Stochastic simulation of high resolution rain fields: application to assess gauge-based rainfall uncertainty in a land surface model implemented over the AMMA-CATCH Niger observatory.

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Abstract

Producing high resolution rainfields is a key element in several domains: (i) studying the climatology of rainfall at fine space-time scales, (ii) modelling the hydrological processes on the continental surface since hydrologic, agronomic or Soil-Vegetation-Atmosphere-Transfers models require high resolution forcing rain fields as input, (iii) calibrating/validating satellite rainfall algorithms. The relevant resolutions for these various purposes may be as fine as 1 km in space and 5 minutes in time to resolve the convective scale. A statistico-dynamic method is proposed to simulate rainfields at fine time steps (_˜5 minutes) conditionned by point rain gauge measurements. The method combines (i) a geostatistical model simulating rainfields at the event time step with (ii) a lagrangian kriging interpolation that is used to disaggregate the event rainfield down to 5 minutes time steps. Rainfields are stochastically simulated over the AMMA-CATCH Niger observatory reproducing satisfactorily the main space-time characteristics of the Sahelian rainy systems. They are then used to assess how rainfall uncertainty propagates into the Sethys-Savannah land surface model. The results show a strong sensitivity of the model outputs to rainfall uncertainty especially marked when considering the partitioning between infiltration and runoff.

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