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Interdisciplinary Approach for Assessment of Continental River Flood Risk: A Case Study of the Czech Republic

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In this research, GIS-based hydrological model-driven approach produces the distribution of continent-level flood risk based on national-level GIS data. In order to reveal flood hazard, exposure, and vulnerability in a large river basin, the system employs the simplified model such as GFiD2M (Global Flood inundation Depth 2-dimension Model) to calculate the differential inundation depth and the economic loss by pixel-based statistical processing, considering climate and socioeconomic scenarios, the representative concentration pathways emissions and the shared socioeconomic pathways, despite current limitations of data collections and poor data availability.

We need new approaches to seek the possibility of its national-scale application, so that the framework can bring (1) improved flood inundation map (i.e. discharge, depth, velocity) using rainfall runoff inundation model, based on the in-situ data (rain-gauge and water level), validated with Earth Observation data, i.e. MODIS, (2) advanced flood forecasting using radar and satellite observed rainfall for national-level operational hydrological observations, (3) potential economic impact with the effect of flood hazard and risk under climate and socioeconomic changes based on rainfall from general circulation model.

The preliminary examinations showed the better possibility of a nation-wide application for integrated flood risk management. At the same time, the hazard and risk model were also validated against event-based flood inundation of a national-level flood in the Czech Republic.
Within the Czech Republic, although radar rainfall data have been used in operational hydrology for some time, there are also other products capable of warning us about the potential risk of floods. For instance, images from Europe's Sentinel satellites have not been evaluated for their use in Czech hydrology. This research is at the very beginning of a validation and its evaluation, focusing mainly on heavy rainfall and antecedent soil moisture. Also, a comparison with existing products aimed at flash floods, occurring in Czech territory, is performed. The objective is to gain some typical patterns that could be used in flood forecasting. Neural network forecasting models can be utilized based on this information in the future.

This interdisciplinary approach on regional and national cooperation is important to cover and understand local flood risk for decision making of disaster risk reduction over the Eurasian region. In this bilateral research, we addressed the necessity for technical cooperation in the mutual exchange of technical knowledge and skills involving data sharing focusing on disaster risk management and reduction. Future works include a utilization of Global Flood Awareness System (GloFAS, near-real time forecasting) in order to improve the national-scale simulation results for large rivers worldwide.