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1 Rain multifractal nowcasting with radar data

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There is a very large consensus that rainfield forecasting uncertainty is the main source of uncertainties in river flow modelling. This is particularly true for floods, as well as when there is (almost) no direct information on the flow (ungaged basins). This consensus is related to the weather forecast model inability to adequately model the rainfield, since the physical processes at the meso-scale of the atmospheric motion that causes rain are mostly parameterised by rather ad-hoc sub-grid modelling. Furthermore, the long spin-up time of these models impede them to deliver short time term forecasts, which are indispensable in emergency situations. As an alternative, various statistical methods of treatment of satellite and/or radar images have been developed, because both of them are delivering much smaller scale information. However, they are not physically based and in particular do not take into account the strongly non-linear dynamics of the storm cells, but are rather based on quasi-gaussian assumptions of rain-rates, life-cycle and displacements of the storm cells. These assumptions have no empirical support.

A more recent approach, which can be understood as both a broad compromise and a wide extension of the above mentioned approaches, is based on space-time cascade models. The latter take into account the hierarchy over a wide range of space-time scale, comprising the dynamical structures and processes that generate cloud developments and transport of water content, and the thermodynamic and micro-physical processes leading to water vapour condensation growth of cloud droplets and fall of raindrops.

This approach has become possible by the successive developments of multifractal cascade models with continuous scales, scaling anisotropy between space and time and causality. These models have the advantage to have a very limited number of parameters that has been evaluated for the rain field.

In this presentation, we will discuss concrete issues related to the tests and the implementation of a rain multifractal nowcasting procedure using radar data to determine the past of the multiplicative cascade generator. In particular, we will discuss various optimality criteria with respect to predictability laws -i.e. the power-law space-time degradation of the resolution of the forecast- to determine the corresponding future of this generator, either in a deterministic forecast mode or in an ensemble forecast mode.