

The Israel early warning system for floods

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Floods characteristic in the Eastern Mediterranean

- The dominating pattern of floods in the region is flush floods
- Large climate and hydrological variability: North to South, West to East, seasonal and inter-seasonal variability.
- Major flood events during the transition seasons at the arid areas

Israel



Nablus, West bank



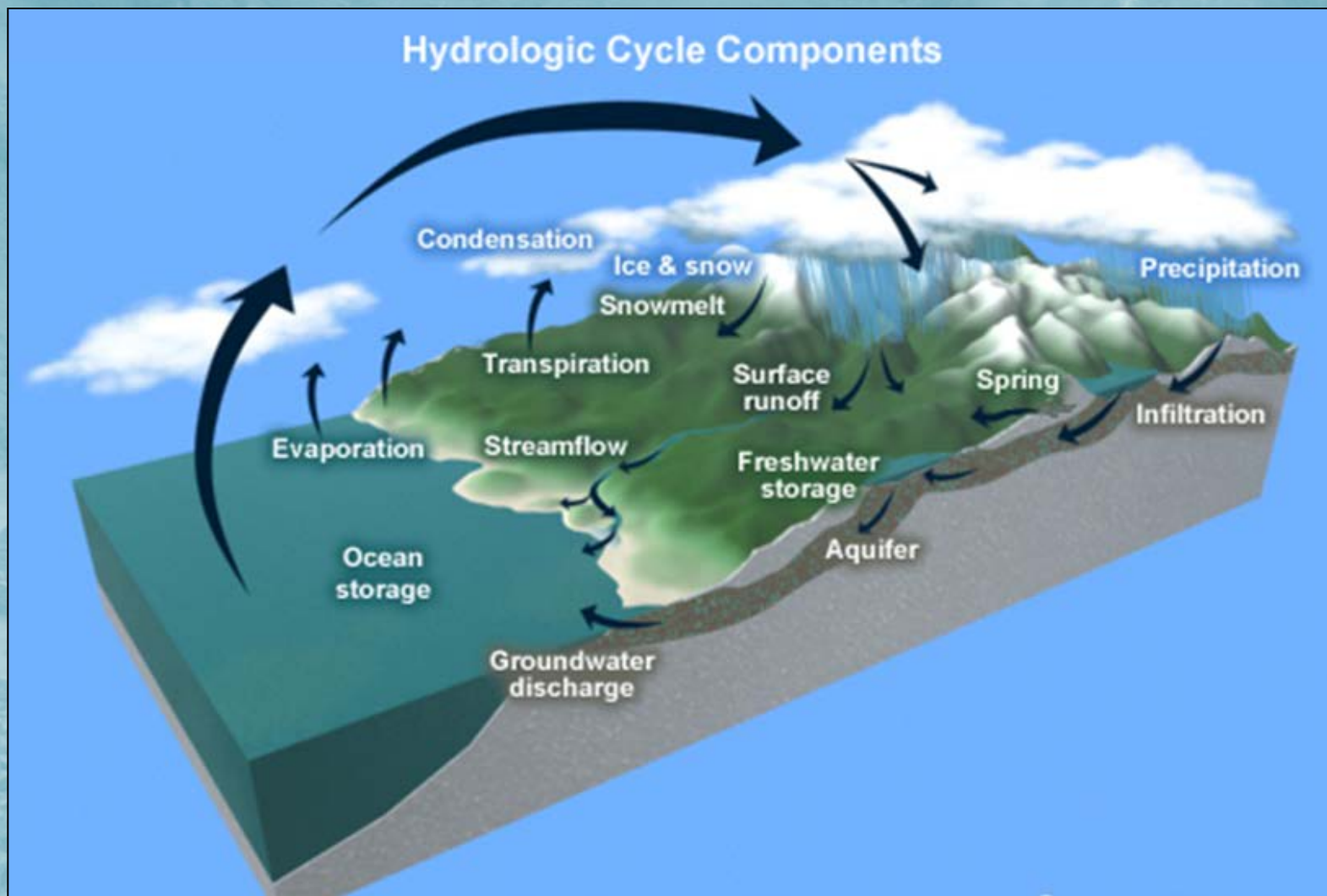
Israel – Egypt border 07.05.14



WRF-Hydro: Earth Systems Modeling

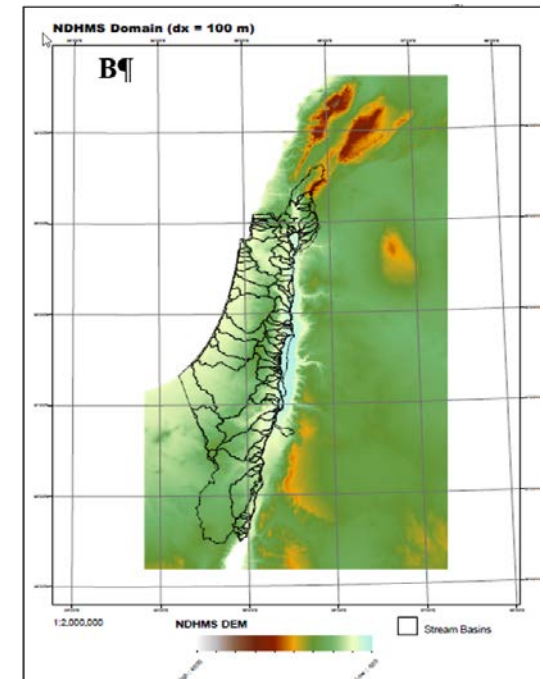
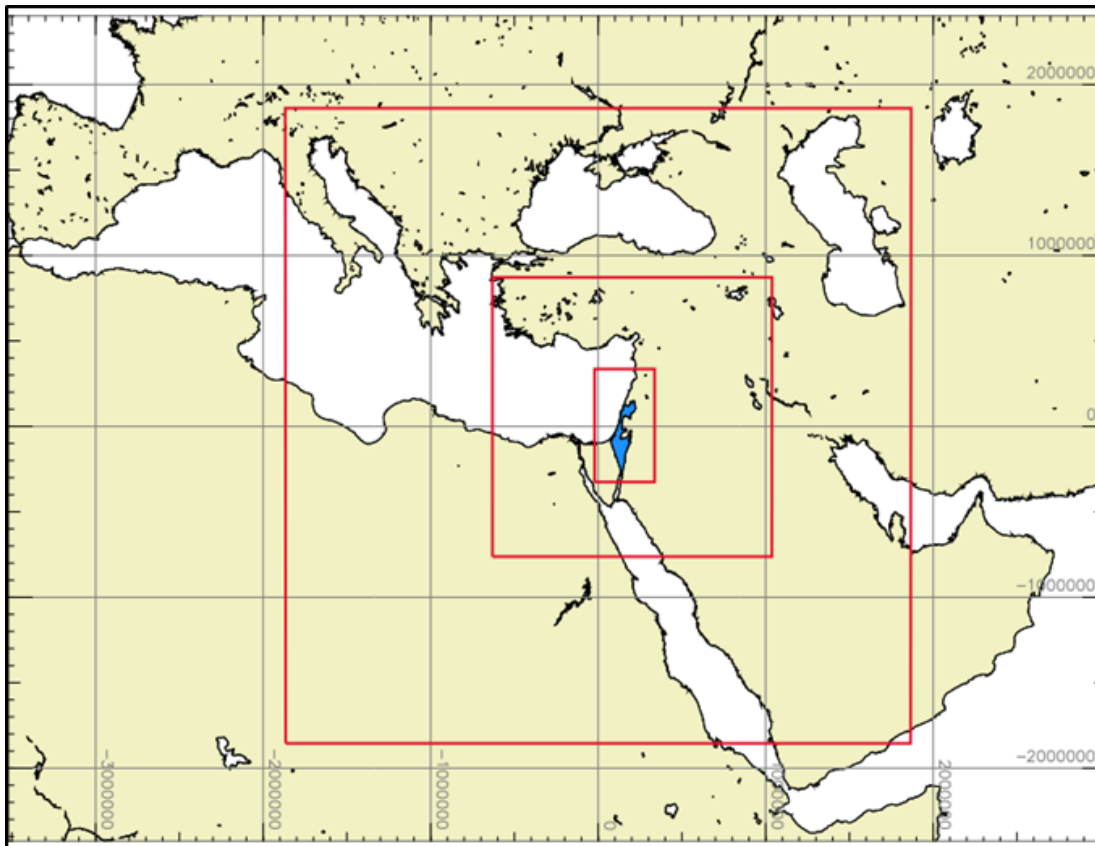
Full water cycle depiction...

physics-based distributed runoff processes

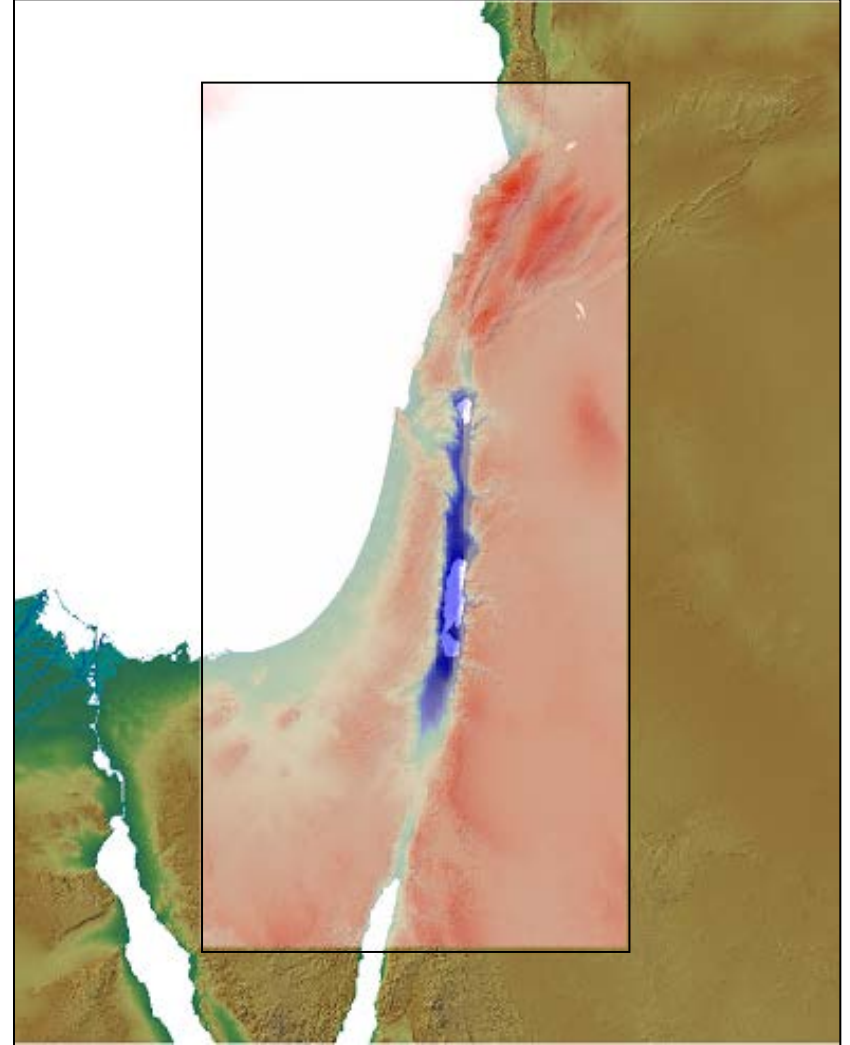
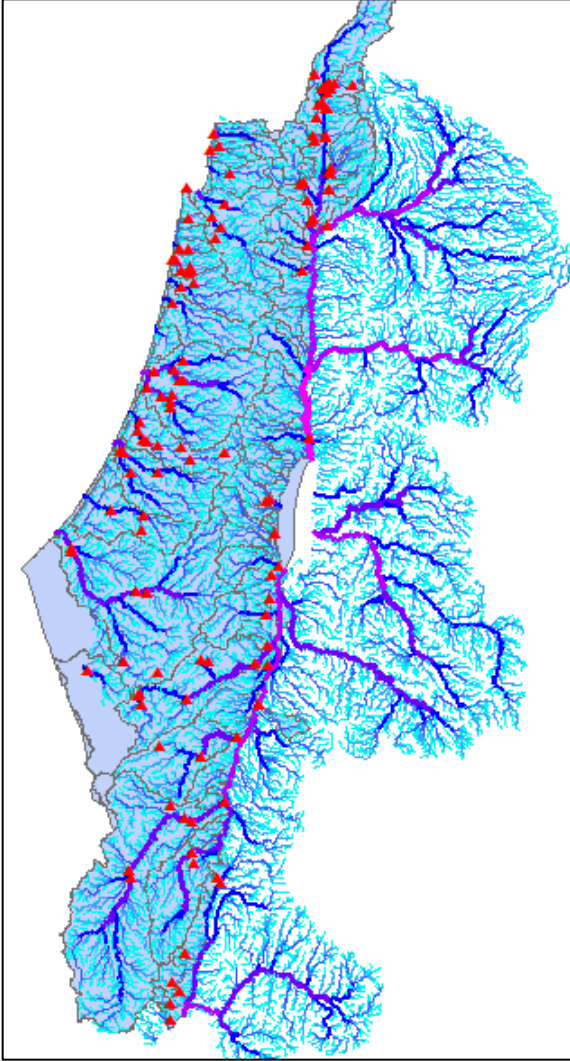


The WRF-Hydro domain

Map of the 3 nested Grids of WRF simulations
at the East Mediterranean



The forecast points at the WRF-Hydro domain



Article

Comparing One-Way and Two-Way Coupled Hydrometeorological Forecasting Systems for Flood Forecasting in the Mediterranean Region

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Abstract: A pair of hydro-meteorological modeling systems were calibrated and evaluated for the Ayalon basin in central Israel to assess the advantages and limitations of one-way *versus* two-way coupled modeling systems for flood prediction. The models used included the Hydrological Engineering Center-Hydrological Modeling System (HEC-HMS) model and the Weather Research and Forecasting (WRF) Hydro modeling system. The models were forced by observed, interpolated precipitation from rain-gauges within the basin, and with modeled precipitation from the WRF atmospheric model. Detailed calibration and evaluation was carried out for two major winter storms in January and December 2013. Then, both modeling systems were executed and evaluated in an operational mode for the full 2014/2015 rainy season. Outputs from these simulations were compared to observed measurements from the hydrometric station at the Ayalon basin outlet. Various statistical metrics were employed to quantify and analyze the results: correlation, Root Mean Square Error (RMSE) and the Nash–Sutcliffe (NS) efficiency coefficient. Foremost, the results presented in this study highlight the sensitivity of hydrological responses to different sources of simulated and observed precipitation data, and demonstrate improvement, although not significant, at the Hydrological response, like simulated hydrographs. 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, as well as previous studies, 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. However, more research needed in order to better understand the land-atmosphere coupling mechanisms driving hydrometeorological processes on a wider variety precipitation and terrestrial hydrologic systems.

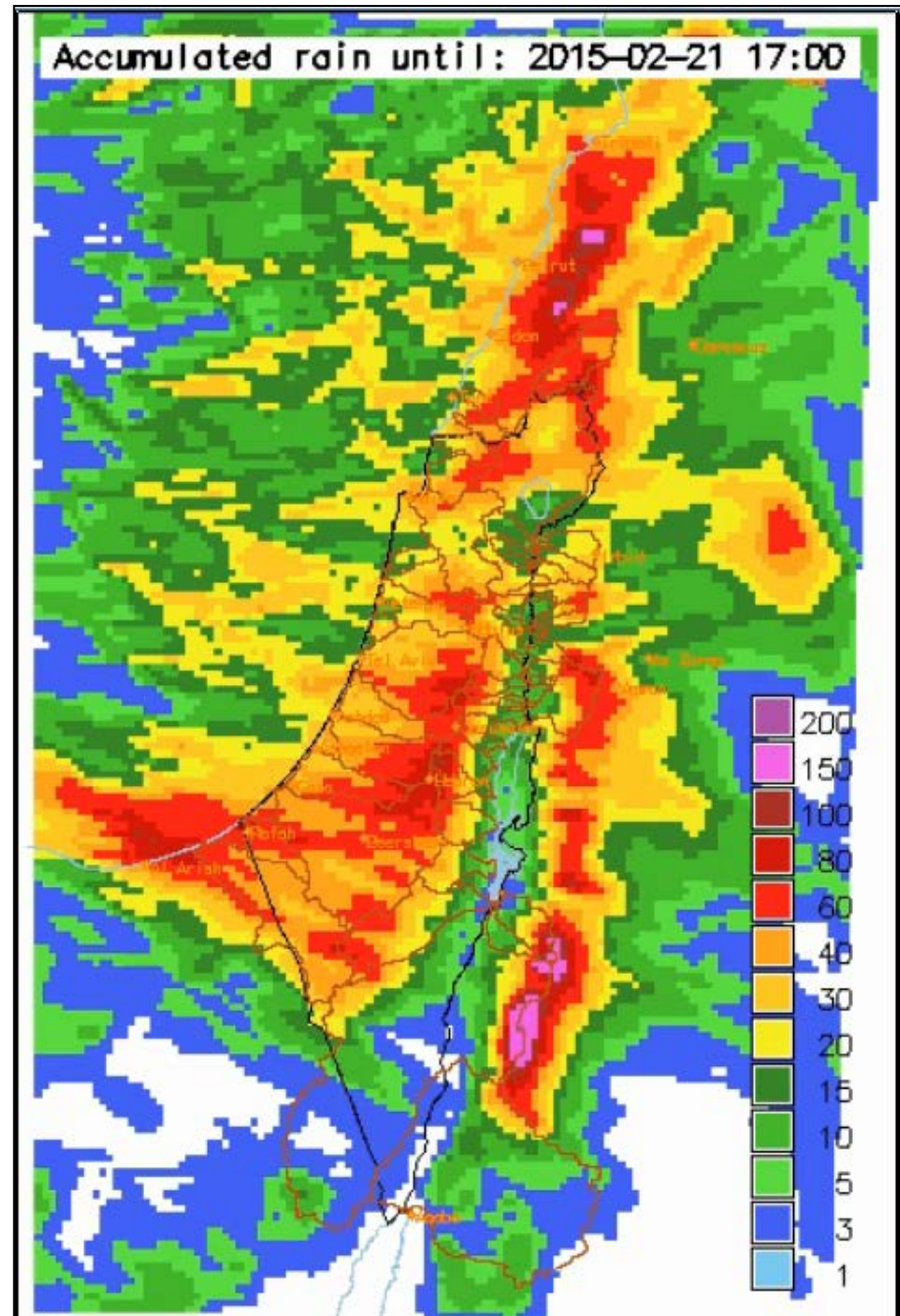
Keywords: floods; atmospheric-land surface coupling; WRF-Hydro

Recent
publications
regarding the
Israel flood
forecasting
system

Meteorological input into the Hydrological models:

1. Global atmospheric models (GFS, ECMWF)
2. Cosmo FDA
3. Observed IMS rain gauges
4. IMS corrected Radar (INCA)

72h forecast: Precipitation



Israeli flood forecasting website



<http://floods.online/home/map>



[Log in](#)

Interactive Maps

Meteorology Map

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Probability



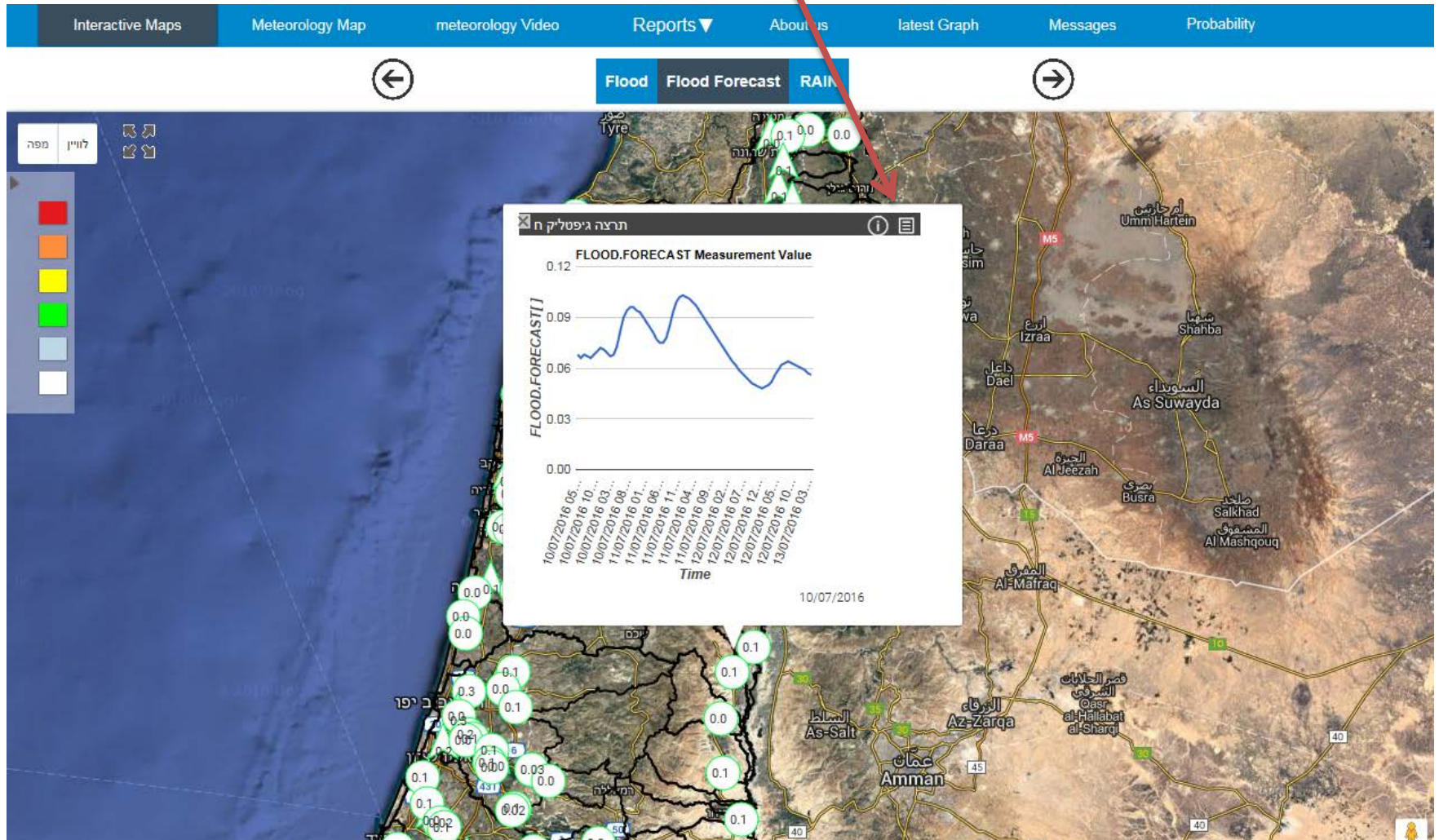
Flood

Flood Forecast

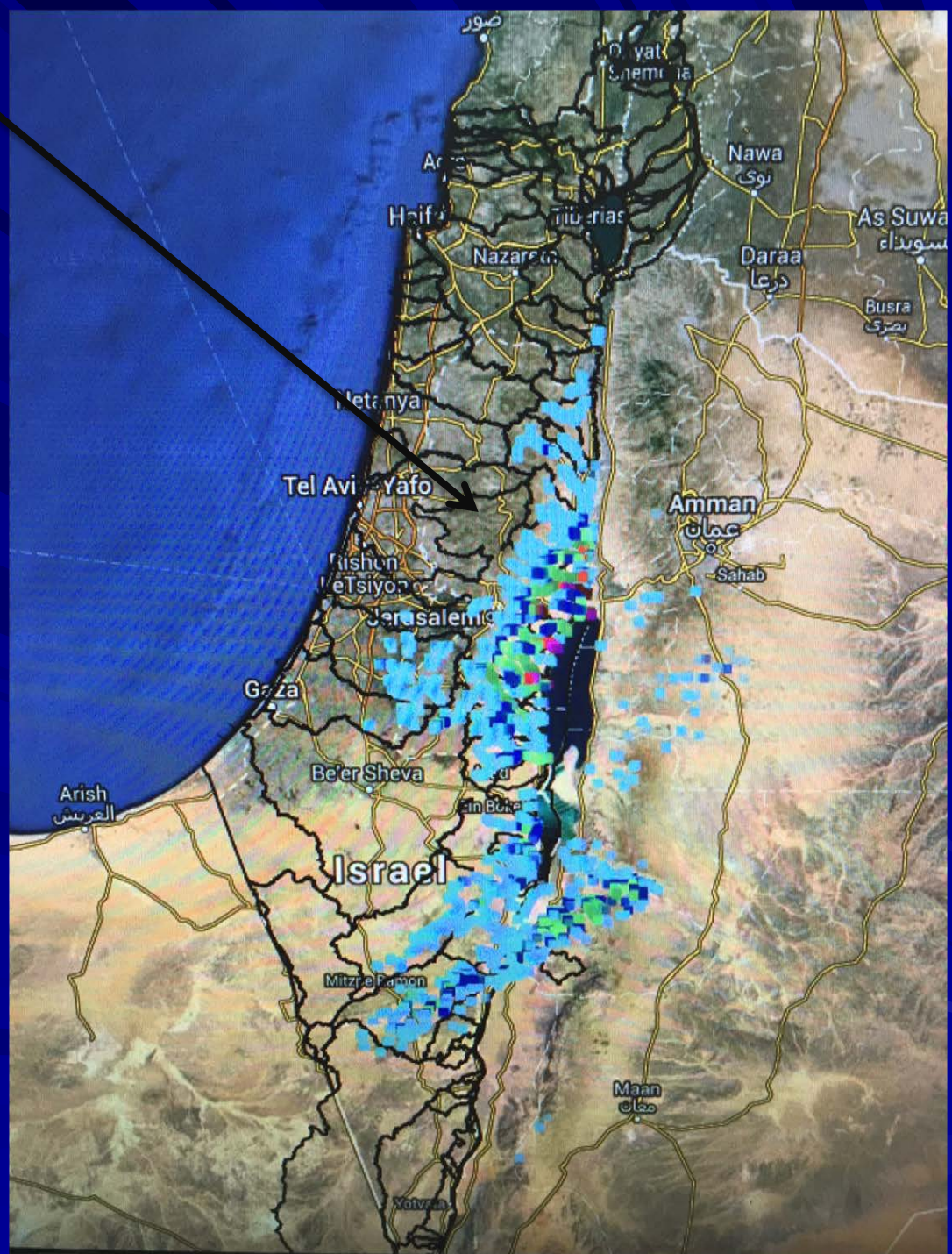
RAIN



Observed and expected hydrographs

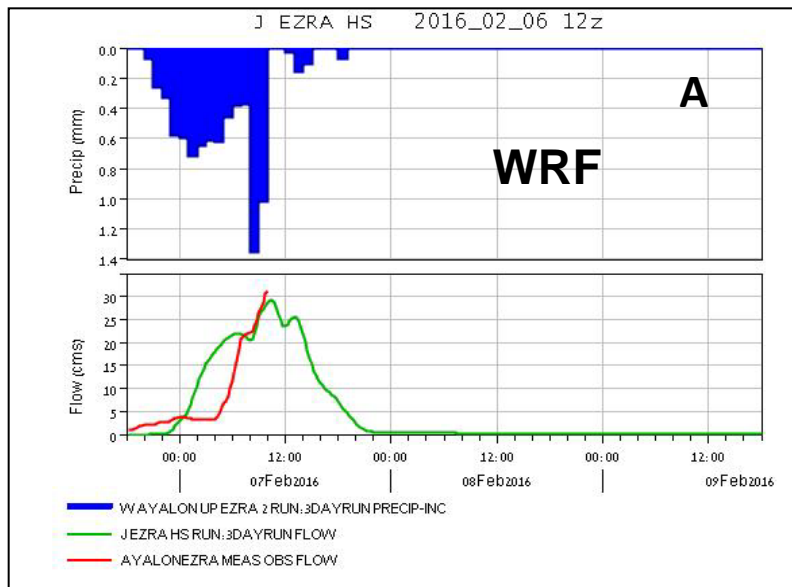


Forecast for gridded runoff

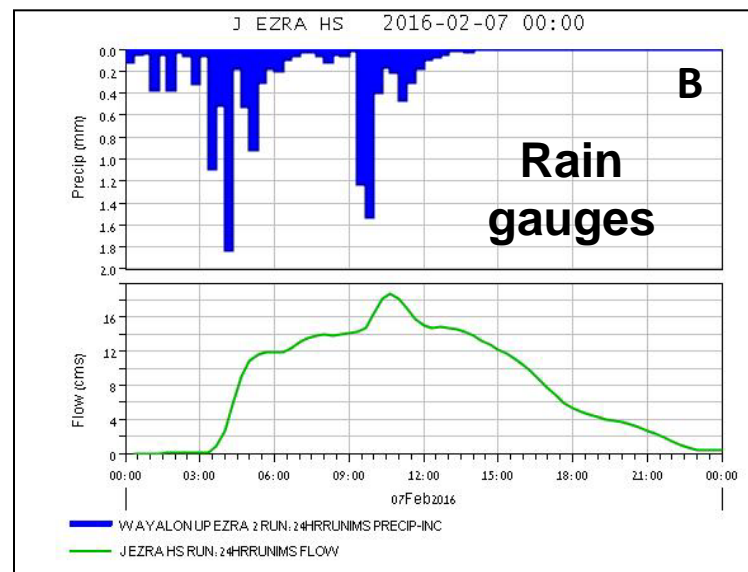


Observed and forecast hydrographs using different precipitation sources : The Ayalon basin, 07-02-2016

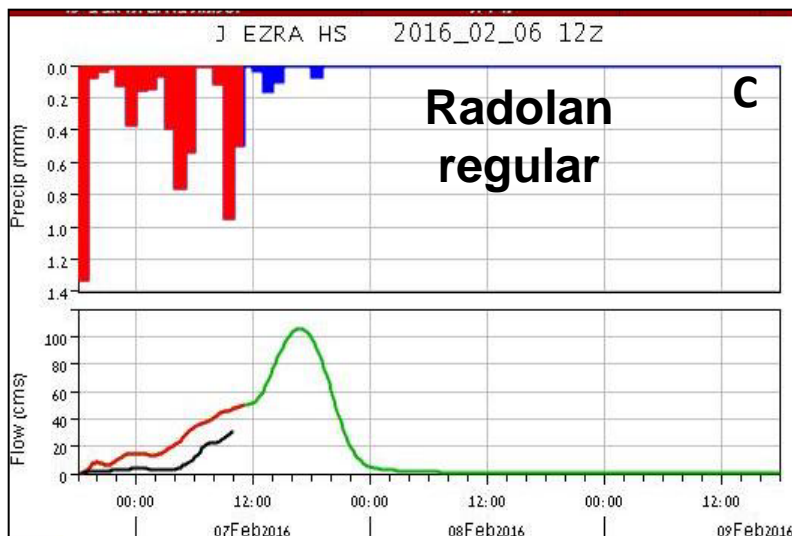
HEC-HMS-Hydrograph_EZRA_HS_2016_02_06_12Z: WRF



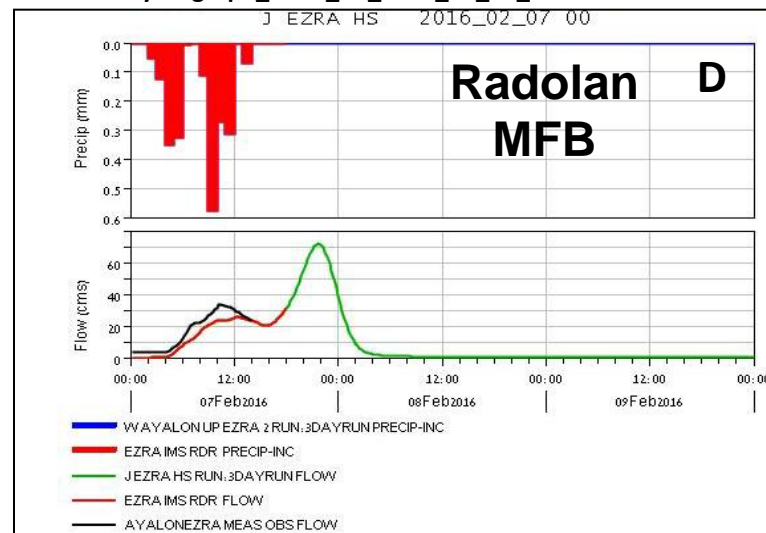
HEC-HMS-Hydrograph_EZRA_HS_2016_02_07_IMS JSON



HEC-HMS-Hydrograph_EZRA_HS_2016_02_06_12Z: RADOLAN-REGULAR



HEC-HMS-Hydrograph_EZRA_HS_2016_02_06_12Z: RADOLAN-MFB



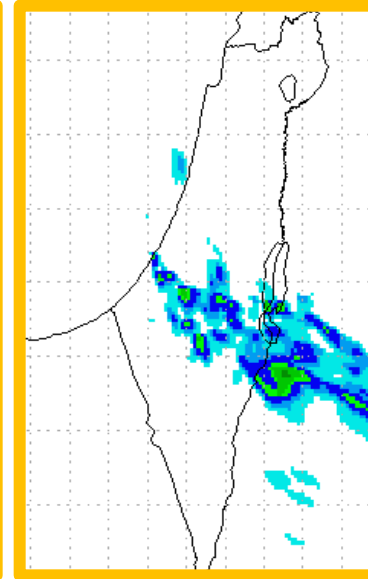
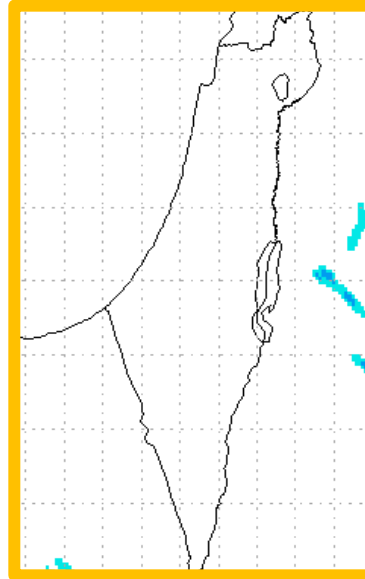
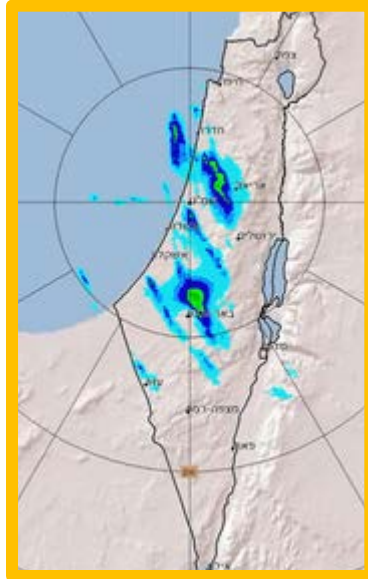
COSMO rain forecasts 12/04/2016 00Z + 48h

RADAR with
rain gauges

COSMO without
DA

COSMO with
full DA

13/4/2016
18-24Z



* COSMO with full DA = continuous nudging to surface observations, radiosondes, amdars, including latent heat nudging to radar data

Summary

- Ensemble of atmospheric models improve the Hydrological forecasts.
- Fully coupled atmospheric-land surface hydrological models has higher skill in respect to uncoupled models.
- Radar corrected data (RADOLAN, INCA) and data assimilation are still essential in order to reduce large the precipitation variability