Geophysical Research Abstracts, Vol. 8, 07939, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07939

Stochastic downscaling of extreme precipitation

M. Vrac (1) and **P. Naveau** (2)

(1) Center for Integrating Statistical and Environmental Sciences, The University of Chicago, USA. (2)Laboratoire des Sciences du Climat et de l'Environnement, IPSL-CNRS, France

When stochastically modeling precipitation within a complex statistical framework, at least two classical approaches can be implemented. More precisely, precipitation are either assumed to be adequately fitted by a gamma type distribution function or by a Generalized Pareto one (GPD). This latter approach is motivated by Extreme Value Theory (EVT) and consequently, only the very large precipitation exceedances are modeled. Such a restriction greatly reduces the span of the modeled distribution, i.e. the EVT approach exclusively deals with the upper tail. In contrast, a gamma type fit has the advantage of better representing the core of the distribution. But, the tail of the gamma distribution is often too light in practice, leading to underestimated probabilities of large rainfall intensities. As an alternative, we propose to model precipitation amplitudes via a mixture of both the Gamma and GPD distributions.

Concerning the spatio-temporal aspect of precipitation with respect to weather patterns, we opt for the stochastic weather typing approach that is based on recurrent large-scale circulation patterns or weather states. These states characterize the large-scale structure of the atmosphere. Whereas classical weather typing methods define and work on *circulation*-related patterns, we work here on *precipitation*-related patterns, directly defined from a learning set of observed local precipitations. Indeed, this type of "regional" weather states has shown some advantages compared to more classical upper-air circulation patterns, to downscale precipitation. Once the K precipitation-related structures are defined, each day are associated to one of the K patterns. But, for either historical simulations or future projections purposes, instead of assigning each day to a state through a deterministic way, a nonhomogeneous Markov model (NMM) is fitted to the observed sequence S_1^T of states S_t from time $t = 1$ to $t = T$, with $1 \leq t \leq T$.

We apply our downscaling approach between small-scale precipitation data from the region of Illinois, USA and large-scale numerical weather model outputs over a larger region that encompasses the studied weather stations. Different diagnostic tools are implemented to show the main advantages and drawbacks of our approach.