Geophysical Research Abstracts
Vol. 18, EGU2016-15832, 2016
EGU General Assembly 2016

Universal multifractal analysis of high-resolution snowfall data

Timothy Raupach (1), Auguste Gires (2), Ioulia Tchiguirinskaia (2), Daniel Schertzer (2), and Alexis Berne (1)
(1) LTE IEE ENAC, Ecole Polytechnique Fédérale de Lausanne, Switzerland, (2) Laboratoire Eau, Environnement, Systèmes Urbains, École des Ponts ParisTech, Université Paris-Est, Marne-la-Vallée, France

Universal multifractal analysis offers useful insights into the scaling properties of precipitation data. While much work has been done on the scaling properties of rainfall fields, less is known about the scaling properties of solid precipitation such as snowfall, especially at high resolution.

We present results of a universal multifractal (UM) analysis of high-resolution solid precipitation data. The data were recorded using a 2D-video-disdrometer (2DVD) situated in the Swiss Alps. Analysis was performed on a one-hour period of snowfall, during which time the mean wind speed was zero, temperatures were low, and no hail was detected. The 2DVD recorded information on individual particles, from which we calculated snow mass.

Three "cuts" of the spatio-temporal snowfall process were analysed using the UM framework. First, high-resolution timeseries of precipitation intensity at 100 ms temporal resolution were analysed. These results show two scaling regimes with a transition area between them. Second, we analysed reconstructed vertical columns of particle concentration and snow mass, assuming no horizontal wind and constant vertical velocity (equal to the one recorded on the ground). Strong scaling was observed in the particle concentration fields, with the influence of large (and therefore rare) snowflakes degrading the quality of the scaling observed for higher moments of the particle distribution. There was a clear difference between the measured fields and fields in which the vertical distribution of particles was made homogeneous, indicating that the measured snowfall fields contained non-homogeneous fields. Scaling behaviour was observed down to vertical scales of about 0.5 m, which is similar to published results using rain data. Finally, we used the UM framework to investigate the scaling properties of 2D maps of snow accumulation over a subset of the instrument collection area of 5.12 x 5.12 cm̂2. As expected from the vertical column analysis, given that the sampling size was smaller than 0.5 m, no scaling was observed. Results were similar for maps containing varying numbers of particles.

The results from this study offer insights into the behaviour of solid precipitation at high temporal and spatial resolution and allows testing of the homogeneity of snow particle distribution in space and time.