



## Flash Flood Forecast Verification – Croatia, 2016

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Because of the steep mountains and hilly areas with torrents, urbanization process along Adriatic coast, insufficiently developed drainage system, and insufficient sewage capacity, Croatia is quite vulnerable to flash floods. Flash floods are hydrometeorological phenomena which have a different character than river floods, notably short time scales and occurring in small spatial scales, which make forecasting of flash floods quite a different challenge than traditional flood forecasting approaches.

Verification has always been recognized as important, an essential ingredient in the flash flood forecasting process, but in reality has been poorly understood and not well implemented, and often not maintained as a continuing activity.

The 2016 was the first year for which Croatian Meteorological and Hydrological Service (DHMZ) has made flash flood warning verification. Information and documentation about the actual flash flood events have been collected from the media and National Protection and Rescue Directorate (DUZS). In 2016 79 flash flood events occurred and 99 flash flood warnings were issued to the public and authorities.

The purpose of verification can be classified in two groups - administrative and scientific. Administrative purpose summarizes verification information into the scores; although scores provide comprehensive outlook, they are limited in a sense that they measure only a specific aspect of the forecast quality. Scientific approach provides more details for understanding the uncertainties and limitations in hydrological and meteorological forecasting models, and the ways in which they can be improved.

Verification scores and post-event assessments can improve the quality of the future warnings. Publishing this results and making them available to the stakeholders and partners is reinforcing the DHMZs credibility, user-oriented policy and dedication to the cause.

This analysis presents the results of flash flood forecast verification in Croatia, discusses different verification approaches, forecasting and diagnostic models, their capabilities and limits, which can be used for the future improvements. Also, this verification process has led to development of the first Croatian flash flood database which would be essential for evaluating and improving operational forecast products and holds great potential for advancing predictability of flash flooding.