Geophysical Research Abstracts
Vol. 17, EGU2015-7602, 2015
EGU General Assembly 2015

High-resolution numerical modeling of meteorological and hydrological conditions during May 2014 floods in Serbia

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In May 2014 west Balkan region was affected by catastrophic floods in Serbia, Bosnia and Herzegovina and eastern parts of Croatia. Observed precipitation amount were extremely high, on many stations largest ever recorded. In the period from 12th to 18th of May, most of Serbia received between 50 to 100 mm of rainfall, while western parts of the country, which were influenced the most, had over 200 mm of rainfall, locally even more than 300 mm. This very intense precipitation came when the soil was already saturated after a very wet period during the second half of April and beginning of May, when most of Serbia received between 120 i 170 mm of rainfall. New abundant precipitation on already saturated soil increased surface and underground water flow, caused floods, soil erosion and landslides. High water levels, most of them record breaking, were measured on the Sava, Drina, Dunav, Kolubara, Ljig, Ub, Toplica, Tamnava, Jadar, Zapadna Morava, Velika Morava, Mlava and Pek river. Overall, two cities and 17 municipals were severely affected by the floods, 32000 people were evacuated from their homes, while 51 died. Material damage to the infrastructure, energy power system, crops, livestock funds and houses is estimated to more than 2 billion euro.

Although the operational numerical weather forecast gave in generally good precipitation prediction, flood forecasting in this case was mainly done through the expert judgment rather than relying on dynamic hydrological modeling. We applied an integrated atmospheric-hydrologic modelling system to some of the most impacted catchments in order to timely simulate hydrological response, and examine its potentials as a flood warning system. The system is based on the Non-hydrostatic Multiscale Model NMMB, which is a numerical weather prediction model that can be used on a broad range of spatial and temporal scales. Its non-hydrostatic module allows high horizontal resolution and resolving cloud systems as well as large-scale precipitation patterns. Hydrological component of the system is the Hydrology Prediction Model HYPROM which calculates overland flow and river discharge using full dynamic governing equations integrated over a regular grid.

This paper was realized as a part of the projects “Studying climate change and its influence on the environment: impacts, adaptation and mitigation” (43007) and “Assessment of climate change impacts on water resources in Serbia” (37005) financed by the Ministry of Education and Science of the Republic of Serbia within the framework of integrated and interdisciplinary research for the period 2011–2015.