An interactive Web-GIS application for identifying flood vulnerable areas based on GNSS meteorology

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GNSS has proved to be a powerful tool in atmospheric studies. In ground-based GNSS meteorology, the spatial- temporal variability of precipitable water vapor (PWV) derived from GNSS observations can be used for predicting changes of PWV which can be related to forecasting rainfall. Also, the demand of effective visualization on real-time weather forecasting has been increased in recent years that resulted in a wide variety of interactive online maps for severe weather warning systems.

Considering the capability of GNSS meteorology for weather monitoring and forecasting applications, this study aims to implement the GNSS-derived PWV prediction models based on a web-based geo visualization approach. In the proposed methodology the GNSS-derived PWV and meteorological data such as temperature, pressure and relative humidity are jointly implemented on the interactive web-GIS platform. The proposed Web-GIS tool is served as an online mechanism for mapping sever rainfall events to display anticipated vulnerable areas as well as their corresponding level of vulnerability. The severe rainfall event can be localized by evaluating the prediction of PWV, which are calculated from the GNSS-derived PWV and meteorological data. The web-GIS tool visualizes the location of the highly intense precipitation and intensity of predicted GNSS-derived precipitation through space and time interactively. Development of this responsive web thematic map was done by applying several java scripts libraries including Bootstrap, CartoDB, Leaflet, D3, SpatialSankey and the web-based map tile layers from CartoDB and Leaflet. By combining this geo-visualization technique with our previous research outcome for predicting GNSS-derived PWV, the vulnerability to flooding due to potential sever rainfall are effectively provided in near real-time. The proposed method will enhance the decision-making process of the local government and hazard management agencies. In addition, this study also provides the critical information of flooding and related hazards to the general public.

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