Geophysical Research Abstracts
Vol. 12, EGU2010-2622, 2010
EGU General Assembly 2010

High-resolution forecasts of seasonal precipitation: a combined statistical-dynamical downscaling approach

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Global seasonal forecasts of precipitation are currently produced by the major weather centers. These predictions are available several months in advance at horizontal resolutions of ∼200 km grid-size. They have proved useful to providing an estimate of the expected precipitation over large areas. However, their value is limited for regional applications, for example, hydrological applications such as water resources planning and flood forecast in areas characterized by complex terrain, where information at finer temporal and spatial resolutions is required.
Downscaling of global precipitation forecasts to the regional scale is possible through statistical and dynamical approaches. Each of these strategies possesses advantages and limitations in physical, computational and real-time implementation aspects; these have been widely reviewed and discussed in literature. For instance, statistical downscaling is computationally cheap but it relies on reliable long-term records of observed precipitation. These may be sparsely distributed. In contrast, dynamical downscaling techniques which produce regional scale gridded precipitation forecasts using regional climate model nested down from global models, may fill the gaps in sparsely observed areas, but the technique is computationally demanding, in particular if real-time forecasts are desired.

The present work combines dynamical and statistical downscaling methods to provide real-time seasonal forecasts of precipitation at high horizontal resolution. These forecasts will serve hydrological applications in the Levant area, where the water budget strongly depends on the fine spatial distribution of seasonal precipitation.

Statistical downscaling based on a KNN regression algorithm which makes use of predictors from CFS model outputs and local precipitation data is applied in a two-fold manner. In the first instance, it is implemented using the available long-term gauges observations and NCEP CFS global seasonal forecasts to provide seasonal precipitation forecasts at the observation locations. To fill the unobserved gaps, a high-resolution re-analysis of precipitation is produced by downscaling global re-analysis using WRF model and assimilation of meteorological observations. The gridded downscaled precipitation is used as gridded synthetic observations in the KNN-based statistical downscaling procedure of NCEP CFS forecasts: a dynamically enhanced statistical downscaling procedure.

A comparative discussion of both methodologies and preliminary results will be presented.