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# Monitoring Monsoon Floods in Bangladesh Using Radar and Optical Remote Sensing

**Master Thesis**

Degree Program: Geodesy and Geoinformatics

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# Abstract

Flood is one of the world's most common natural disasters that affects millions of people every year in the world. Bangladesh is well-known in the world for its prolonged history of natural disasters and flooding is a very common phenomenon that the country suffers almost every year. Flood frequency, severity, duration, and damage have all grown in Bangladesh during the previous few years. Therefore, monitoring of floods and identification of flood-damaged areas are very important for successful flood response. For assessing and mapping flood effects, remote sensing is the most advanced and feasible tool accessible to flood-prone area management. This study is focused on providing an effective technique for monitoring floods and flood-related risk assessment for the population on a country level using both radar and optical remote sensing data. In this study, a cloud-based computational method developed in Google Earth Engine with different remote sensing imagery was utilized, and also different image classification techniques were used to classify flooded water from other features. The use of radar (Sentinel-1) and optical (Sentinel-2 and Landsat-8) data produced similar results and the used classifiers, namely the Classification and Regression Tree, the random forest, and the threshold-based classification performed very well with the data sets and their results were very proportionate. Three years of data starting from 2018 till 2020 were used and after considering all the three years of analyzed data, the overall accuracy was above 98% for all of the classifiers. The three year average error of omission and commission rates for the CART, random forest and the threshold-based classifier were approximately 2%, 1.5% and 0.14%. Though the yearly modeled flood coverage varied, but considering the three year flood frequency map, about one-third of the country's land and 0.49% of the country's population suffers from the high flood risk. Whereas, around 7% of the country's land and 43.56% of the country's population are in the medium flood risk zone. The used data for built-up areas risk assessment didn't show significant results for this study though it had very high spatial resolution (100 meters). This study aimed to use advanced remote sensing technology to present a technique that can be applicable everywhere just by changing the area of interest and time periods.

**Keyword:** radar remote sensing; optical remote sensing; image classification; Google Earth Engine; monsoon flood mapping; risk assessment; Bangladesh