Abstract

Wildfire observations are increasingly important as changing wildfire regimes globally affect societies and ecosystems. Wildfire behaviour, comprising the way that wildfires spread through the landscape, connects wildfire to its physical controls and has been shown to predict other wildfire characteristics. However, observations of wildfire behaviour are limited due to the spatial and temporal resolution of available observation methods. This thesis aims to investigate wildfire behaviour from the observation perspective, testing the ability to predict wildfire behaviour free from physical variables through spatiotemporal interpolation applied on low temporal resolution Sentinel-2 observations, determining whether simplistic assumptions are sufficient to estimate wildfire spread characteristics, and finding how often those assumptions apply to general wildfires. I tested two interpolation methods that assume a constant fire rate of spread between two observed fire perimeters, classified from Sentinel-2 imagery. The two interpolation methods differ by the path along which fire travels: the shortest lines to the two perimeters ("nearest path") or the shortest path avoiding unburned areas ("visibility graph"). Neither method closely matched observed wildfire behaviour, though otherwise both performed similarly well. Estimated wildfire behaviour strongly tended to underestimate rates of growth, with average estimated fire arrival times being later than observations (+22 hours) and average burn areas during interpolation being underestimated (10% of total end burn area). The main reason for underestimated rates of growth is the assumption of constant rate of spread, which universally underestimated rate of growth at the start of an interpolation interval and overestimated rate of spread at the end of an interpolation interval. This result strongly suggests that fire rate of spread gradually decreases over a fire's lifetime, indicating that measures of fire rate of spread over longer time intervals, as are common among existing products, are scale dependent, and poorly account for fire behavioural characteristics at different temporal scales.