Geophysical Research Abstracts
Vol. 14, EGU2012-3793, 2012
EGU General Assembly 2012

Global calibration of river channel parameters using river discharge and inundated areas

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River discharge is a natural integrator of meteorological variables. The integration is made over a spatial domain (catchment) which is geophysically appropriate, and over time. It takes into account the correlations and covariances between several meteorological variables in a meaningful way, integrating information from a multidimensional variable space. Furthermore, river discharge observations are available and generally reliable. Therefore, river discharge is an important variable to consider in verifying meteorological forecasts performance, but also for its relevance to applications, such as floods.

The river-floodplain model CaMa-Flood is applied in the verification of the ECMWF re-analysis. In the present configuration, the model runs globally at about 25 km resolution (although the basic unit is a catchment rather than grid-point). In an initial phase, the routing scheme was tested by carrying out simulations forced by the output of HTESSEL (the ECMWF land surface scheme) forced by ERA-Interim near surface meteorology and fluxes, including a precipitation correction with GPCP. The initial results pointed to the need of calibrating the river channel parameters (river bank height and river width) to achieve reasonable results on a global scale. The calibration was performed by perturbing the river channel section parameters and evaluating its performance using river discharge and remote sensed inundated areas throughout the globe. The calibration was processed on a continental scale, and generally improved the simulated river discharge and inundated areas. However, a single set of calibrated parameters not always maximize the skill of both river discharge and inundated area. The present method also returns a set of perturbed parameters accounting for the uncertainty associated with the calibration process.

The preliminary results of forcing CaMa-Flood, using the calibrated parameters, with ECMWF re-analysis and standalone HTESSEL runoff point to some problems in the re-analysis, associated with under/over estimation of precipitation, but also due to changes in the land surface soil and snow hydrology.