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The advantages of using data assimilation and ensemble of meteorological models for floods forecasting at semi-arid environment

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Using multiple precipitation inputs for flash floods forecasting in semi-arid environments

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Abstract

A set of hydro-meteorological models were calibrated and evaluated for a domain in Israel for operational flood forecasting at the Israeli Hydrological Service. The Hydrological models included the fully coupled distributed WRF-Hydro model, standalone uncoupled version of the Hydro model and the HEC-HMS lump model. Previous study assessed the advantages and limitations of one-way versus two-way coupled modeling systems for flood prediction in Israel The results highlight the sensitivity of hydrological responses to different sources of precipitation data, and less so, to hydrologic model formulation. With observed precipitation data both calibrated models closely simulated the observed hydrographs. The two-way coupled WRF/WRF-Hydro modeling system produced improved both the precipitation and hydrological simulations as compared to the one-way WRF simulations. Findings from this study suggest that the use of two-way atmospheric-hydrological coupling has the potential to improve precipitation and, therefore, hydrological forecasts for early flood warning applications. The objectives of this current study was to examine the advantages of continuous meteorological data assimilation into numerical weather prediction models for hydrological applications and the usage of various precipitation input for running an Hydrological ensemble. The high resolution 2.5 km COSMO model was run by the Israeli Meteorological Service with continuous data assimilation mode, part data assimilation and with no data assimilation. The data assimilation included surface observations, radiosonds, amdars, including latent heat nudging to radar data. The precipitation forecasts quality were evaluated using the Fractional Skill Score (FSS). This spatial verification method calculates for every grid point the fraction of the surrounding area. These fractions are then compared between the models and with the similarly transformed radar composite.
The Hydro hydrological model was run for selected storms for the full domain using the following precipitation input:
Corrected radar data, COSMO with and without data assimilation based on ECMWF initial conditions, ECMWF 0.1 degrees, GFS based WRF 3km model coupled with the Hydro model, ECMWF based WRF 3km model coupled with the Hydro model.
Preliminary results shows highest score for using the COSMO model with data assimilation for flush flood prediction in Israel, and the advantage of using ensemble of meteorological forcing for hydrological predictions.