

Editorial

Preface: Remote Sensing in Flood Monitoring and Management

Guy J-P. Schumann [†]

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Joint Institute for Regional Earth System Science and Engineering, University of California Los Angeles, Los Angeles, CA 90095, USA; gjpschumann@gmail.com; Tel.: +1-626-394-3538

[†] Now at Remote Sensing Solutions Inc., Monrovia, CA 91016, USA

Abstract: This Special Issue is a collection of papers studying the use of remote sensing data and methods for flood monitoring and management. The articles contributed span a wide range of topics and present novel processing techniques, review methods and discuss limitations, and also report on current capabilities and outline emerging needs. This preface provides a brief overview of the content.

Keywords: flood hazard and risk; satellite imagery; altimetry; digital elevation model; hydrodynamics

1. Scope

Floods can be mapped and monitored with remotely sensed data acquired by aircraft and satellites, or even from ground-based platforms. The sensors and data processing techniques that exist to derive information about floods are numerous. Instruments that record flood events may operate in the visible, thermal and microwave range of the electromagnetic spectrum. Due to the limitations posed by adverse weather conditions during flood events, active radar is invaluable for monitoring floods; however, if a visible image of flooding can be acquired, retrieving useful information from this is often more straightforward.

Apart from providing direct information about flooding, remote sensing data can also be integrated with flood models (via model calibration or validation, and data assimilation techniques) or provide floodplain topography data to augment the amount and type of information available for efficient flood management. There have been notable studies on integrating remotely sensed data with flood modeling since the late 1990s and there is now a general consensus among space agencies to strengthen the support that satellite missions can offer. This trend has stimulated more research in this area, and significant progress has been achieved in recent years in fostering our understanding of the ways in which remote sensing can support flood monitoring and management.

This Special Issue presents a collection of work on current efforts to aid advancing flood monitoring and management through remotely sensed data. The following section gives a brief overview of the large variety of papers contributed to this Special Issue, presenting the use of remote sensing data and methods in flood research and applications.

2. Overview of Contributions

The variety of high quality research and application studies published in this Special Issue is large and I only provide a brief overview here. I encourage the reader to refer to the entire Special Issue to gain insight into the current state-of-the-art methods employed in remote sensing for flood monitoring and management.

The contributed articles cover local to global scale applications and range across a number of fields (e.g., disaster management and societal impact, flood forecasting, rainfall-runoff modeling,

DEM processing, water quality, and wetlands). For instance, Schroeder *et al.* [1] developed a global, multi-year fractional surface water index from satellite microwave data. Revilla-Romero *et al.* [2] show the use of a similar index to complement global flood forecasting, and the potential of combining multi-annual satellite flood maps and modeling to provide better flood hazard mapping capabilities is demonstrated by Giustarini *et al.* [3]. At more regional to local scales, imagery can be used to detect localized flooding [4], assist rapid response [5], infer flood damages [6] and exposure [7], and even map temporal change [8,9], inundation dynamics [10] as well as flood regimes [11].

A number of papers in this Special Issue also demonstrate that much is to be gained from combining satellite flood maps with digital elevation models (DEMs) and also distributed process models. Merging zonal flood information with topography can reveal complexities in water surface dynamics [12,13] and in local flow connectivity [14], which are difficult to observe with flood imagery or maps alone. Integrating satellite data with models can lead to significant improvements in the latter, especially for large scale flood hydrology and hydrodynamics, as illustrated by Pinel *et al.* [15] in the Amazon Basin and by Jung and Jasinski [16] in the Atchafalaya Basin. Data assimilation of remotely sensed data can be employed to help improve simulations from different types of models, as illustrated by Reager *et al.* [17] for a land surface model and GRACE terrestrial water storage and by Massari *et al.* [18] for satellite soil moisture and a rainfall-runoff model.

With a proliferation of free Earth Observation data now and in the near future, there is an obvious need to not only understand the limitations and errors of the data and methods, as examined for flood mapping by Ticehurst *et al.* [19] and for river plume monitoring by Devlin *et al.* [20], but also to develop more sophisticated data processing algorithms (e.g., [21]) as well as robust frameworks for handling the many heterogeneous geospatial data sets [22] and for effective information management and transfer across networks [23].

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