<sup>61</sup> See N Bindoff *et al* '2007: Observations: Oceanic Climate Change and Sea Level' in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 385, 409.

<sup>62</sup> See M Jáen (n14) 91; and United Nations Educational, Scientific and Cultural Organization 'The Global Conference on Oceans and Coasts at Rio + 10: Toward the 2002 World Summit on Sustainable Development, Johannesburg' (7 December 2001) available at [www.unesco.org](http://www.unesco.org) (last visited 3 January 2005).

<sup>63</sup> See N Bindoff (n61) 408, 409.

<sup>64</sup> See N Bindoff (n61) 416.

<sup>65</sup> See N Bindoff (n61) 420.

warming<sup>66</sup> and that it is the result of two major processes: thermal expansion and ocean mass change.<sup>67</sup> Rising sea levels are thus not only a result of more water entering the oceans because of melting; they are also due to the swelling of the same quantity of water we have been used to seeing.<sup>68</sup> The combination of these two circumstances results in what the IPCC has estimated to be a global average sea level rise of approximately 1.7 millimetres per year during the 20th century, with a disturbing 3-millimetre per year rise just between 1993 and 2007.<sup>69</sup> In other words, the mean sea level has gone up by about twenty centimetres in the last one hundred years. Considering these figures and because the upward trend is steady, low-lying coastal and island nations are rightfully concerned.

## 2.3 Projections on climate change

Nobel Prize winner Niels Bohr used to say: “prediction is very difficult, especially if it is about the future.” Such is of course the case with climate change predictions, since they entail predictions on human behaviour and depend entirely on the mitigative actions governments take today and in the near future. Notwithstanding the foregoing, a particularly relevant parameter, as we have learned, is how countries deal with their GHG emissions. The IPCC bases its projections for climate change on different scenarios that we have included at the end of this thesis as “Supplement C.” They consider varying degrees of action to stabilize and reduce GHG concentrations in the atmosphere. In sum, these scenarios indicate that if governments don’t seriously commit to cleaner and sustainable development policies, GHG emissions will continue to grow in the decades to come and with them, their atmospheric concentration, average temperatures and sea level, causing far graver changes than those already tangible in the 20th century.<sup>70</sup> “If projections of approximately 5°C warming in this century (the upper end of the range) are realized, then the Earth will have experienced

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<sup>66</sup> See IPCC Summary for Policymakers (n36) 2.

<sup>67</sup> See N Bindoff (n61) 408

<sup>68</sup> See N Bindoff (n61) 414.

<sup>69</sup> See N Bindoff (n61) 409. See also “Supplement B” for a graph illustrating the rise of surface temperatures, sea level and retreat of snow cover.

<sup>70</sup> See IPCC Summary for Policymakers (n36) 7.

about the same amount of global mean warming as it did at the end of the last ice age; there is no evidence that this rate of possible future global change was matched by any comparable global temperature increase of the last 50 million years.”<sup>71</sup>

“Of all the ongoing and expected changes from global warming, however, the increase in the volume of the oceans and accompanying rise in the level of the sea will be the most immediate, the most certain, the most widespread, and the most economically visible in its effects.”<sup>72</sup> As for predictions on the extent of sea level rise, while average numbers based on calculations of thermal expansion and melting of ice and snow are possible, it is difficult to speak of generalized effects, as much depends on the particular characteristics of the coastline, such as composition (sand, rock, frozen land, etc.), susceptibility to erosion, shape and slope.<sup>73</sup> However, allowing warming to continue at this pace, or to accelerate, entails the risk of having the Greenland and West Antarctic ice sheets melt in their entirety; scenarios that individually would raise global sea level by seven meters and six meters, respectively.<sup>74</sup> Other projections show that if both Antarctic ice sheets melt, thirty million cubic kilometres of ice would flow into the oceans and cause the average sea level to rise by fifty-seven meters.<sup>75</sup>

To make matters worse, warming entails further warming: increasing temperatures reduce the capacity of land and oceans to absorb CO<sub>2</sub> while at the same time generate more water vapour.<sup>76</sup> As the concentration of GHGs warm the Earth and snow and ice melt, darker land and water surfaces become exposed. In turn, these surfaces absorb more

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<sup>71</sup> E Jansen (n31) 465.

<sup>72</sup> O Pilkey (n58) 4.

<sup>73</sup> See O Pilkey (n58) 54 and N Mimura (n47) 698. For an illustration of the possible extent of sea level rise in the Caribbean see C Kraul ‘Rising sea levels threaten Caribbean’ in *LatinAmerican Post* (2010) available at <http://www.latinamericanpost.com/index.php?mod=seccion&secc=7&conn=5921> (last visited 28 April 2010).

<sup>74</sup> See GA Meehl *et al* ‘2007: Global Climate Projections’ in S Solomon *et al* (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge U Press 2007) 747, 819.

<sup>75</sup> See O Pilkey (n58) 65.

<sup>76</sup> See IPCC Summary for Policymakers (n36) 7 and H Le Treut (n40) 116.

heat from the Sun, causing more warming, melting and sea level rise, turning the global warming phenomenon into a self-reinforcing cycle.<sup>77</sup>

### 2.3.1 Physical impact of sea level rise on island nations

Islands are particularly vulnerable to sea level rise because of their limited size, high dependency on marine natural resources, reduced arable land, exposure to natural disasters and climate extremes, low adaptive capacity and because in general, most of the population and infrastructure is located close to the coasts with ports often hosting the capital or larger cities.<sup>78</sup> Because of the numerous and severe effects a rising sea has on these territories, but also due to their remoteness, adaptive measures usually swallow a big part of the gross domestic product (“GDP”).<sup>79</sup> Atoll States in the Pacific, like limestone islands in the Caribbean, have little surface water and few streams and therefore, rely entirely on rainfall and groundwater; both sources gravely vulnerable to global warming and sea level rise.<sup>80</sup> Many islands will suffer potable water shortages as salty water invades underground lenses and annual rainfall decreases, with severe consequences ensuing on irrigation, health and food supplies.<sup>81</sup>

As ocean temperatures rise, the microscopic plants (zooxanthella) that live in the skin of the coral animal (polyp), and on which this one depends, will die, causing the disease known as coral bleaching.<sup>82</sup> This means that, in addition to water scarcity, with *high confidence*<sup>83</sup> islands will suffer severe impacts on their fisheries.<sup>84</sup> In the Seychelles, mass coral mortality in the last decade has greatly decreased the extent of fringing reefs, harming the nursing grounds of many fish species and allowing stronger waves to hit the coast and intensify erosion.<sup>85</sup>

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<sup>77</sup> See H Le Treut (n40) 97.

<sup>78</sup> See N Mimura (n47) 690-691.

<sup>79</sup> See N Mimura (n47) 689.

<sup>80</sup> See N Mimura (n47) 693.

<sup>81</sup> See N Mimura (n47) 689.

<sup>82</sup> See O Pilkey (n58) 112 and 114.

<sup>83</sup> About 8 out of 10 chance. “See Supplement A.”

<sup>84</sup> See N Mimura (n47) 689.

<sup>85</sup> See N Mimura (n47) 698.

If we look at the situation in Tuvalu, where the highest mount reaches 4 meters above the water, sea level rise is “a modern and unnatural disaster against which they are largely impotent.”<sup>86</sup> As a result of increased flooding incidents, water supplies, arable land and coastal settlements in general have already suffered.<sup>87</sup> To cite another example, on the Majuro atoll of the Marshall Islands, because of its now salty soil, many vegetables are grown in oil barrels filled with earth.<sup>88</sup>

Aside from the direct physical consequences of climate change, severe impacts are expected on the tourism industries of coastal nations, particularly small island nations whose GDP heavily depends on it. In the Maldives, sea level rise could have such dire effects on the fishing and tourism industries that its GDP could see a 40% reduction.<sup>89</sup> Sea level and temperature rises will accentuate the erosion of beaches and degradation of marine ecosystems, making once paradisiacal destinations unattractive, and all the more so when coastlines in the Northern Hemisphere (closer to the homes of potential tourists) start enjoying tropical-like climates. Additional disincentives for tourism will come from an increased risk of contagious diseases common to tropical and subtropical islands, such as malaria, dengue, filariasis, schistosomiasis, diarrhoeal diseases, heat stress, skin diseases, acute respiratory infections and asthma.<sup>90</sup> More of the consequences climate change will bring to small islands are found in “Supplement D”.

In sum, sea level rise will reduce the size of islands and atolls, concentrating the often already dense population conglomerations but also encroaching groundwater deposits, adding stress on limited food supplies and health standards and cutting an important source of income: tourism.

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<sup>86</sup> RE Jacobs ‘Treading Deep Waters: Substantive Law Issues in Tuvalu’s Threat to sue the United States in the International Court of Justice’ (2005) 14 Pac Rim L & Pol’y J 103, 104.

<sup>87</sup> See RE Jacobs (n86) 106 and N Bindoff (n61) 414.

<sup>88</sup> See O Pilkey (n58) 19.

<sup>89</sup> See N Mimura (n47) 709.

<sup>90</sup> See N Mimura (n47) 689.

### 2.3.2 Impact of sea level rise on State sovereignty

The Law of the Sea Convention was successful in attaining a compromise on the needs and desires of all nations, developed and developing, coastal and landlocked, by balancing the freedom of the seas with territorial sovereignty and the protection of the marine environment. “Unlike its predecessors, the 1982 Convention seems to have established, once and for all, the parameters for establishing stable borders in the oceans [...]”<sup>91</sup> The starting point –or rather, line– for the distinct maritime zones is the baseline, generally defined as the low-water line along the coast<sup>92</sup> or, in the case of islands or atolls with fringing reefs, the seaward low-water line of the reef.<sup>93</sup>

From what we have learned on the effects of global warming and sea level rise, it is clear that these also have the potential to profoundly shift the baselines and thus, the geography of areas over which States exercise diverse degrees of sovereignty; “even alter legal entitlements afforded to States under [UNCLOS].”<sup>94</sup> While it is true that in UNCLOS we find the tools necessary to delimit the maritime zones such as the territorial sea, continental shelf and exclusive economic zone, nothing is said regarding changing physical circumstances. A strict interpretation of the Law of the Sea Convention could mean that a retreating baseline entails the retreat of the outer reach of the exclusive economic zone, for example, converting waters usually closed to foreign fishing into the high seas, where all nations have equal exploitation rights.<sup>95</sup> Analogous consequences could take place where an archipelagic State sees one or several islands permanently submerged and thus, can no longer justify the strait baselines it had

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<sup>91</sup> JL Jesus ‘Rocks, New-born Islands, Sea Level Rise and Maritime Space’ in J Frowein *et al* (eds) *Verhandeln für den Frieden* (Springer Berlin 2003) 579, 594.

<sup>92</sup> See UNCLOS (n4) Art 5.

<sup>93</sup> See UNCLOS (n4) Art 6.

<sup>94</sup> R Verheyen (n33) 138. For an overview of the effects of sea level rise on maritime boundaries see R Verheyen (n33) 193-200 and AHA Soons ‘The Effects of a Rising Sea Level on Maritime Limits and Boundaries’ (1990) 37 NILR 207; R Rayfuse ‘W(h)ither Tuvalu? International Law and Disappearing States’ (2009) 9 UNSWLRS and R Verheyen (n33) 193-200.

<sup>95</sup> See UNCLOS (n4) Art 87 and WC Burns ‘Potential Causes of Action for Climate Change Damages in International Fora: The Law of the Sea Convention’ (2006) 2 McGill Int’l J Sust Dev L Pol’y 27, 42.

previously drawn, thereby losing a great portion of its archipelagic waters.<sup>96</sup> Similarly, for islands where the continental shelf extends up to 350 nautical miles from the baseline, sea level rise could make once exclusive mineral deposits and oil or gas reserves the *common heritage of mankind*.<sup>97</sup> Another problem could arise where an island, whose fresh water deposits and land have turned salty, can no longer sustain human habitation or economic life of its own: According to Article 121 of UNCLOS, such an island would not be entitled to an exclusive economic zone or a continental shelf.<sup>98</sup> The ensuing economic consequences of these changing circumstances could be devastating for islands already suffering the constraints of a limited GDP, overwhelming expenses of climate change-adaptation measures, post-natural disaster reconstruction, etc.

Judge Jesus appears to be of the view that to adjust maritime borders as sea level rises would be contrary to the purpose of UNCLOS of strengthening peace, security, cooperation and friendly relations and that “stable, predictable and continuous ocean borders [are] of paramount importance in achieving this fundamental goal [...]”<sup>99</sup> Nevertheless, if one looks into the debate on the doctrine of inter-temporal law,<sup>100</sup> the possibility that conflicts could arise should not be ignored, particularly in view of the enormous economic interests affecting the continental shelves and exclusive economic zones. The issue could invite, for example, a dispute as to whether the rising tide and the rights enshrined in UNCLOS affected by it should be appraised in light of the rules of international law existing in 1982 and therefore, as fixed, or whether these rights should follow the conditions required by the evolution of law.<sup>101</sup> While in principle we agree with Judge Jesus, we cannot avoid considering the far-reaching consequences of sea level rise and therefore believe that UNCLOS should be adapted to the present and future circumstances of States parties to it.

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<sup>96</sup> See JL Jesus (n91) 601.

<sup>97</sup> See UNCLOS (n4) Part XI.

<sup>98</sup> See UNCLOS (n4) Art 121.

<sup>99</sup> See JL Jesus (n91) 593, 600 and 602.

<sup>100</sup> See for example I Brownlie (n21) 124-5.

<sup>101</sup> See *Island of Palmas (or Miangas) case (Netherlands v USA)* [1929] UNRIAA II, 829.

When the rising seas affect low-lying atolls and islands the consequences are serious: While populations retreat fleeing the ever-higher tides, they find themselves tiptoeing into water all the same, as it creeps up from behind. The possibility of countries disappearing is real, particularly if Antarctica's 800-pound gorillas accompany glacier melt and thermal expansion.<sup>102</sup> With this dreadful future in sight, "[r]ealizing that the people of Tuvalu will soon have to follow their island to a salty demise or move to higher ground the Prime Minister has requested environmental refugee status for its citizens from both Australia and New Zealand."<sup>103</sup> Although New Zealand was careful not to accept Tuvaluans as *environmental refugees*, it agreed to allow a limited number to immigrate each year; a treatment that it afforded the people of Tonga and Kiribati as well.<sup>104</sup> Taking it a step further, President Nasheed has suggested the possibility of purchasing land in Sri Lanka or India and have the Maldives as a whole relocated.<sup>105</sup>

If one considers the delicacies of State recognition, such as those with which the ICJ is currently dealing concerning the status of Kosovo,<sup>106</sup> and the general rule that fundamental elements of statehood are the population and territory,<sup>107</sup> one cannot start to imagine the legal and moral difficulties that would relate to *State disappearance*. As for the human element however, the ominous conditions under which political refugees live today do provide a clear picture of the tragic future that lies ahead for the tens of millions of potential island refugees.<sup>108</sup>

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<sup>102</sup> See GA Meehl (n74) 819.

<sup>103</sup> RE Jacobs (n86) 107.

<sup>104</sup> See Department of Immigration 'Pacific Access Category' (20 January 2010) <http://www.immigration.govt.nz/migrant/stream/live/pacificaccess/> (last visited 1 March 2010).

<sup>105</sup> See O Pilkey (n58) 21.

<sup>106</sup> See *Accordance with International Law of the Unilateral Declaration of Independence by the Provisional Institutions of Self-Government of Kosovo (Request for Advisory Opinion)* UNGA Res A/RES/63/3 (A/63/L.2) (8 October 2008) available at <http://www.icj-cij.org/docket/files/141/14799.pdf> (last visited 15 February 2010).

<sup>107</sup> See Montevideo Convention on the Rights and Duties of States (adopted 26 December 1933, entered into force 26 December 1934) 165 LNTS 19, Art 1; F Mariño Menéndez *Derecho Internacional Público: Parte General* (Trotta Madrid 1995) 84-85; I Brownlie *Principles of Public International Law* (Oxford U Press 2003) 70-71 and R Rayfuse (n98) 6.

<sup>108</sup> The exodus of population of the Caterets islands of Papua New Guinea can be seen as a first hint of what is to come. For further reference see B Merchant 'First Official Climate

## 2.4 Conclusion

Sceptics may believe that a rise in temperature of a couple of decimals surely cannot have the effects the IPCC presents. Undeniably, “[i]t is far easier to deny that a problem exists, when its sources are multiple and complex and its effects diffuse and difficult to measure,”<sup>109</sup> but as the IPCC’s findings show, the climate crisis is real. The effects presented above, if anything, should be considered as understatements of what can actually happen, the nature of the IPCC and its processes being subject to extremely high levels of consensus.<sup>110</sup> Reality is that “global warming is likely to be the most expensive environmental problem ever [...]. Weather patterns will be altered. Economies will be disrupted. Habitat and landmass will be lost. And, as yet unpredictable environmental problems will result.”<sup>111</sup> Indeed, sea level rise has the potential to affect severely the maritime boundaries and zones of coastal nations and with it, the scope, purpose and value of the Law of the Sea Convention.

The situation appears all the more troublesome when considered in light of the persisting lack of consensus among States as to the measures which can, should and need to be adopted in order to curb GHG emissions. Because we cannot afford to wait, it becomes necessary to look into existing mechanisms which may be used to compel polluting States to “face up to climate change”. As we shall now observe, because of the effect climate change will have on the seas and therefore, on UNCLOS, and in view of its comprehensive dispute settlement apparatus, some commentators see the Convention as a hopeful mechanism.

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Change Refugees Evacuate Their Island Homes for Good’ in *Treehugger* (8 May 2009) available at <http://www.treehugger.com/files/2009/05/first-climate-change-refugees-evacuate.php> (last visited 3 May 2010).

<sup>109</sup> M Jáen (n14) 123.

<sup>110</sup> See D Farber ‘Adapting to Climate Change: Who should pay?’ (2007-2008) 23 *J Land Use & Envtl L* 6.

<sup>111</sup> A Strauss ‘The Legal Option: the United States in International Forums for Global Warming Emissions’ (2003) 33 *ELR* 10185, 10191.

### 3 Climate change and the Law of the Sea Convention

As Patricia Birnie and Alan Boyle acknowledge, UNCLOS is one of the cornerstones of modern international environmental law;<sup>112</sup> an accomplishment product of more than a decade of negotiations that officially began at the Third United Nations Conference on the Law of the Sea (“UNCLOS III”). It is evident throughout the Convention that –as discussed during the United Nations Conference on the Human Environment held in Stockholm the year before– considerations on the state and future of the global environment greatly influenced these negotiations.<sup>113</sup> Even if one could consider UNCLOS to be a compilation and modernization of the 1958 Geneva Conventions on the Law of the Sea,<sup>114</sup> the truth is that it goes far beyond in many areas, especially when it comes to the protection and conservation of the marine environment<sup>115</sup> and to the implementation of measures to achieve this.<sup>116</sup>

Inspired by Principle 22 of the Stockholm Declaration,<sup>117</sup> Article 235 of the Law of the Sea Convention establishes that “States shall cooperate in the [...] further development of international law relating to responsibility and liability for the assessment of and compensation for damage and the settlement of related disputes, as well as, where appropriate,

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<sup>112</sup> See P Birnie and A Boyle *International Law & the Environment* (Oxford U Press New York 2002) 348. See also M Jáen (n14) 108.

<sup>113</sup> See M Nordquist (ed) *United Nations Convention on the Law of the Sea 1982 A Commentary* (Martinus Nijhoff Publishers Dordrecht 1991) Vol IV 37 and 55. See also United Nations Organisation ‘General Principles for the Assessment and Control of Marine Pollution’ in *Report of the United Nations Conference on the Human Environment* (1 January 1973) A/CONF.48/14/REV.1, 3, 73.

<sup>114</sup> See Convention on the Territorial Sea and Contiguous Zone (adoption 29 April 1958, entry into force 10 September 1964) 516 UNTS 96, Art 24; Convention on the High Seas (adoption 29 April 1958, entry into force 30 September 1962) 450 UNTS 96, Arts 24 and 25; Convention on Fishing and Conservation of the Living Resources of the High Seas (adoption 29 April 1958, entry into force 20 March 1966) 559 UNTS 285; and Convention on the Continental Shelf (adoption 29 April 1958, entry into force 10 June 1964) 499 UNTS 312.

<sup>115</sup> See A Boyle ‘Marine Pollution under the Law of the Sea Convention’ (1985) 79 Am J Int’l L 347, 347.

<sup>116</sup> See K Ramakrishna ‘Environmental Concerns and the New Law of the Sea’ (1985) 16 J Mar L & Com 1, 10.

<sup>117</sup> See Stockholm Declaration (n7) Principle 22.

development of criteria and procedures for payment of adequate compensation, such as compulsory insurance compensation funds.”<sup>118</sup> While this is something the Association of Small Island States (“AOSIS”) has sought for almost two decades now,<sup>119</sup> to date such cooperation has been limited to producing and modernizing liability and compensation regimes pertaining to the transportation of oil,<sup>120</sup> hazardous and noxious substances<sup>121</sup> and nuclear material,<sup>122</sup> avoiding altogether the issue of climate change and its effects on coastal nations.<sup>123</sup> States have also been reluctant to accept the need for ambitious targets to reduce GHG emissions, mainly because they fear the possibility that stricter restrictions on emissions will affect their growth and economic prosperity. Former United States President George W. Bush, for example, summarized his position in the following words: “I oppose the Kyoto Protocol because it exempts 80 percent of the world, including major population centers such as China and India, from compliance, and would cause serious harm to the US economy.”<sup>124</sup> From what we learned in the previous Chapter and from all the information the IPCC has presented since its creation, this is evidently a short-sighted reasoning: Less than one century from now adaptation costs will make growth and prosperity very difficult, in some cases unattainable,

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<sup>118</sup> See UNCLOS (n4) Arts 235(2) and 235(3).

<sup>119</sup> See Intergovernmental Negotiating Committee for a Framework Convention on Climate Change ‘Set of informal papers provided by delegations, related to the preparation of a framework convention on climate change – Elements for a framework convention on climate change, proposed by Vanuatu on behalf of States Members of the Alliance of Small Island States’ (18 June 1991) A/AC.237/Misc.1/Add.3, 22.

<sup>120</sup> International Convention on Civil Liability for Oil Pollution Damage, 1992 (Consolidated text) in International Maritime Organization (ed) *Civil Liability for Oil Pollution Damage* (IMO 1996) 47; International Convention on Civil Liability for Bunker Oil Pollution Damage (adopted 23 March 2001, entered into force 21 November 2008) IMO LEG/CONF.12/19.

<sup>121</sup> International Convention on Liability and Compensation for Damage in connection with the Carriage of Hazardous and Noxious Substances by Sea (adopted 3 May 1996, not yet in force) 35 ILM 1415.

<sup>122</sup> Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, 1971 (adopted 17 December 1971, entry into force 15 July 1975) 974 UNTS 255.

<sup>123</sup> See Secretariat of the UNFCCC ‘Declarations by Parties to the UNFCCC’ available at [http://unfccc.int/essential\\_background/convention/items/5410.php](http://unfccc.int/essential_background/convention/items/5410.php) (last visited 19 April 2010).

<sup>124</sup> GW Bush ‘Text of a letter from the President to Hagel, Helms Creg and Roberts’ in Peter N. Stearns (ed) *World History in Documents: A Comparative Reader* (New York U Press 2008) 409.

throughout the planet.<sup>125</sup> To most nations, the effects of a warmer planet will not come as obvious as those of an oil spill or a nuclear meltdown and thus, it is not “blood priority” which will lead to tackling the climate crisis. At the same time, it is difficult to believe or accept that the lack of ambition for Kyoto and post-Kyoto reduction targets is what impedes the effective protection and preservation of the environment. In sum, such disbelief is what drives our quest for an alternate path towards compelling States to “face up to climate change” and in this quest, we see possibilities in UNCLOS, which, despite the lack of an explicit reference to climate change, contains numerous obligations that could apply to it.<sup>126</sup>

In the previous Chapter we saw that climate change is having devastating effects on the marine environment, particularly on coral reefs and fisheries which, coupled with sea level rise, will overwhelm low-lying coastal and island States. Since UNCLOS was drafted (at least in part) to prevent harm from coming to our oceans and ensure their sustainable exploitation, it serves to look into the provisions of said Convention in order to determine to what extent they can be used to tackle climate change. For this analysis, we shall refer mainly to the rules of interpretation and application of treaties embodied in the Vienna Convention on the Law of Treaties (“VCLT”),<sup>127</sup> since it is generally viewed as expressive of customary international law<sup>128</sup> and applies to UNCLOS by virtue of its Article 293(1).<sup>129</sup>

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<sup>125</sup> See R McLeman ‘Climate Change Migration, Refugee Protection, and Adaptive Capacity Building’ (2008) 4 McGill Int’l J Sust Dev L & Pol’y 1, 18.

<sup>126</sup> See M Jáen (n14) 93.

<sup>127</sup> Vienna Convention on the Law of Treaties (adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTS 331.

<sup>128</sup> See R Jennings ‘Treaties’ in M Bedjaoui (ed) *International Law: Achievements and Prospects* (Martinus Nijhoff Paris 1991) 135, 136 and I Sinclair *The Vienna Convention on the Law of Treaties* (Manchester U Press 1984) 1-10.

<sup>129</sup> Article 293(1): “A court or tribunal having jurisdiction under this section shall apply this Convention and other rules of international law not incompatible with this Convention.” See UNCLOS (n4) Art 293(1).

## 3.1 Rules relevant to the application and interpretation of the Law of the Sea Convention

### 3.1.1 *Lex posterior* and *lex specialis*

“The main task of any tribunal which is called upon to construe or apply or interpret a treaty is to give effect to the expressed intention of the parties.”<sup>130</sup> The rules that pertain to the interpretation of international instruments are often akin to those we use to interpret the laws and regulations of our national legal systems. There may be acute differences, like those concerning the hierarchy given to rules of interpretation but, because these rules are based on principles stemming from logic, we can assert they are common to most civilized nations, with the particular trait that they are always conditioned to the will of States.<sup>131</sup> Such is the case for example, of the maxims *lex posterior derogat legi priori* and *lex specialis derogat legi generali* that are referred to when confronted with two or more conflicting bodies of norms that pertain to the same subject-matter, so that a preference in their application may be given to one body over the other(s).

The *lex posterior* principle is found in Article 30 of the VCLT, which states that unless otherwise specified and subject to certain exceptions, the will of the parties is that latter treaties prevail over earlier ones.<sup>132</sup> An expression of this principle is often included in multilateral agreements for the sake of clarity. Such is the case with UNCLOS, whose Article 311 clearly states that as between States parties to it, the Law of the Sea Convention prevails over the 1958 Geneva Conventions.<sup>133</sup> Applied to the hypothetical conflict between norms enshrined in UNCLOS and the UNFCCC, because the latter is more recent, *lex posterior* dictates that the norms of the UNFCCC should prevail. This, however, is but a theoretical

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<sup>130</sup> I Sinclair (n128) 115.

<sup>131</sup> See M Shaw *International Law* (Cambridge U Press 2003) 28-29 and R Verheyen (n33) 140.

<sup>132</sup> See VCLT (n127) Art 30. See also R Jennings (n128) 144.

<sup>133</sup> Namely, the Convention on the Territorial Sea and Contiguous Zone (n114); Convention on the High Seas (n114); Convention on Fishing and Conservation of the Living Resources of the High Seas (n114); and Convention on the Continental Shelf (n114). See UNCLOS (n4) Art 311.

debate and it is not the purpose of this thesis to observe where these treaties conflict with one another, but rather to show that UNCLOS can apply to climate change when no conflict exists.

As for the principle of *lex specialis*, like in domestic law, a norm that specifically addresses a subject prevails over one which relates to it in more general terms.<sup>134</sup> It would therefore follow that climate change is more aptly addressed by the UNFCCC than UNCLOS. Again, however, our objective is not to decide this, but to show that so long as these treaties are not in conflict, *lex specialis* does not bars the application of UNCLOS to such phenomenon. Some, nonetheless, might be of the view that the climate change regime constitutes a “stronger” kind of *lex specialis*;<sup>135</sup> one which precludes the application of the Law of the Sea Convention to climate change, whether or not a conflict exists amongst these fields of international law.<sup>136</sup>

### **3.1.2 Climate change law and the doctrine of self-contained regimes**

Almost the entire international community has adhered to the Framework Convention on Climate Change and its Protocol;<sup>137</sup> two instruments adopted in the effort to stabilize “greenhouse gas concentrations in the atmosphere at a level that [...] prevent[s] dangerous anthropogenic interference with the climate system.”<sup>138</sup> Their scope is broad and, shipping and aviation aside,<sup>139</sup> attempts to cover all areas relevant to the climate crisis. These aspects of the UNFCCC and the Kyoto Protocol could lead to believe that the climate change law these have established constitute a self-contained regime

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<sup>134</sup> See M Shaw (n131) 116 and R Verheyen (n33) 139.

<sup>135</sup> In its 2001 report, the International Law Commission referred to self-contained regimes as “strong” forms of *lex specialis*. See International Law Commission ‘Report of the International Law Commission on the work of its fifty-third session’ (2001) Doc A/56/10, 140.

<sup>136</sup> See R Verheyen (n33) 139.

<sup>137</sup> At present, 193 States and the European Union are parties to the UNFCCC while 190 States and the European Union are parties to the Kyoto Protocol. See United Nations Treaty Collection ‘Status of Treaties’ (7 May 2010) available at <http://treaties.un.org/Pages/Home.aspx?lang=en> (last visited 8 May 2010).

<sup>138</sup> UNFCCC (n4) Art 2 and Kyoto Protocol (n12) Preamble.

<sup>139</sup> In the climate change regime, these industries are dealt with by the International Civil Aviation Organization and the International Maritime Organization (“IMO”), respectively. See Kyoto Protocol (n12) Art 2(2).

analogous, for example, to that of diplomatic law, which impedes the application of other sources to the matter of climate change.<sup>140</sup>

### 3.1.2.1 The self-contained regime doctrine

The ICJ first introduced the notion of *self-contained regimes* in the *Case concerning United States Diplomatic and Consular Staff in Tehran*.<sup>141</sup> In summary, the case dealt with the 1979 hostage crisis in Tehran which the United States argued was attributable to the Iranian government and in breach of the Vienna Conventions on Diplomatic and Consular Relations.<sup>142</sup> The Court found that Iran had indeed allowed a group of militants to attack and occupy the United States Embassy by force; to seize the diplomatic and consular staff as hostages; endorsed the action of those militants; and deliberately maintained their occupation of the Embassy and detention of its staff to coerce the United States.<sup>143</sup> However, because Iran argued<sup>144</sup> that its conduct was a justified response to what it claimed were more than 25 years of illegal activities by the United States in Iran, the Court also ventured to decide whether or not said conduct should have circumscribed to the aforementioned Vienna Conventions.<sup>145</sup> On this issue, the ICJ explained that “[t]he rules of diplomatic law, in short, constitute a self-contained régime which, on the one hand, lays down the receiving State's obligations regarding the facilities, privileges and immunities to be accorded to diplomatic missions and, on the other, foresees their possible abuse by members of the mission and specifies the means at the disposal of the receiving State to counter any such abuse.”<sup>146</sup> It followed that Iran’s actions (and/or lack of action) during the hostage crisis were forms of retaliation

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<sup>140</sup> See R Verheyen (n33) 139.

<sup>141</sup> See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (United States of America v Iran) [1980] ICJ Rep 3.

<sup>142</sup> Namely, the Vienna Convention on Diplomatic Relations (adopted 18 April 1961, entry into force 24 April 1964) 500 UNTS 95 and the Vienna Convention on Consular Relations (adopted 24 April 1963, entry into force 19 March 1967) 596 UNTS 261. See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 6-8.

<sup>143</sup> See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 40-41.

<sup>144</sup> Although the case was heard *in absentia*, Iran presented its position to the Court by way of two brief letters. See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 8.

<sup>145</sup> See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 38.

<sup>146</sup> *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 40.

that the self-contained regime of diplomatic law did not contemplate and because they affected rights and obligations under a regime which embodies a set of legal consequences available to the parties, such forms were deemed unlawful.<sup>147</sup>

To determine then, if the provisions embodied in the UNFCCC and Kyoto Protocol constitute a self-contained regime, they must meet the test set out in the ICJ's judgment. This means that, on the one hand, the regime has to lay down States' rights and obligations relevant to its objective in a comprehensive manner,<sup>148</sup> including those relating to climate change damages. On the other, said *corpus* should foresee the breach of these rules, the causation of damage and provide the tools necessary to counter such breach or obtain proper relief<sup>149</sup> in a way that prevents recourse to other means, i.e. that they are efficacious.<sup>150</sup>

### **3.1.2.2 Climate change law and the self-contained regime test**

If we start by looking into the primary obligations contained in both the UNFCCC and the Kyoto Protocol, we find there are detailed provisions for mitigating climate change as well for adapting to it. We also find financial obligations incumbent upon developed country Parties (those belonging to Annex I of the UNFCCC) to help less developed nations (Non-Annex I Parties) enact clean development policies and adapt to the stresses caused by global warming. Nevertheless, both instruments dodge the issue of climate change damage: neither of them “contains provisions that help to define climate change damage, prohibit certain types of damages, concretise obligations with regard to adaptation, or stipulate that damages should be compensated.”<sup>151</sup>

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<sup>147</sup> See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 41.

<sup>148</sup> See UNFCCC (n4) Art 2 and Kyoto Protocol (n12) Preamble. See also R Verheyen (n33) 142. These rules are often referred to as primary rules of international law.

<sup>149</sup> i.e. secondary rules of international law.

<sup>150</sup> See *Case Concerning United States Diplomatic and Consular Staff at Tehran* (n141) 40-41. For a more detailed, yet well summarized analysis on the concept of self-contained regimes see E Klein ‘Self-Contained Regime’ (November 2006) in R Wolfrum (ed) *Max Planck Encyclopedia of Public International Law* available at [www.mpepil.com](http://www.mpepil.com) (last visited 10 May 2010) and R Verheyen (n33)139-142.

<sup>151</sup> R Verheyen (n33) 142.

When we look into the secondary rules of international law established by Kyoto and the UNFCCC we come to a similar conclusion. Even though the subject of climate change damage had already been mentioned in several international forums prior to the adoption of the UNFCCC, including at the United Nations General Assembly (“UNGA”),<sup>152</sup> early in the negotiations towards signing the UNFCCC it became apparent that issues such as possible residual damage and liability would be excluded.<sup>153</sup> This led AOSIS to propose the creation of an international insurance pool<sup>154</sup> and the insertion of a paragraph to the effect that the Framework Convention should not prejudice existing rights under international law, including “rules governing international liability for damage to people, property and the environment.”<sup>155</sup> To the regret of AOSIS however, the inclusion of this idea in the Convention did not find the necessary support and therefore, upon signature of the UNFCCC, several Pacific islands resorted to declare that signature of the Convention in no way constituted a renunciation of any rights under international law concerning State responsibility for the adverse effects of climate change. They further stated that no provisions in the Convention could be interpreted as derogating from the principles of general international law,<sup>156</sup> a position to which adhered an additional number of States upon signature of the Kyoto Protocol.<sup>157</sup>

Concerning the provisions on dispute settlement and compliance mechanisms in the UNFCCC and Kyoto Protocol, neither the *travaux préparatoires* nor the subsequent practice of States show any resolve to exclude other sources of law.<sup>158</sup> As for the UNFCCC in particular, the

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<sup>152</sup> See UNGA Res 44/207 (22 December 1989) UN Doc A/44/862, [4]. See also R Verheyen (n33) 46.

<sup>153</sup> See R Verheyen (n33) 48.

<sup>154</sup> See R Verheyen (n33) 50.

<sup>155</sup> See Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (n119) 22 and F Yamin and J Depledge *The International Climate Change Regime: a Guide to Rules, Institutions and Procedures* (Cambridge U Press 2004) 13.

<sup>156</sup> See Secretariat of the UNFCCC ‘Declarations by Parties to the UNFCCC’ (n123). See also F Yamin and J Depledge (n155) 13.

<sup>157</sup> See Secretariat of the UNFCCC ‘Declarations and Reservations by Parties to the Kyoto Protocol’ available at [http://unfccc.int/kyoto\\_protocol/status\\_of\\_ratification/items/5424.php](http://unfccc.int/kyoto_protocol/status_of_ratification/items/5424.php) (last visited 19 April 2010).

<sup>158</sup> See R Verheyen (n33) 143.

secondary rules cannot be considered efficacious since the COP has yet to put them in place. An annex on arbitration is also pending and no specific legal consequences are included in the provisions of said Convention.<sup>159</sup> As for the Kyoto Protocol, even though it contains a compliance mechanism which includes sanctions, because their enactment is pending adoption by the Parties to the Protocol and they do not include reparations for actual climate change damage, they remain inefficacious and thus, do not meet the requirements of the test set by the ICJ in the *Case Concerning United States Diplomatic and Consular Staff at Tehran*.<sup>160</sup>

### **3.1.3 Conclusion**

The climate change law established by the UNFCCC and Kyoto Protocol does not meet the requirements of the ICJ's test and therefore cannot be considered a self-contained regime. Even if it did meet this test however, like most matters in international law and because the system entirely relies on the will of States, the notion of climate change law being a self-contained regime would depend on States wishing it to be so. The history of negotiations towards these instruments, coupled with the ensuing declarations of States, shows that this was and is not their will.<sup>161</sup>

## **3.2 Interpretation of the definition of pollution of the marine environment in the context of climate change**

Also essential to the applicability of UNCLOS to climate change is fitting the warming of ocean temperatures, as well as their acidification, into the definition of pollution of the marine environment.

Based on a draft suggested by UNESCO's Inter-governmental Oceanographic Commission and the United Nations' Group of Experts on

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<sup>159</sup> See R Verheyen (n33) 143.

<sup>160</sup> See R Verheyen (n33) 143.

<sup>161</sup> This would probably remain the case even if the upcoming COP -which is to take place in Cancun, Mexico- adopted a successor to the Kyoto Protocol.

the Scientific Aspects of Marine Pollution (“GESAMP”),<sup>162</sup> Article 1(4) of UNCLOS defines pollution of the marine environment as: “the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.”<sup>163</sup>

This definition is twofold: the first part relates to the origin and location of pollution while the second, to the effects that qualify such pollution. Respecting the structure of the definition, we will look at these two elements separately.

## **3.2.1 The sources of pollution of the marine environment**

### **3.2.1.1 Carbon dioxide**

In “the introduction by man, directly or indirectly,” UNCLOS implies what is expressed in its Part XII, i.e. that pollution originates from five main sources, all of which are human-related: land-based activities,<sup>164</sup> exploitation of the seabed,<sup>165</sup> dumping of wastes at sea,<sup>166</sup> shipping,<sup>167</sup> and pollution from or through the atmosphere.<sup>168</sup> Although some delegations suggested defining the *marine environment*, UNCLOS left its meaning to be deduced from the provisions of Part XII, thereby allowing for flexibility in recognition of the “continuously-expanding human knowledge and human activities related to the marine environment, including its protection and preservation.”<sup>169</sup>

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<sup>162</sup> See R Churchill and V Lowe *The Law of the Sea* (Manchester U Press 1999) 328 and M Nordquist (n113) Vol IV 53.

<sup>163</sup> UNCLOS (n4) Art 1(4).

<sup>164</sup> See UNCLOS (n4) Arts 194(3a) and 207.

<sup>165</sup> See UNCLOS (n4) Arts 194(3c), 208 and 209.

<sup>166</sup> See UNCLOS (n4) Arts 194(3a) and 210.

<sup>167</sup> See UNCLOS (n4) Arts 194(3b) and 211.

<sup>168</sup> See UNCLOS (n4) Arts 194(3a) and 212.

<sup>169</sup> M Nordquist (n113) Vol I 42.

In broad terms, there are four carbon sinks on our planet: the air, the oceans, the sediments (fossil fuels) and the terrestrial biosphere.<sup>170</sup> The exchange of carbon atoms between these reservoirs constitutes the carbon cycle, which influences the climate system by, *inter alia*, reducing CO<sub>2</sub> in the atmosphere.<sup>171</sup> Of the four, the oceans are the most important sink, absorbing about 50% of the CO<sub>2</sub> originating from fossil fuel burning processes<sup>172</sup>. Pollution from or through the atmosphere merits particular attention since fossil fuel burning is the main cause of today's increased concentration of CO<sub>2</sub> in the atmosphere and seas. With the swelling of CO<sub>2</sub> concentrations in the air subsequent to the Industrial Revolution, the intake of CO<sub>2</sub> by the oceans has also increased, turning the waters sour.<sup>173</sup> It could therefore be argued that as a result of CO<sub>2</sub>-emitting human activities, through the atmosphere, man is indirectly introducing CO<sub>2</sub> to the marine environment and thereby polluting it.

### 3.2.1.2 Thermal energy

A similar reasoning supports the argument that heat (energy) is being indirectly introduced to the oceans as a result of those human activities that are responsible for global warming, since there is evidence that ocean temperatures are rising along with atmospheric temperatures. Originally, GESAMP's definition did not explicitly refer to energy, but as the report from its 1<sup>st</sup> session shows, heat was considered a substance for the purpose of this definition.<sup>174</sup> The drafters included "energy" as a source of pollution because they acknowledged that both radiation and heat effluents could have deleterious effects on the marine environment.<sup>175</sup> Examples of the effects they considered include: "(a) excessive growth of vegetation which interferes with navigation; (b) increase in fouling and boring organisms on vessels and structures; (c) thermal blocks which interfere with migrations of fish; and (d) when associated with other types of discharge, increased

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<sup>170</sup> See N Benson 'Carbon Cycle' in G Philander (ed) *Encyclopedia of Global Warming and Climate Change 1* (Sage Publications 2008) 162, 162.

<sup>171</sup> See N Benson 'Carbon Cycle' (n170) 162.

<sup>172</sup> See S Gray *et al* 'Ocean Changes' in G Philander (ed) *Encyclopedia of Global Warming and Climate Change 2* (Sage Publications 2008) 738, 739.

<sup>173</sup> See S Gray (n172) 739.

<sup>174</sup> See GESAMP 'Report of the First Session' (17 July 1969) GESAMP I/11, 14.

<sup>175</sup> See GESAMP 'Report of the First Session' (n174) 8.

microbiological activity and thereby oxygen depletion [...].”<sup>176</sup> Generation of electricity through the combustion of fossil or nuclear fuels, for example, often uses water vapour to power a turbine; a process that results in large quantities of water being heated and disposed of into rivers and oceans, normally after having spent some time in the facility’s cooling towers.<sup>177</sup>

Although climate change was possibly not in the minds of the delegates discussing the definition of marine pollution at UNCLOS III, the provisions of Part XII do invite a teleological interpretation of the definition. To exclude thermal energy from the definition would be to apply a restrictive interpretation to Article 1(4) which would prejudice the intention of the parties<sup>178</sup> and be contrary to the customary rule of interpretation of treaties embodied in article 31(1) of the VCLT according to which a treaty should be interpreted in good faith in accordance with the ordinary meaning of its terms.<sup>179</sup> Another argument favouring the consideration of thermal energy as a source of pollution within the scope of this definition is that a treaty must be interpreted in light of changing circumstances.<sup>180</sup> In this sense, to exclude thermal energy would be incompatible with the Convention’s concern to prevent pollution from all sources.<sup>181</sup> It would seem even less reasonable in light of the articles of Part XII concerned with marine scientific research for the purpose of determining sources and effects of all kinds of pollution;<sup>182</sup> because what would be the point of promoting studies, undertaking programmes of scientific research and encouraging exchange of information and data

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<sup>176</sup> Intergovernmental Oceanographic Commission ‘Summary Report of the Fifth Session’ (25 March 1968) SC/CS/150 Annex VI, 4. See also GESAMP ‘Report of the First Session’ (n175) 14 and GESAMP ‘Report of the Second Session’ (20 June 1970) GESAMP II/11, Annex V 13.

<sup>177</sup> Eric Lavoisier (Duro Felguera Plantas Industriales, S.A.) ‘Interview’ (3 March 2010). Other processes use ocean or river water to warm natural gas, which in its liquid state is at minus 160°C. Both an increase and decrease in temperature can result in harm to the marine environment.

<sup>178</sup> See M Jáen (n14) 120.

<sup>179</sup> See VCLT (n127) Art 31(1).

<sup>180</sup> See M Doelle ‘Climate Change and the Use of the Dispute Settlement Regime of the Law of the Sea Convention’ (2006) 37 *Ocean Development & International Law* 3, 319, 322; M Jáen (n14) 120 and VCLT (n127) Art 31(3)c.

<sup>181</sup> See M Jáen (n14) 120 and UNCLOS (n4) Art 194.

<sup>182</sup> See for example UNCLOS (n4) Arts 200 and 202.

acquired about the sources and effects of marine pollution,<sup>183</sup> if this would result in excluding particular sources of pollution from the definition? This rationale seems all the more untenable when one considers the enormous efforts and resources allocated to climate change research and its effects on the marine environment in the past decades under the auspices of the IPCC.

### **3.2.2 The effects of pollution of the marine environment**

The second element of this definition refers to the effects of pollution of the marine environment. For the introduction of a substance or energy to qualify as pollution, the possibility or certainty that such action will result in harm to the health of human or marine life or affect the diverse functions and uses of the sea is necessary.<sup>184</sup>

#### **3.2.2.1 From carbon dioxide**

In 2009, the Secretariat of the Convention on Biological Diversity<sup>185</sup> published a report on the impacts of acidification on marine biodiversity, which presents alarming findings showing that acidification is indeed having most of the effects enlisted in the definition of marine pollution.<sup>186</sup>

The dilution of atmospheric CO<sub>2</sub> in the oceans through rain or absorption creates carbonic acid (“H<sub>2</sub>CO<sub>3</sub>”) and other acid-base products, which turn the waters sour.<sup>187</sup> This limits access to carbonic materials like aragonite and calcite, which certain plants and animals use to form their shells or grow on, i.e. sea urchins, snails and corals.<sup>188</sup> Because of acidification, such organisms develop weaker skeletons and grow at a

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<sup>183</sup> See UNCLOS (n4) Art 200.

<sup>184</sup> See UNCLOS (n4) Art 1(4).

<sup>185</sup> Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79.

<sup>186</sup> See Secretariat of the Convention on Biological Diversity ‘Scientific Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity’ (2009) Technical Series 46, 60. See also MercoPress ‘Scientists warn about impact on marine life of growing oceans’ acidity’ in *MercoPress* (22 February 2010) available at <http://en.mercopress.com/2010/02/22/scientists-warn-about-impact-on-marine-life-of-growing-oceans-acidity> (last visited 29 April 2010).

<sup>187</sup> See C Cumo ‘Earth’s Climate History’ (n23) 338 and S Gray (n172) 739.

<sup>188</sup> See Secretariat of the Convention on Biological Diversity (n186) 59.

slower rate, which threatens their existence *per se*,<sup>189</sup> but also as higher ocean temperatures cause coral bleaching and sea level rise drowns those coral reefs unable to keep up with the tide.<sup>190</sup>

An increase of H<sub>2</sub>CO<sub>3</sub> in seawater can dissolve existing coral reefs and thereby cause harm to the feeding grounds and nurseries of many of the world's important fisheries, with serious economic and environmental consequences, in particular for island nations.<sup>191</sup> Ultimately, the oceans' capacity to absorb CO<sub>2</sub> is reduced, making it more difficult to rely on them as carbon sinks for the stabilization of atmospheric CO<sub>2</sub> concentrations. Man's indirect introduction of carbon dioxide into the oceans thus results in a self-reinforced cycle of acidification and warming.<sup>192</sup>

### **3.2.2.2 From thermal energy**

As for the effects of rising ocean temperatures, much was presented in the previous Chapter. We learned that as global atmospheric temperatures rise, ocean surface temperatures follow, gradually warming deeper waters and causing harm to temperature-sensitive fish stocks and ecosystems such as coral reefs. However, a warmer atmosphere not only raises ocean temperatures: by encouraging evaporation and melting of ice, it also alters the salinity of the water, which subsequently affects its density, and thereby, ocean circulation patterns.<sup>193</sup> Changes in temperature, density and currents directly result in deleterious effects to marine biodiversity, i.e. by causing migration and shifts or expansions in species range.<sup>194</sup> Coral bleaching is thought to be the worst consequence of warming seawaters because of its effects on marine life and fisheries in general, which translates into a deterioration of fisheries and tourism attractions and ensues in severe harm to the economy of certain coastal and island economies.<sup>195</sup>

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<sup>189</sup> See Secretariat of the Convention on Biological Diversity (n186) 59.

<sup>190</sup> See O Pilkey (n58) 112-113.

<sup>191</sup> See Secretariat of the Convention on Biological Diversity (n186) 59 and N Mimura (n47) 689.

<sup>192</sup> See Secretariat of the Convention on Biological Diversity (n186) 60 and H Le Treut (n40) 97.

<sup>193</sup> See S Gray (n172) 739.

<sup>194</sup> See S Gray (n172) 740.

<sup>195</sup> See M Jáen (n14) 96 and 121.

### 3.2.3 Conclusion

According to the research presented, both the introduction of CO<sub>2</sub> and thermal energy into the marine environment result in at least such deleterious effects as harm to living resources and marine life and hindrance to marine activities. The fact that during the drafting of the definition of marine pollution the parties decided to replace the term “resulting” with the phrase “which results or is likely to result,”<sup>196</sup> further shows the consensus at UNCLOS III that all preventive measures should be underscored to assure the sustainable uses of the oceans and conservation of marine biodiversity. Additionally, because they were aware of the consequences global warming could have on the marine environment, “it would appear that the negotiating Parties, had they wanted to, had the opportunity to exclude climate change from the definition.”<sup>197</sup> In view of the foregoing, a State suffering the consequences of climate change might successfully argue that the provisions of UNCLOS, particularly those of Part XII, are applicable to the climate crisis. To deny that ocean warming and acidification constitute “pollution of the marine environment” would deprive our most important environmental treaty<sup>198</sup> of its significance, ignore its object and purpose<sup>199</sup> and lead to a result which is manifestly absurd or unreasonable.<sup>200</sup>

Because the obligations to protect and preserve the marine environment are linked to the definition of pollution of the marine environment and the possibility of enforcing them in the context of climate change depends on having GHG emissions fall within its scope, we ask the reader to keep in mind the sources and effects herein analysed throughout the remainder of this paper.

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<sup>196</sup> See M Nordquist (n113) Vol I 33.

<sup>197</sup> R Verheyen (n33) 204.

<sup>198</sup> See M Jáen (n14) 107 citing ML McConnell and E Gold ‘The Modern Law of the Sea: Framework for the Protection and Preservation of the Marine Environment?’ (1991) 23 *Journal of International Law* 1, 83, 84.

<sup>199</sup> As per VCLT (n127) Art 31(1).

<sup>200</sup> As per VCLT (n127) Art 32(b).

## 4 Mitigating climate change through the Law of the Sea Convention

Although in recent years progress was at the COP to establish funds and mechanisms to deal with the challenges of mitigation and adaptation to climate change, reality is that such funds are and will probably remain insufficient to adequately address the problems and damages climate change imposes on many nations. Because time is a luxury many low-lying coastal and island countries cannot afford, it is probable that alternative forums will have to tackle the matter of liabilities for climate change and compensations owed.

Supposing it is possible to fit anthropogenic warming and acidification into the definition of Article 1(4), then, as we shall see in this Chapter, some of the obligations contained in Part XII could be used to motivate action to alleviate climate change, particularly if for this purpose recourse is made to the compulsory dispute settlement mechanism contained in UNCLOS. In other words, by contributing to enhancing the greenhouse effect, States could be found in breach of UNCLOS and held “responsible for the fulfilment of their obligations concerning the protection and preservation of the marine environment [and] shall be liable in accordance with international law.”<sup>201</sup> This Chapter will touch upon the obligations to mitigate climate change under the Law of the Sea Convention, analyze the compulsory settlement of disputes mechanism, enforcement preconditions and finally, the reparations available and most convenient in cases of environmental damage.

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<sup>201</sup> UNCLOS (n4) Art 235(1).

## 4.1 Obligations to prevent climate change

### 4.1.1 The obligation to protect and preserve the marine environment

Under Article 192, States have the obligation to protect and preserve the marine environment.<sup>202</sup> They have the duty to prevent prospective damage and take active measures to maintain, or improve, the present condition of the marine environment.<sup>203</sup> The broad terms of this obligation reflect the desire to put in place a legal order for the seas and oceans that promotes the protection and conservation of the marine environment.<sup>204</sup> In essence, “Article 192 captures a substantive duty to prevent pollution of any kind.”<sup>205</sup>

Article 194 elaborates by imposing the duty on States to take all measures necessary to prevent, reduce and control pollution from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities.<sup>206</sup> It highlights the obligation to carry out best efforts to mitigate the risk and actual occurrence of pollution that could result from the introduction by man of a contaminant of whatever nature, while recognizing the principle of common but differentiated responsibilities. Interpreted as per the VCLT,<sup>207</sup> the all-encompassing terms of this obligation suggest no intention to exclude anthropogenic ocean warming and acidification. Such an interpretation is further supported by Article 194(3), pursuant to which the measures taken to prevent, reduce and control pollution of the marine environment must deal with all its possible sources.<sup>208</sup> States should pay particular attention to include, when seeking to prevent, reduce and control pollution, measures necessary to protect and

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<sup>202</sup> See UNCLOS (n4) Art 192.

<sup>203</sup> See M Nordquist (n113) Vol IV 40.

<sup>204</sup> See UNCLOS (n4) Preamble and M Nordquist (n113) Vol IV 36.

<sup>205</sup> See R Verheyen (n33) 202.

<sup>206</sup> See UNCLOS (n4) Art 194(1).

<sup>207</sup> See VCLT (n127) Art 31.

<sup>208</sup> See UNCLOS (n4) Art 194(3).

preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other marine life.<sup>209</sup>

Since GHG emissions cause damage to the marine environment through warming and acidification of sea and ocean waters, it is reasonable to argue that States failing to take effective mitigation measures –i.e. by reducing GHG emissions– breach the obligation to protect the marine environment, while by letting coral bleaching spread, they fail to comply with their preservation duties. It may be difficult to prove what the mitigation standard and emissions limits are, but for this, environmental agreements and the reports of the IPCC and the Secretariat of the UNFCCC provide guidance.

#### 4.1.2 The “No-harm” rule

A condition for international law to be effective is the recognition among nations that they are equal and that they must respect each other’s sovereign rights. Following the World Wars when these basic principles were ignored, the drafters of the United Nations Charter remind us that they are preconditions to coexisting as good neighbours.<sup>210</sup> The rule that no State should use or allow the use of its territory in such a way as to cause harm to other States stems from these principles.

In international environmental law, this rule is generally recalled from the *Trail Smelter Arbitration*, where the panel decided that, “under the principles of international law, [...] no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.”<sup>211</sup> Allusions to this long-settled *sic utere tuo ut alienum non laedas* principle, also known as the “no-harm” rule, are found in several articles of UNCLOS.

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<sup>209</sup> See UNCLOS (n4) Art 194(5). Interestingly, this paragraph appeared in the text of the Convention as a proposal of the delegation from the United States (See Nordquist (n13) Vol IV 63).

<sup>210</sup> See UN Charter (n17) Preamble, Art 1(2) and 2(1).

<sup>211</sup> *The Trail Smelter (Unite States of America v Canada)* (1941) 3 RIAA 1911, 1965.

Article 194(2) ascertains that “States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment, and that pollution arising from incidents or activities under their jurisdiction or control does not spread beyond the areas where they exercise sovereign rights in accordance with this Convention.”<sup>212</sup> In terms of *pollution of the marine environment*, “damage by pollution” translates into “harm to living resources and marine life, hazards to human health, hindrance to marine activities [...] impairment of quality for use of sea water and reduction of amenities.”<sup>213</sup>

Article 193 refers to States’ “sovereign right to exploit their natural resources pursuant to their environmental policies and in accordance with their duty to protect and preserve the marine environment.”<sup>214</sup> UNCLOS hereby achieves a balance between interests of economic development and those of environmental protection and preservation by combining the following three concepts: the right to exploit natural resources, the right to exploit those resources applying national environmental policies, and a general obligation of environmental law.<sup>215</sup> The wording points to the principle of common but differentiated responsibilities –as each State will meet its obligation pursuant to its policies– and reflects the concern of developing countries that too heavy a burden could derive from this

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<sup>212</sup> UNCLOS (n4) Art 194(2).

<sup>213</sup> UNCLOS (n4) Art 1(4).

<sup>214</sup> UNCLOS (n4) Art 193. This Article rephrases Principle 21 of the Stockholm Declaration (n7) whereby “States have [...] the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not causes damage to the environment of other States or of areas beyond the limits of national jurisdiction.” Interesting to note concerning the interpretation of this Principle is the following statement made by the delegation of the United States of America, particularly when bearing in mind the position held by the former President Bush with regards to the Kyoto Protocol (see GW Bush (n124)): “The United States of America considers it obvious that nothing contained in this principle [...] diminishes in any way the obligation of States to prevent environmental damage [...]” United Nations Organisation *Report of the United Nations Conference on the Human Environment* (1 January 1973) A/CONF.48/14/REV.1, 66. Another country reluctant to ratify the Kyoto Protocol, Australia, expressed a similar view at UNCLOS III when noting that “while a State may do whatever damage it wishes to areas under its own sovereignty, it may not cause damage to areas outside its sovereignty.” See M Nordquist (n113) Vol IV 46.

<sup>215</sup> See M Nordquist (n113) Vol IV 47 and 49.

environmental obligation.<sup>216</sup> Similar to the rationale within the UNFCCC and the Kyoto Protocol, many delegates at UNCLOS III shared the view that developed nations were most responsible for existing environmental damage and consequently, should bear the greater costs.<sup>217</sup>

In light of the above, a State suffering the effects of climate change could argue that the sovereign right to exploit carbon and hydrocarbon resources cannot be dissociated from the obligation to protect and preserve the marine environment and that by burning fossil fuels without controlling the ensuing GHG emissions, a State is in breach of Articles 193 and 194(2) of UNCLOS. Such State is benefiting from the right while ignoring the corresponding duty and is accountable pursuant to Article 235 of the Convention. The evidentiary burden, as set in the *Trail Smelter Arbitration* for example, entails the difficulties of establishing the causal link and the distinction between natural changes and/or damages and those that stem from anthropogenic forces. This causal link is what will secure a State's right to obtain damages from another and will be addressed in section 4.3. Let us first, however, introduce the dispute settlement mechanism provided for in the Law of the Sea Convention.

## 4.2 Settlement of disputes

Article 287 has been commended by many as one of the great achievements of UNCLOS III, particularly considering the difficulties encountered in finding a single, generally acceptable, dispute settlement procedure.<sup>218</sup> Said Article seeks to ensure that the efforts put in developing a comprehensive legal regime for the peaceful uses of the oceans are respected and consequently, that the Convention attains the objective to balance the

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<sup>216</sup> See M Nordquist (n113) Vol IV 45 and K Ramakrishna (n116) 14

<sup>217</sup> See M Nordquist (n113) Vol IV 46.

<sup>218</sup> See LDM Nelson 'Some Issues' in P Chandrasekhara Rao and R Khan (eds) *The International Tribunal for the Law of the Sea: Law and Practice* (Kluwer Law International The Hague Netherlands 2001) 51; N Klein *Dispute Settlement in the UN Convention on the Law of the Sea* (University Press Cambridge UK 2005) 54; J Seymour 'The International Tribunal for the Law of the Sea: A Great Mistake?' (2006) 13 *Ind J Global Legal Stud.*

sovereign rights and interests of Coastal States with those of the international community.<sup>219</sup>

Article 287 of UNCLOS provides that States shall, when signing, ratifying or acceding to the Convention or at any time thereafter, choose, by means of a written declaration, one or more of the following means for the settlement of disputes concerning the interpretation or application of this Convention:

1. the International Tribunal for the Law of the Sea (“ITLOS”);
2. the International Court of Justice;
3. an arbitral tribunal;
4. a special arbitral tribunal for disputes related to (i) fisheries, (ii) protection and preservation of the marine environment, (iii) marine scientific research, or (iv) navigation, including pollution from vessels and by dumping.<sup>220</sup>

Since Article 287 invites the Parties to UNCLOS to submit their preference of procedure at any moment, as well as to choose a procedure among those referred to above, it is foreseeable that States involved in a dispute may not have manifested their preference or selected the same compulsory mechanism. To cope with this plausible incompatibility the drafters of the Convention agreed that in such cases States parties to a dispute would have to submit it to arbitration.<sup>221</sup>

To ensure the compulsory dispute settlement mechanism would not dissuade States from adhering to UNCLOS, certain optional exceptions were conceded.<sup>222</sup> Under Article 298, States are entitled to exempt from the compulsory mechanism the following matters:

1. disputes related to sea boundary delimitations, or to historic bays and titles, insofar as they concern the interpretation and application of the Articles 10(6) and 15 of the Convention;

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<sup>219</sup> See SN Nandan ‘Introduction to the Law of the Sea’ in M Bedjaoui (ed) *International Law: Achievements and Prospects* (Martinus Nijhoff Publishers Dordrecht Netherlands 1991) 839, 847.

<sup>220</sup> See UNCLOS (n4) Art 287(1).

<sup>221</sup> See UNCLOS (n4) Art 287(3), (4).

<sup>222</sup> See G Eiriksson *The International Tribunal for the Law of the Sea* (Kluwer International Law The Hague Netherlands 2000) 15.

2. disputes concerning military activities, including military activities by government vessels and aircraft engaged in non-commercial service, and disputes concerning law enforcement activities in regard to the exercise of sovereign rights or jurisdiction related to marine scientific research or fisheries;
3. disputes in respect of which the Security Council of the United Nations is exercising the functions assigned to it by the Charter of the United Nations.<sup>223</sup>

The result of these exceptions is that States are free to choose the manner in which they settle these sorts of differences, subject, of course, to the provisions of the United Nations Charter and UNCLOS on peaceful settlement.<sup>224</sup> Aside from these exceptions, there is no escaping the compulsory nature of the Convention's dispute settlement mechanism, which means that no compromise is required to institute proceedings.

Of the 160 States which up to 1 March 2010 had ratified the Convention<sup>225</sup>, only 50 of them have presented declarations pursuant to Articles 287 and/or 298.<sup>226</sup> These declarations differ both in form and substance, but most important to note is that the vast majority of States Parties have not yet manifested their preferred forum for the settlement of disputes. This means that in all probability, if a State Party to UNCLOS were to file a claim against one or more States Parties, an arbitral tribunal instituted in accordance with Annex VI of the Convention would be the most likely forum to entertain the dispute. If we look into the declarations made, on the one hand, by some island or coastal nations, and on the other, those made by certain major polluters and likely defendants, we find that permanent adjudicatory bodies like ITLOS and ICJ could also be requested

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<sup>223</sup> See UNCLOS (n4) Art 298.

<sup>224</sup> See UN Charter (n17) Art 2(3) and UNCLOS (n4) Art 279.

<sup>225</sup> See Division for Ocean Affairs and the Law of the Sea 'Chronological lists of ratifications of, accessions and successions to the Convention and the related Agreements as at 1 March 2010' (01 March 2010) [http://www.un.org/Depts/los/reference\\_files/chronological\\_lists\\_of\\_ratifications.htm](http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm) (last visited 25 April 2010).

<sup>226</sup> See Division for Ocean Affairs and the Law of the Sea 'Settlement of disputes mechanism' (01 March 2010) [http://www.un.org/Depts/los/settlement\\_of\\_disputes/choice\\_procedure.htm](http://www.un.org/Depts/los/settlement_of_disputes/choice_procedure.htm) (last visited 25 April 2010).

to settle a climate change dispute brought under UNCLOS. Such a scenario could materialize, for example, if Cape Verde or Trinidad and Tobago instituted proceedings against Australia, Canada, Germany, Italy, Portugal, or Spain;<sup>227</sup> the benefit of such forums being, *inter alia*, the publicity of the hearings and judgments. In fact, because of the pressure public opinion could pose on such proceedings, it could well happen that the dispute be settled without the court or tribunal having to exercise its adjudicatory powers, the defendant State either agreeing to cease its wrongful conduct and to adequately compensate the claimant or with the parties to the UNFCCC deciding on a comprehensive liability and compensation mechanism for injured and/or vulnerable States. While this may seem very optimistic to some, examples of defendants succumbing to public scrutiny are known, with a notorious one being France's unilateral decision to terminate all nuclear tests subsequent to New Zealand's request for a revision of the ICJ's 1974 judgment.

### 4.3 Jurisdiction and standing

International disputes often remain unsettled because the claimant State is unable to ascertain the jurisdiction of the body from which it seeks support or because it fails to establish its standing. In this section, we will address these obstacles, recalling what has been examined in this thesis concerning the link between UNCLOS and climate change.

Article 288 of the Convention establishes that “a court or tribunal referred to in article 287 shall have jurisdiction over any dispute concerning the interpretation or application of this Convention.”<sup>228</sup> This means that these adjudicatory bodies can only hear disputes related to UNCLOS; hence the importance of linking climate change to the Convention.

Because climate change is not explicitly addressed in the Law of the Sea Convention, it was necessary to examine whether the legal principles of *lex posterior* and *lex specialis* precluded applying UNCLOS to

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<sup>227</sup> See Division for Ocean Affairs and the Law of the Sea ‘Settlement of disputes mechanism’ (n226).

<sup>228</sup> UNCLOS (n4) Art 288.

climate change, which we did in Chapter 3. We concluded this is not the case and further saw that climate change law does not meet the requirements of a self-contained regime which would impede applying the Convention in this context. Having done this, we briefly analyzed the effects thermal energy and carbon dioxide have on the marine environment and found that it is reasonable to fit these contaminants within the definition of pollution of the marine environment embodied in Article 1(4). In section 4.1., we considered the obligations to protect and preserve the marine environment and to refrain from causing harm by pollution, to conclude that –aside from their binding character– State can be held in breach of these obligations through their failure to adequately mitigate climate change. As a result of this analysis, it is now possible to conclude that there is indeed a link between climate change, marine pollution and the aforementioned obligations. Such a conclusion allows us to affirm that the ICJ and the tribunals presented in section 4.2. have jurisdiction to entertain proceedings instituted by a State suffering sea level rise, warming or acidification of the waters over which it exercises different degrees of sovereign powers.

Jurisdiction is not, however, the only prerequisite to a court addressing the merits of a climate change suit: a claimant State must also prove its *locus standi*.

In the *South West Africa Cases*, the ICJ recognized that States have standing to espouse a claim for acts occurring outside their territory if they can prove to have a legal interest.<sup>229</sup> In the words of Eduardo Jimenez de Aréchaga and Attila Tanzi, “[t]he requirement of damage is really an expression of the fundamental legal principle that no one can maintain an action unless he has an interest of a legal nature. It is always the element of damage suffered by one State that entitles that particular State to claim against the State which caused the damage, and demand redress.”<sup>230</sup>

In the field of environmental law, reference can be made to the *Nuclear Tests* cases, where Australia and New Zealand argued that their

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<sup>229</sup> See *South West Africa (Ethiopia v South Africa; Liberia v South Africa)* [1966] ICJ Rep 6, 34.

<sup>230</sup> EJ de Aréchaga and A Tanzi ‘International State Responsibility’ in M Bedjaoui (ed) *International Law: Achievements and Prospects* (Martinus Nijhoff Paris 1991) 347, 349.

legal interest stemmed from the presence of radioactive fall-out in their territories following France's experiments in the Mururoa atoll, over forty six hundred kilometres from their respective territories. While France denied that its nuclear tests produced damage to these States, it implicitly recognized that such purported damage constituted a legal interest.<sup>231</sup> In those cases, a legal interest existed notwithstanding the conduct took place outside the territories of Australia and New Zealand because the damaging consequences of such tests –namely the radioactive fall-out– directly affected these States. In *The 'MOX' Plant Case*,<sup>232</sup> albeit the denial by the United Kingdom that commissioning the Sellafield nuclear fuel reprocessing plant posed an environmental danger for Ireland,<sup>233</sup> the United Kingdom recognized Ireland had a legal interest concerning such conduct.<sup>234</sup>

In the context of climate change, a State could find support in these cases to argue that its standing derives from the damages suffered as a result of another State's GHG emissions in breach of UNCLOS, irrespective of the distance separating them and such State's sovereign rights to exploit its natural resources. Whether or not these damages and the link to the defendant State are proven are not prerequisites for standing, since, as shown by the *'Mox' Plant* and *Nuclear Tests* cases, the mere possibility that damage exists grants this.

Now, because international law affords different kinds of reparations depending on the damages suffered and obligations breached, once jurisdiction and standing are established, it is important to consider which are most suitable for States suffering the effects of anthropogenic climate change in their marine environment.

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<sup>231</sup> *Nuclear Tests Case (Australia v France) (Order Interim Measures)* (22 June 1973) [1973] ICJ Rep 99, 104-5; *Nuclear Tests Case (New Zealand v France) (Order Interim Measures)* (22 June 1973) [1973] ICJ Rep 135, 140-41.

<sup>232</sup> *The 'MOX Plant' Case* (n6).

<sup>233</sup> *The 'MOX Plant' Case (Ireland v United Kingdom)* ITLOS Case No 10 (*MOX Plant Case*) (*Written Response of the United Kingdom*) (15 November 2001) [97]-[99].

<sup>234</sup> Secretary of State for the Environment 'Town and Country Planning Act 1990: Appeal by United Kingdom NIREX Limited. Proposed Rock Characterisation Facility on Land and Adjoining Longlands Farm, Gosforth, Cumbria' Ref No APP/H0900/A/94/247019 (17 March 1997) [6].

## 4.4 Reparations

As mentioned earlier, “States are responsible for the fulfilment of their obligations concerning the protection and preservation of the marine environment [and] shall be liable in accordance with international law.”<sup>235</sup> Having ascertained the jurisdiction of a court or tribunal and established its *locus standi*, a State must prove by “clear and convincing evidence” that the climate change damages it has suffered resulted from wrongful actions or inactions of another State or group of States, in breach of the obligation to protect and preserve the marine environment and/or the “no-harm” rule as established in UNCLOS. Because this challenge is more of a scientific nature than a legal one, it is left out of this study. Once a State has overcome this obstacle, however, relying on the general principle of international law that the breach of an international engagement entails the duty to make reparations for the injury caused,<sup>236</sup> it can ask the adjudicatory body for reparations. This section analyzes the forms of reparations which most adequately address the aspirations of States seeking to tackle climate change through UNCLOS.

“Reparation is the generic term which describes the various methods available to a State for discharging or releasing itself from such responsibility.”<sup>237</sup> These methods comprise the following: cessation of the breach; restitution in kind; indemnification or compensation; satisfaction and, occasionally, the right to sanction;<sup>238</sup> their purpose being to “wipe out all the consequences of the illegal act and re-establish the situation which would, in all probability, have existed if that act had not been committed.”<sup>239</sup> A State victim of an internationally wrongful act may request a court or tribunal to consider granting one sole form of redress or a combination of these, depending on the consequences of the breach and the nature of the wrong.

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<sup>235</sup> UNCLOS (n4) Art 235(1).

<sup>236</sup> See *Case Concerning the Factory at Chorzow (Germany v Poland) (Jurisdiction)* PCIJ Rep Series A No 9 21.

<sup>237</sup> EJ de Aréchaga and A Tanzi (n230) 367.

<sup>238</sup> See EJ de Aréchaga (n237) 368.

<sup>239</sup> See *Case Concerning the Factory at Chorzow (Germany v Poland) (Merits)* PCIJ Rep Series A No 17, 47.

In the context of the Law of the Sea Convention and the obligations described in section 4.1., cessation of the wrongful conduct is a straightforward form of reparation that should be at the core of any suit if its objective is to use the Convention to mitigate further climate change. Applied to the obligation to protect and preserve the marine environment, cessation demands that the State in breach correct its conduct to actively prevent damage from its GHG emissions to the marine environment, i.e. reducing its emissions to a level which does not contribute to enhancing the greenhouse effect or to acidifying the oceans and by implementing clean development mechanisms or enhancing anthropogenic removals by sinks of greenhouse gases such as mangroves.<sup>240</sup> As for the “no-harm” rule, a State found in breach of its obligations may be requested to insure that industries subject to its jurisdiction, including those exploiting the continental shelf and territorial waters, as well as vessels and airplanes flying its flag, pollute only to the extent that such pollution is not of serious consequence to the marine environment. For this, such State could be asked to adopt and enforce legislation which promotes GHG emissions reductions and sanctions breaches of emission limits set in line with the objectives of the Kyoto Protocol.

Restitution in kind is, in general, the ideal form of reparation but is only adequate when the damage caused is fully reparable so that the *status quo ante* can be re-established as if the breach of the international obligation had never taken place. In considering whether such form satisfies a particular circumstance, a court or tribunal has to take into account the nature of the damage caused and the practical difficulties restitution could entail. It is evident from what we have learned so far that restoration of the land and marine environment damaged by anthropogenic climate change and excessive GHG emissions would most likely prove inoperable. To address the value of the damaged or lost environment as well as the costs incurred by the claimant in its attempt to restore it, compensation is

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<sup>240</sup> See Kyoto Protocol (n12) Art 6.

probably a more efficacious form of reparation.<sup>241</sup> International law recognizes that compensation also covers the *lucrum cessans* or loss of income if the claimant proves that following the natural order of things he would have obtained a profit which is lost as a consequence of the harmful act, even though the amount cannot be determined with precision.<sup>242</sup>

Brought back to the subject of climate change and the Law of the Sea Convention, compensation could provide wronged States with the resources they request at each COP in order to deal with the consequences of sea level rise, acidification and loss of natural resources. In this context, the indemnity would have to compensate for all the economic losses derived from the breach of such obligations as those presented at the beginning of this Chapter, including but not limited to, loss of territory and contamination of arable land due to sea level rise, harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.<sup>243</sup> In addition, the adjudicatory body seized of the dispute would also have to contemplate the loss of income that resulted from the aforementioned grievances, provided it is not too remote or speculative,<sup>244</sup> such as losses from declined tourism and fishing industries.

Under customary international law, punitive damages or sanctions are incompatible with the duty to make reparations since they go beyond the idea established by the PCIJ in the *Case Concerning the Factory at Chorzow*, which is that reparations should restore the *status quo ante*, not more.<sup>245</sup> Punitive damages could be conventional though, so while UNCLOS does not contemplate them, Article 18 of the Kyoto Protocol does hint to the possibility that non-compliance with reduction terms agreed

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<sup>241</sup> LA de La Fayette 'Compensation for Environmental Damage' in A Kirchner (ed) *International Marine Environmental Law; Institutions, Implementation and Innovations* (Kluwer Law International The Hague 2003) 263.

<sup>242</sup> *Affaire du navire Cape Horn Pigeon (United States of America v Russia)* UNRIIA [1902] vol IX, 63, 65.

<sup>243</sup> See UNCLOS (n4) Art 1(4).

<sup>244</sup> EJ de Aréchaga and A Tanzi (n230) 369.

<sup>245</sup> See *Case Concerning the Factory at Chorzow* (n239) 47 and EJ de Aréchaga and A Tanzi (n230) 368-369.

therein could result in sanctions. The list of consequences to which said article refers has yet to be discussed at the COP however.<sup>246</sup>

Satisfaction, on the other hand, could also prove to be an appropriate form of reparation to compel States to mitigate climate change through a reduction of GHG emissions. A condemnatory judgment against States in breach of their duties to protect and preserve the marine environment, referring in its *rationale* to the applicable standards of care and mitigation, could bridge the gap which to date prevails at the COP between nations eager to avert irreversible anthropogenic climate change and those supposedly unconvinced with the gloomy projections of the IPCC for this century. The court or tribunal adjudicating on this matter would thereby, in all practical terms, replace the stagnant COP and set a precedent which would be difficult to ignore.

Truth remains, however, that while the damage caused by climate change could give rise to the right to seek reparations under the Convention, the gravity of it is such that a substitute to mitigation is not an option. As the Prime Minister of Tuvalu expressed at the Conference of the Parties to the UNFCCC in Poznan, “Tuvalu as a nation has the right to exist forever,”<sup>247</sup> and this can only be achieved through mitigation.

## 4.5 Conclusion

This Chapter continued on the legal challenges facing a climate change suit, focusing on the obligations contained in UNCLOS to prevent and mitigate climate change. It presented the forums that the delegates at the Third United Nations Conference on the Law of the Sea empowered to interpret and apply the Convention and thus, entertain a dispute related to the damaging consequences of climate change on the marine environment. A brief overview of the prerequisites to having a court or tribunal adjudicate on the merits of such a dispute followed, recalling for this purpose the importance of linking climate change to the regime of the Convention.

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<sup>246</sup> See Kyoto Protocol (n12) Art 18.

<sup>247</sup> A Chiu ‘Poznań, Days 8, 9 & 10: The Grand Finale’ (13 December 2008) available at <http://www.worldwatch.org/node/5963> (last visited 29 January 2010).

Supposing the prerequisites met and the merits proven, the Chapter closed with an examination of the diverse forms of reparations available to a claimant State in the context of climate change damages. In sum, together with Chapter 3, it addressed the legal arguments that a State would have to consider to seize the Convention's compulsory dispute settlement mechanism and what it could expect to achieve by this.

Enforcing the obligation to protect and preserve the marine environment and the "no-harm" rule would ensure the sustainable uses of the oceans and the preservation of marine biodiversity; compel major GHG emitters to invest in clean development mechanisms and to assume their duty to assist countries in need so they may adapt to the already unavoidable environmental changes. In this sense, "responsibility and liability for environmental damage should not always be regarded as a negative sanction, but rather [...] as a positive inducement to prevention, restoration or compensation as the case may be."<sup>248</sup>

However, because UNFCCC Annex I nations have been so reluctant to provide the necessary financial means to States suffering the gravest consequences of climate change, it may prove necessary to acquire these means through a condemnatory judgment. The power and far-reaching consequences of a judicial declaration on the unlawful character of an act such as the pollution of the marine environment through GHG emissions should definitely be exploited.

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<sup>248</sup> F Orrego Vicuña 'Responsibility and Liability for Environmental Damage Under International Law: Issues and Trends' (1998) 10 *Georgetown Int'l Envtl L Rev* 279, 280.

## 5 Conclusion

*“This is a matter of life and death.”*<sup>249</sup>

In this thesis, we commenced by focusing on the causes, consequences and projections of climate change, particularly on sea level rise and its effects on low-lying island nations. We learned that they are the greatest victims of industrialization, with practically no contribution to the enhancement of the greenhouse effect, yet affected in their entirety. As the seas rise, the water lenses of these territories are flooded with salt water, the land becomes unusable for agriculture, natural disasters claim ever more lives and property. Additionally, sea level rise could severely affect the maritime boundaries and zones of many nations and with it, the scope, purpose and value of the Law of the Sea Convention. Some countries might even disappear as the oceans engulf all in their path. In fact, the effects of the current and increasing greenhouse gas concentrations are so grave they could actually render the prevention of pollution from other sources pointless, at least for these island nations.

Of course, certain coastal States will also suffer greatly. Bangladesh is one example, where a meter rise will affect a densely populated coastline, with an estimate of 15 million inhabitants becoming environmental refugees and abandoning a region that accounts for approximately 15% of the nation’s agricultural produce.<sup>250</sup> Miami –while situated on the territory of one of the world’s biggest contributors to enhancing the greenhouse effect– is believed to be the most endangered metropolis; yet permits are still being granted to construct massive beach resorts on the waterfront. Venice, a city known for its relationship with its surrounding canals, is also under threat from the rising sea: estimates indicate that in the last 15 years the population of Venice has dropped by 50%,<sup>251</sup> proof that many are already fleeing the all-encroaching waters.

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<sup>249</sup> See M Nasheed (n9).

<sup>250</sup> See O Pilkey (n58) 134.

<sup>251</sup> See O Pilkey (n58) 22.

The facts on global warming, acidification and sea level rise were followed by an analysis of the rules relevant to applying and interpreting the Law of the Sea Convention in the context of climate change. This analysis demonstrated that neither the principles of *lex specialis* nor *lex posterior* precluded applying the provisions of UNCLOS to climate change, insofar as the climate change regime enshrined in the UNFCCC and Kyoto Protocol did not meet the test to be considered “self-contained” and was not in contradiction with the Constitution of the Oceans. In light of the facts presented in Chapter 2, we examined the definition of pollution of the marine environment in the light of climate change, presenting carbon dioxide and thermal energy as the relevant contaminants. This led to the conclusion that an interpretation of the definition of pollution of the marine environment in accordance with the rules set in the Vienna Convention on the Law of Treaties does not exclude greenhouse gas emissions as a source of pollution.

In our research, we chose to focus on UNCLOS because, as presented in Chapter 4, it contains environmental provisions applicable in the context of climate change, but most importantly, because the Convention contains a comprehensive dispute settlement mechanism which States parties to the Convention will have difficulties avoiding. No specific agreement is required to seize an arbitral tribunal established under UNCLOS or, in certain coincidences, the International Court of Justice or the International Tribunal for the Law of the Sea. In brief, the Convention disallows what the UNFCCC and Kyoto Protocol permits, namely, avoiding liabilities for climate change. In deciding then which State(s) to sue, the injured State could look into the annual reports States listed in Annex 1 of the UNFCCC have to submit pursuant to the Kyoto Protocol.<sup>252</sup> We find here another link between UNCLOS and climate change law. While the former establishes the rights and obligations of States concerning the protection and preservation of the marine environment, the latter framework serves as guide in determining the standards of care and diligence incumbent on States, considering always the principle of common but

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<sup>252</sup> See Kyoto Protocol (n12) Art 7.

differentiated responsibilities. The Convention serves to empower a small, drowning State such as Tuvalu to request an arbitral tribunal to find a State in breach of UNCLOS for not limiting its GHG emissions as international standards demand and condemn it to cease its wrongful conduct as well as to compensate Tuvalu for all the damages suffered; compensation which will help it adapt to sea level rise and other consequences of climate change.

Indeed, the effects climate change will have on the rights of States under UNCLOS are such that when the time comes, it is through this Convention that many will assert their standing to take the debate on climate change from the COP to an adjudicatory body. The science and evidentiary burdens of such an endeavour are sure to make matters difficult, but even if a claim is unsuccessful in obtaining relief, a judicial hearing on climate change is sure to put pressure on politicians currently dodging the need to seriously curb GHG emissions.

Aside from the provisions of Part XII which were discussed in Chapter 4, we believe claims could also be construed around the conventional and customary obligation to cooperate for the protection of the marine environment<sup>253</sup> as well as the duty to carry out comprehensive environmental impact assessments prior to engaging in activities likely to cause harm to the environment of other States or areas beyond national jurisdiction.<sup>254</sup> Ultimately, under UNCLOS, States have the obligation to “cooperate in [...] the further development of international law relating to responsibility and liability for the assessment of and compensation for damage and the settlement of related disputes, as well as, where appropriate, development of criteria and procedures for payment of adequate compensation, such as compulsory insurance or compensation funds.”<sup>255</sup>

There are a number of international instruments which could be used in addition to UNCLOS and which were not dealt with here. Perhaps another way of bringing the climate change to the spotlight is litigation under the World Trade Organisation’s dispute resolution system. “Some

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<sup>253</sup> See UNCLOS (n4) Part XII, Seccion 2 and in particular Art 197 and *The ‘MOX Plant’ Case* (n6) [82]; *Fisheries Jurisdiction (United Kingdom v Iceland) (Merits)* [1974] ICJ Rep 3, 31.

<sup>254</sup> See UNCLOS (n4) Art 206.

<sup>255</sup> UNCLOS (n4) Art 235(3).

environmentalists have argued that lax environmental standards externalize the cost of production and should be considered de facto subsidies. It could be argued that emission of GHG is far more insidious than most subsidies. [...] The prospect of countries taking potentially embarrassing, expensive and arguably legal remedial trade action against the United States could help encourage it to engage in serious negotiations over global warming.”<sup>256</sup>

To conclude, there are many means and arguments which can be combined to compel contributors to climate change appropriately mitigate climate change and to assume their obligation to sponsor adaptation measures in vulnerable countries. There is no need to concentrate our hope on the COP for this, though efforts in this front should not be abandoned. What the world does need is a substantial change in the manner climate change has been addressed so far, for in the words of the President of the Maldives, a drowning island nation, “we are all Maldivians; it is only a matter of time before we realize it.”<sup>257</sup>

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<sup>256</sup> A Strauss (n111) 10189.

<sup>257</sup> British Broadcasting Corporation ‘Greatest Debate on Earth’ (n15).

# Supplement A

## Treatment of uncertainty

The IPCC uncertainty guidance note<sup>1</sup> defines a framework for the treatment of uncertainties across all WGs and in this Synthesis Report. This framework is broad because the WGs assess material from different disciplines and cover a diversity of approaches to the treatment of uncertainty drawn from the literature. The nature of data, indicators and analyses used in the natural sciences is generally different from that used in assessing technology development or the social sciences. WG I focuses on the former, WG III on the latter, and WG II covers aspects of both.

Three different approaches are used to describe uncertainties each with a distinct form of language. Choices among and within these three approaches depend on both the nature of the information available and the authors' expert judgment of the correctness and completeness of current scientific understanding.

Where uncertainty is assessed qualitatively, it is characterised by providing a relative sense of the amount and quality of evidence (that is, information from theory, observations or models indicating whether a belief or proposition is true or valid) and the degree of agreement (that is, the level of concurrence in the literature on a particular finding). This approach is used by WG III through a series of self-explanatory terms such as: *high agreement, much evidence*; *high agreement, medium evidence*; *medium agreement, medium evidence*; etc.

Where uncertainty is assessed more quantitatively using expert judgement of the correctness of underlying data, models or analyses, then the following scale of confidence levels is used to express the assessed chance of a finding being correct: *very high confidence* at least 9 out of 10; *high confidence* about 8 out of 10; *medium confidence* about 5 out of 10; *low confidence* about 2 out of 10; and *very low confidence* less than 1 out of 10.

Where uncertainty in specific outcomes is assessed using expert judgment and statistical analysis of a body of evidence (e.g. observations or model results), then the following likelihood ranges are used to express the assessed probability of occurrence: *virtually certain* >99%; *extremely likely* >95%; *very likely* >90%; *likely* >66%; *more likely than not* > 50%; *about as likely as not* 33% to 66%; *unlikely* <33%; *very unlikely* <10%; *extremely unlikely* <5%; *exceptionally unlikely* <1%.

WG II has used a combination of confidence and likelihood assessments and WG I has predominantly used likelihood assessments.

This Synthesis Report follows the uncertainty assessment of the underlying WGs. Where synthesised findings are based on information from more than one WG, the description of uncertainty used is consistent with that for the components drawn from the respective WG reports.

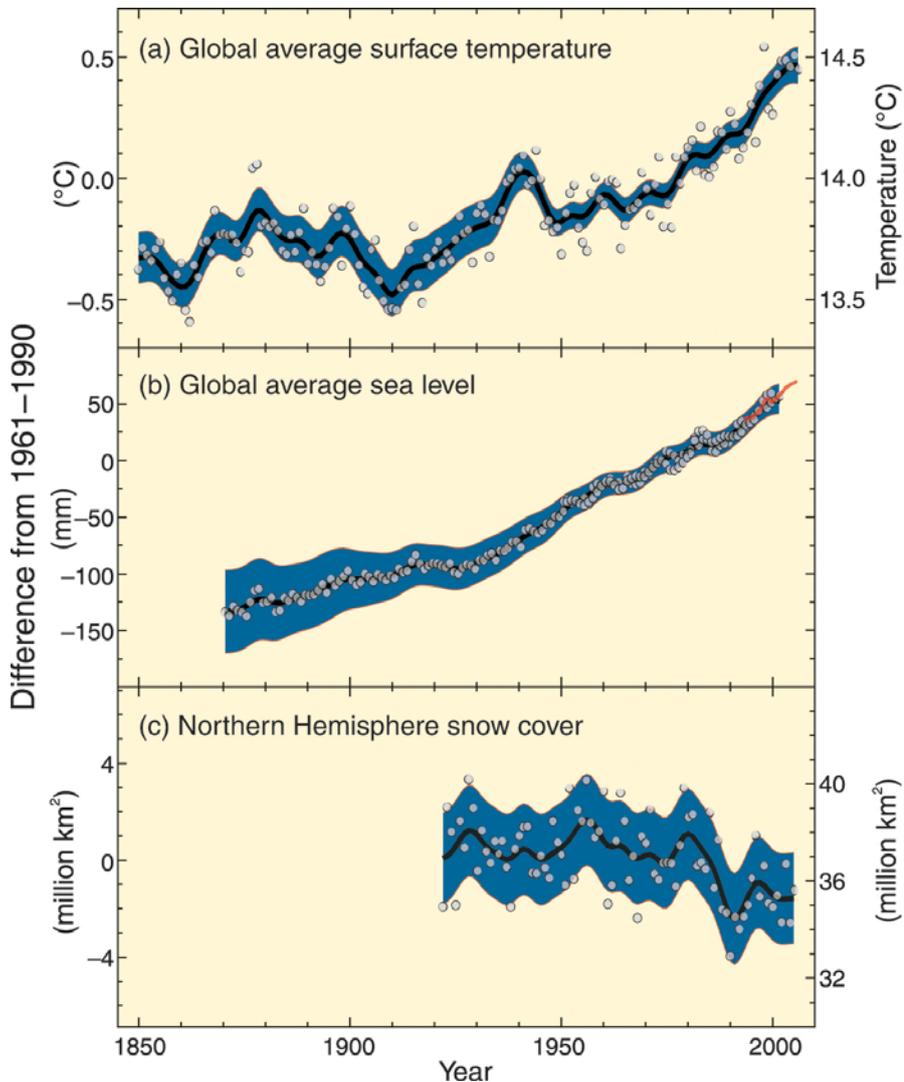
Unless otherwise stated, numerical ranges given in square brackets in this report indicate 90% uncertainty intervals (i.e. there is an estimated 5% likelihood that the value could be above the range given in square brackets and 5% likelihood that the value could be below that range). Uncertainty intervals are not necessarily symmetric around the best estimate.

258

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<sup>258</sup> Intergovernmental Panel on Climate Change 'Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (17 November 2007) available at [www.ipcc.ch](http://www.ipcc.ch) (last visited 28 January 2010) 27.

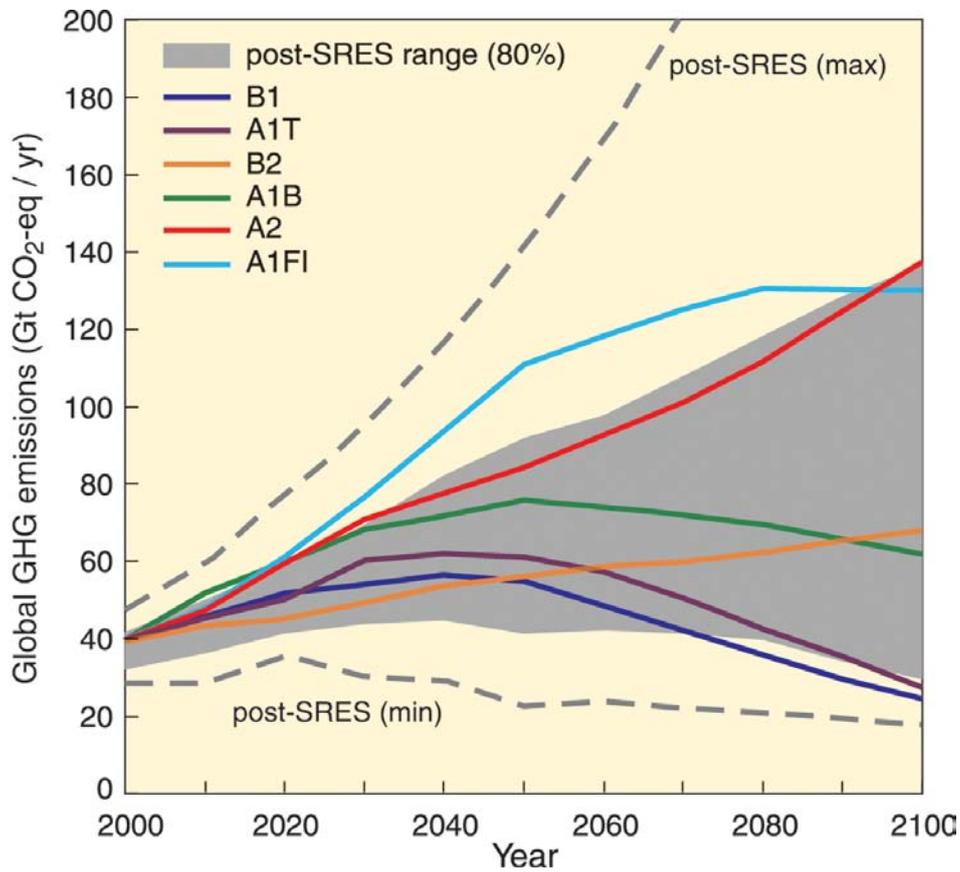
# Supplement B



**Figure SPM.1.** Observed changes in (a) global average surface temperature; (b) global average sea level from tide gauge (blue) and satellite (red) data and (c) Northern Hemisphere snow cover for March–April. All differences are relative to corresponding averages for the period 1961–1990. Smoothed curves represent decadal averaged values while circles show yearly values. The shaded areas are the uncertainty intervals estimated from a comprehensive analysis of known uncertainties (a and b) and from the time series (c).<sup>259</sup>

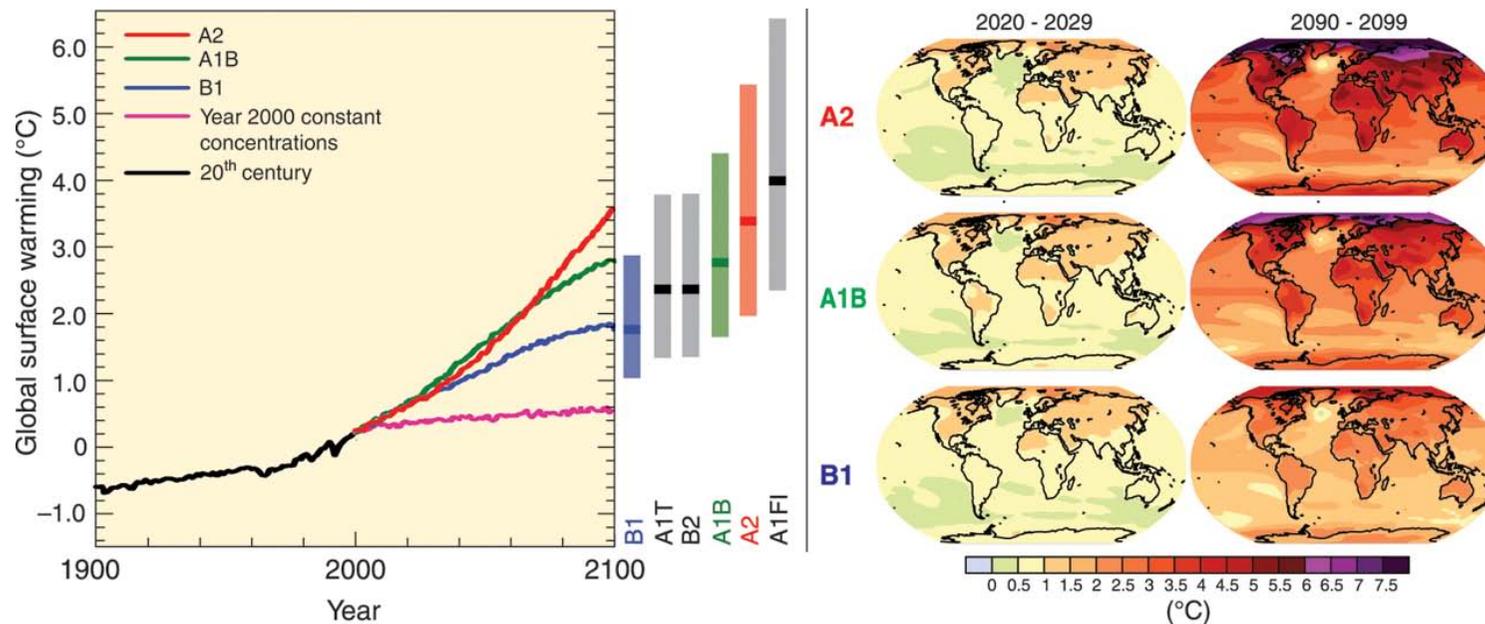
<sup>259</sup> IPCC Summary for Policymakers (n36) 2.

# Supplement C



**Figure SPM.5.** Global GHG emissions (in GtCO<sub>2</sub>-eq) in the absence of climate policies: six illustrative SRES marker scenarios (coloured lines) and the 80th percentile range of recent scenarios published since SRES (post-SRES) (gray shaded area). Dashed lines show the full range of post-SRES scenarios. The emissions include CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and F-gases.<sup>260</sup>

<sup>260</sup> IPCC Summary for Policymakers (n36) 7.

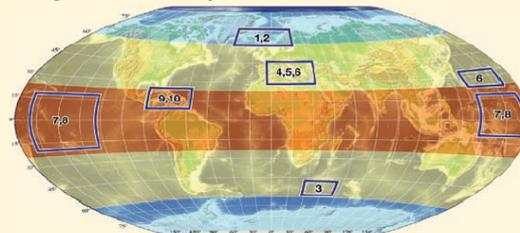


**Right Panel:** Solid lines are multi-model global averages of surface warming for scenarios A2, A1B and B1, shown as continuations of the 20th-century simulations. These projections also take into account emissions of short-lived GHGs and aerosols. The pink line is not a scenario, but is for Atmosphere-Ocean General circulation Model (AOGCM) simulations where atmospheric concentrations are held constant at year 2000 values. The bars at the right of the figure indicate the best estimate (solid line within each bar) and the likely range assessed for the six SRES marker scenarios at 2090-2099. All temperatures are relative to the period 1980-1999.<sup>261</sup>

<sup>261</sup> IPCC Summary for Policymakers (n36) 10.

# Supplement D

**Box 16.1. Range of future impacts and vulnerabilities in small islands**



\* Numbers in bold relate to the regions defined on the map

Region* and system at risk	Scenario and reference	Changed parameters	Impacts and vulnerability
1. Iceland and isolated Arctic islands of Svalbard and the Faroe Islands: Marine ecosystem and plant species	SRES A1 and B2 ACIA (2005)	Projected rise in temperature	<ul style="list-style-type: none"> <li>The imbalance of species loss and replacement leads to an initial loss in diversity. Northward expansion of dwarf-shrub and tree-dominated vegetation into areas rich in rare endemic species results in their loss.</li> <li>Large reduction in, or even a complete collapse of, the Icelandic capelin stock leads to considerable negative impacts on most commercial fish stocks, whales, and seabirds.</li> </ul>
2. High-latitude islands (Faroe Islands): Plant species	Scenario I / II: temperature increase / decrease by 2°C. Fosaa et al. (2004)	Changes in soil temperature, snow cover and growing degree days	<ul style="list-style-type: none"> <li>Scenario 1: Species most affected by warming are restricted to the uppermost parts of mountains. For other species, the effect will mainly be upward migration.</li> <li>Scenario II: Species affected by cooling are those at lower altitudes.</li> </ul>
3. Sub-Antarctic Marion Islands: Ecosystem	Own scenarios Smith (2002)	Projected changes in temperature and precipitation	<ul style="list-style-type: none"> <li>Changes will directly affect the indigenous biota. An even greater threat is that a warmer climate will increase the ease with which the islands can be invaded by alien species.</li> </ul>
4. Mediterranean Basin five islands: Ecosystems	SRES A1FI and B1 Gritti et al. (2006)	Alien plant invasion under climatic and disturbance scenarios	<ul style="list-style-type: none"> <li>Climate change impacts are negligible in many simulated marine ecosystems.</li> <li>Invasion into island ecosystems become an increasing problem. In the longer term, ecosystems will be dominated by exotic plants irrespective of disturbance rates.</li> </ul>
5. Mediterranean: Migratory birds (Pied flycatchers – <i>Ficedula hypoleuca</i> )	None (GLM/ STATISTICA model) Sanz et al. (2003)	Temperature increase, changes in water levels and vegetation index	<ul style="list-style-type: none"> <li>Some fitness components of pied flycatchers suffer from climate change in two of the southernmost European breeding populations, with adverse effects on reproductive output of pied flycatchers.</li> </ul>
6. Pacific and Mediterranean: Siam weed ( <i>Chromolaena odorata</i> )	None (CLIMEX model) Kriticos et al. (2005)	Increase in moisture, cold, heat and dry stress	<ul style="list-style-type: none"> <li>Pacific islands at risk of invasion by Siam weed.</li> <li>Mediterranean semi-arid and temperate climates predicted to be unsuitable for invasion.</li> </ul>
7. Pacific small islands: Coastal erosion, water resources and human settlement	SRES A2 and B2 World Bank (2000)	Changes in temperature and rainfall, and sea-level rise	<ul style="list-style-type: none"> <li>Accelerated coastal erosion, saline intrusion into freshwater lenses and increased flooding from the sea cause large effects on human settlements.</li> <li>Less rainfall coupled with accelerated sea-level rise compound the threat on water resources; a 10% reduction in average rainfall by 2050 is likely to correspond to a 20% reduction in the size of the freshwater lens on Tarawa Atoll, Kiribati.</li> </ul>
8. American Samoa; 15 other Pacific islands: Mangroves	Sea-level rise 0.88 m to 2100 Gilman et al. (2006)	Projected rise in sea level	<ul style="list-style-type: none"> <li>50% loss of mangrove area in American Samoa; 12% reduction in mangrove area in 15 other Pacific islands.</li> </ul>
9. Caribbean (Bonaire, Netherlands Antilles): Beach erosion and sea turtle nesting habitats	SRES A1, A1FI, B1, A2, B2 Fish et al. (2005)	Projected rise in sea level	<ul style="list-style-type: none"> <li>On average, up to 38% (<math>\pm 24\%</math> SD) of the total current beach could be lost with a 0.5 m rise in sea level, with lower narrower beaches being the most vulnerable, reducing turtle nesting habitat by one-third.</li> </ul>
10. Caribbean (Bonaire, Barbados): Tourism	None Uyarra et al. (2005)	Changes to marine wildlife, health, terrestrial features and sea conditions	<ul style="list-style-type: none"> <li>The beach-based tourism industry in Barbados and the marine diving based ecotourism industry in Bonaire are both negatively affected by climate change through beach erosion in Barbados and coral bleaching in Bonaire.</li> </ul>

262

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