Estimating the Impact of Soil Moisture Profiles and Its Impact in River Flow Forecasting

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Abstract

Flood forecasts can be affected by the presence of artificial irrigated fields, and if they are not considered in the forecast model they may lead to underestimation of flood magnitude. To incorporate these irrigated fields in the suite of forecast models, the changing soil moisture profiles need to be estimated. There is significant expertise at the University of Arizona to address all the components of this proposal. Both the PIs and their colleagues at the UA will collaborate in the development of cost-effective techniques to measure and model the impacts of irrigation practices on short-term (hourly to seven-day) streamflow forecasts in the Southwestern US. Other benefits will include the use of in situ and remote sensing soil moisture measurements, developing a method for generating hourly to seven-day ensemble hydrometeorological forecasts, and developing an additional method for generating hourly to seven-day ensemble streamflow forecasts for the Southwestern US. The project will follow three main research lines: i) generation of ensemble atmospheric forecasts using a coupled land-atmosphere model currently operational at the UA; ii) generation of ensemble short-term streamflow forecasts using outputs from i) with a suite of land hydrology models; and iii) evaluation of hydrological predictions using both current practices and the unique soil moisture measurement techniques available at the UA.

Particular attention will be given to the statistical flood characteristics for irrigated versus unirrigated lands. The hypothesis is that farmland irrigation practices will maintain artificially high levels of near-surface soil moisture, thereby causing storm-period surface and interflow runoff components to be larger, giving rise to larger flood peaks that form more quickly than under unirrigated conditions. Specifically, we will assess the differences in joint statistics of the forecasted flood-peaks, times-to-peak and above-flood-stage-volumes between natural (i.e., unirrigated) and irrigated conditions for the Southwestern US.

The researchers will work in close contact with the Colorado Basin River Forecast Center

(CBRFC; Kevin Werner, Ed Clark and Craig Peterson) and with the NWS office co-located at the University of Arizona.