Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02344, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02344
EGU General Assembly 2008

Modeling flood events with local singularity model

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Flood events can be considered as singular processes. Singular physical or chemical processes may result in anomalous amounts of energy release or mass accumulation that, generally, are confined to narrow intervals in space or time. Singularity is a property of different types of non-linear natural processes including cloud formation, rainfall, hurricanes, flooding, landslides, and earthquakes. The end products of these non-linear processes have in common that they can be modeled as fractals or multifractals which are related genetically to singularities. This paper explores non-linear modeling techniques to identify and characterize singular hydrological events – floods from historical data collected from river flow gauging stations. We show that the average flow released from large flood events follow power-law relations with the time period since the flow peak point. The local singularity index estimated from the power-law relations characterizes the degree of singularity of flood event. This power-law model has been demonstrated to be related to but being advantageous than the ordinary power-law model associating flow recession rate and recession time. This model was validated with peak flow data from several river gauging stations recorded in the Oak Ridges Moraine (ORM), southern Ontario, Canada, for the past 50 years.