Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06057, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06057
EGU General Assembly 2008

Nonlinear characteristics of high-resolution rainfall dynamics in Korea

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Occurrence of floods is commonplace in the Korean peninsula, because of the region's mountainous landscape and frequent intense rainfalls during the rainy reason. The impacts of floods on life and property are often severe, and it has been estimated that floods cost Korean economy around 2 billion dollars a year. While the need to produce accurate flood forecasts is clearly recognized towards undertaking disaster prevention and mitigation measures, this task also remains extremely challenging. An important reason for this situation is our lack of understanding of rainfall dynamics at high resolutions (and, at times, even availability of such data), since high-resolution rainfall data are essential inputs for flow models. To this effect, an attempt is made in the present study to investigate the nature of hourly rainfall dynamics in Korea, with particular emphasis on the nonlinear (and possibly chaotic) characteristics of rainfall. Rainfall data observed at four stations (one station from each of the four major river basins) are studied, using a host of linear and nonlinear methods that include: autocorrelation function, power spectrum, phase-space, and correlation dimension. Since rainfall dynamics can often change depending on the time period under consideration (because of changes in climate, land use and others), rainfall characteristics over different durations (e.g. 30, 20, 10, and 5 years) are also studied and significant change

periods identified, if any. The outcomes of this study are expected to serve as useful inputs also to studies that deal with long-term climate change.