Geophysical Research Abstracts
Vol. 12, EGU2010-989, 2010
EGU General Assembly 2010


# The Space-Time Cascade of Atmospheric Radiances from TRMM and MTSAT

Julien Pinel (1), Shaun Lovejoy (1), Daniel Schertzer (2,3)

(1) McGill, Physics, Montreal, Canada, (lovejoy@physics.mcgill.ca), (2) CEREVE, Université Paris Est, France, (Daniel.Schertzer@cereve.enpc.fr), (3) Météo France, 1 Quai Branly, Paris 75005, France

Space-time statistical properties of atmospheric fields including precipitation are of capital importance for our general understanding of the atmospheric dynamics. In quite general turbulent flows, well-defined statistical relation between spatial size and temporal duration of structures exists. Studying this relation for atmospheric structures can help us improve the quality of our meteorological measurements and weather forecasting, but it can also help us to clarify the general concepts of weather and climatology.

In the past, atmospheric datasets did not cover a wide enough range of space-time scales and data were problematic due to calibration and sparse network issues. But today, the development of satellite measurements allows us to access atmospheric data over very large space-time ranges, avoiding many of the problems associated with in-situ measurements. It is therefore possible (in principle) to understand the behavior of space-time statistics for the different atmospheric fields over wide ranges of scales. In this presentation, we analyze the atmosphere showing that various radiance have multiplicative cascade structures implying the existence of a scale invariant mechanism repeating scale after scale to build up the statistics of atmospheric fields from a large external scale down to extreme small scales. The multiplicative cascade hypothesis (which represents the generic multifractal process) predicts that these statistics should respect the following relation :

<e(L)**q> = (Louter/L)**K(q)

where e(L) is the studied field at resolution L, Louter is the outer scale of the cascade (where it starts) and K(q) is a scaling exponent function describing all the statistical properties as a function of scale.

We present here the results of an analysis made from datasets coming from two satellites, MTSAT and TRMM. Infrared radiances measured by MTSAT satellite (spatial resolution: 5km - temporal resolution: 1 hour) over the region 40S-30N latitude and 80E-200E longitude and over a period of two months have been analyzed. Infrared and passive microwave radiances and radar reflectivity measured by TRMM satellite (spatial resolution : 2-4km - temporal resolution : 2-4 days) over the region 38S-38N latitude and for all longitudes over a period extending to a few years have been analyzed.

Ranges of scales in space and time over which we observe scaling behavior, scaling exponent functions, outer scales and other multifractal parameters have been calculated for all the previously mentioned atmospheric fields (or associated flux). We discuss these results and their consequences for our general understanding of atmospheric dynamics, weather and climate.