2.18 MULTIFRACTAL ANALYSIS OF TROPICAL CYLCONE RADAR DATA: REMOVING MISSING DATA BIASES AND CONSEQUENCES FOR MESO-SCALE MODELLING

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The tropical cyclone Bolaven struck hard South Korea in August 2012, after passing through Jeju island. We analysed in details the structure and mechanisms of Bolaven across scales, with the help of a universal multifractal (UM) analysis. Surprisingly, there had not been so many multifractal studies of typhoons (see however, Chygyrynskaia et al., 1995; Lazarev et al, 1995 on 1D multifractal analysis of the wind field) in spite of the inherent capacity of multifractals to deal with extreme multiscale phenomena like typhoons and the increased availability of higher quality data.

We used the rain rate estimates from AWS (Automatic Weather System) and a S-band radar in Jeju island, both operated by KMA (Korea Meteorological Administration), as well as from simulations of the mesoscale CReSS model. This large amount of space time data was analyzed to quantify the mean intermittency with the help of its fractal co-dimension C1 and its multifractality index , which measures how fast the intermittency evolves for higher order statistics.

We discuss in detail the biases due to missing radar data, unfortunately reported as zero values, as well as how to analytically remove them. At the lowest altitudes, they are due to the minimum radar beam elevation angle of 0.5 degrees that does not affect the estimates α=1.42 and C_1=0.114 at 5 km altitude. The empirical and semi-theoretical scaling moment functions put clearly on evidence the existence of a critical order of divergence of statistical moments $q_D = 3$. This extreme behavior is unfortunately missed by the current CReSS outputs that are furthermore limited to an average over the altitude.