MSc Thesis, Summary: Mapping of Floodplains in the Atankwidi River Basin

Introduction

The Atankwidi River Basin is situated in the Upper East Region of Ghana. The Basin has an area of around 275 km^2. The semiarid climate in which the Atankwidi is situated is characterized by one rainy season spanning from April to September and one dry season spanning from September to April. All of the year's precipitation falls during the rainy season – roughly 1000mm – with a peak downfall in August. This concentrated precipitation pattern mixed with the clayey soil, the low sloping topography and the sometimes raised water levels downstream – e.g. due to water release from the Bagré Dam – produces often flooding in the basin. When very large, the flooding can destroy houses and crops taking away the livelihoods from people already living in the least economically developed region of the Volta Basin, but when the flooding is small there is not enough water to flood the rice fields. Another economically very important use of the flooding which has only recently been discovered is the Shallow Ground Water Irrigation (SGI) which is conducted during the dry season by digging shallow wells, with a depth of up to 6 m.

Objective

There exists a potent theory stating that the recharge of the shallow groundwater table is manly locally recharged by the floodplains from the previous rainy season. To see if the shallow groundwater table is indeed locally recharged by the floodplains of the previous rainy season a mapping of the floodplains for the years 2007 and 2009 is conducted. The year 2007 is chosen for the reason of the great flood which occurred during that particular rainy season and also because of the research on SGI that was conducted dry season 2007, after the great flood. The year 2009 is chosen because that was when this project was made and hence also the time when the fieldwork was conducted.

Methodology

The following methodology was used to map the floodplains of 2007 & 2009:
Radar satellite imagery for the years 2007 and 2009 – L-band PALSAR & C-band ALOS – to be mapped with the GIS software IDRISI + a Digital Elevation Model (DEM) – resolution 96 m – flooded by the software SOBEK. The reason for going through with both the mapping of

the satellite imagery and the modeling of the DEM is to be able to better estimate the peak flooding and to look at the problem from more “viewpoints”.
A fieldwork was conducted for the following reasons: 1) mapping the area with a GPS, so that an error assessment of the final Idrisi-mapped map could be made and to better understand the different reflectances coming from different crops and conditions, 2) collecting ground control points for geo-referencing of the satellite images, 3) mapping the river course, 4) getting acquainted with the area and the ruling conditions.

RESULTS

The year 2009 turned out to be a relatively dry year in the Atankwidi River Basin and no large and distinct floods where observed, thus no flood maps could be created for the year 2009, but the fieldwork still gave a lot of vital information which could be used when creating a flood map for 2007.
The SOBEK-modeled DEM showed interesting and useful results, though the roughness of the resolution of the DEM used made it difficult to speculate about anything else but large general patterns of the floodplains hence not showing the true complexity of the basin.
The C-band images proved to be too noisy to give useful information on the flood plains. The noise may have been due to the high backscatter caused by the large floodplains of the area. The L-band images, however, gave very good information on the floodplains. This together with the information deduced from the modeled DEM gave the basis for the creation of the floodplain map of 2007, which was drawn by hand in Idrisi.
The final flood map created is not very accurate but is believed to be able to serve the goal of this project, i.e. providing a flood map for the purpose of comparing the places where floodplains occurred in 2007 with the places where the shallow groundwater wells gave good yield the following dry season.