# 第Ⅱ部門

# Vulnerability Analysis of Regional Flood Hazard Based on MODIS Imagery and Demographic Data in the Huaihe River Basin, China

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## **1. Introduction**

Large scale flooding due to heavy rainfall and drainage congestion are being regularly experienced in the floodplain area of the Huaihe River basin, China. There is danger of loss of life and severe damage to the economies. To some extent the actual amount of flood damage of a specific flood event depends on the vulnerability of the affected socio-economic and ecological systems. In this regard, vulnerability has emerged as the most critical concept in disaster studies. Although vulnerability is a multidimensional and multivariate concept associated with high uncertainty in measurement and classification, land use and population are the key components of exposure for flood hazard vulnerability analysis.

Satellite remote sensing provides powerful techniques for detecting flooded areas and classifying land use and land cover, and many studies have been undertaken in these research fields with the application of a range of satellite data sources, such as Landsat, IKONOS, SPOT, NOAA-AVHRR and RADARSAT SAR data. For a severe flood occurring in a large area, Moderate Resolution Imaging Spectroradiometer (MODIS) data products offer a great opportunity to acquire the expected information by a low-cost and expeditious dynamic analysis. In this research, based on land use classification and identification of flooded area with the application of MODIS satellite data, the population affected by flooding can be generated. Taking spatial analysis method and auxiliary data, the flood hazard vulnerability is analyzed.

The objectives of this study are: (1) to characterize the dynamic change of flooded area captured by MODIS NDVI composite imagery; (2) to estimate the distribution of people at flood risk based on flood event analysis; and (3) to identify and analyze the flood hazard vulnerability.

# 2. Methodology

Instead of following the conventional approach of flooded area delineation and overall damage estimation, this paper proposes a method to identify the people at risk that is vulnerable to flood according to the extraction of flooded area as well as land use classification and change detection. And integrated analysis of vulnerability to flood hazard is discussed.

To study the extent of flood inundation, the analysis of multi-temporal MODIS composite imagery has been performed and the smoothed time profiles of NDVI, EVI and some other derived data are obtained from MOD13 16-day composite time-series data with 250-m spatial resolution. Additionally, the multi-temporal images are classified using the Decision Tree classifier, which is defined as a classification procedure that recursively partitions a data set into more uniform subdivisions based on tests defined at each node in the tree.

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# (1) NDVI Data Preprocessing

After the data analysis of MOD-13 composite imagery, the Savitzky–Golay smoothing filter is applied to process the original NDVI time-series data for improving data quality.

(2) Identification of water area

As a fundamental step, now the identification of water area has been done. The key is to determine the dynamic threshold based on the NDVI sampling analysis. According to multi-temporal data analysis, the water distribution in the Huaihe River basin is identified (Fig. 1) and the dynamic change of water area is generated.





(3) Extraction of flooded area

In terms of historical information about the flood event in the year 2003, flood occurred in the July and August. With the application of spatial analysis, the flood information is generated (Fig. 2).

### 3. Vulnerability Analysis

Combining with demographic data, spatial distribution of people at risk to flood hazard is derived based on overlay analysis and buffer analysis. The result indicates that the people at flood detention areas and around reservoirs are more vulnerable to flood such as Mengwa, Lake Tangduo, etc.

The final result can be put forth after comparison with statistical data. In addition,

accuracy assessment should be taken into consideration.



Fig. 2 The flooded area in the Huaihe River basin, China (2003) (The red color area shows flood inundated area and the blue area is the background water body.)

#### 4. Results and Discussions

This study attempts to analyze the flood hazard vulnerability in the Huaihe River basin, China. The proposed algorithm is applied to produce time-series inundation maps for the analysis of flood event of the year 2003 in the Huaihe River. Meanwhile taking advantage of the results from typical flood event, brief analysis of flood vulnerability at a regional scale is introduced. Accordingly integrated with demographic data and land use information, spatial modeling of vulnerability to flood hazard can be generated.

In this study, it pays more attention on the method to estimate the flooded area, which is applicable to large area flood with long duration. This research is significant to assess vulnerability for the further study.

## Reference

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