Atmospheric complexity or scale by scale simplicity?

S. Lovejoy (1), D. Schertzer (2), J. Pinel (1), V. Allaire (1)

(1) Physics dept., McGill U., 3600 University st., Montréal, Canada
(lovejoy@physics.mcgill.ca/1-514-398-6537) (2) CEREVE, Ecole Nationale des Ponts et
Chaussées, 6-8, avenue Blaise Pascal, Cité Descartes, 77455 MARNE-LA-VALLEE Cedex

Is the numerical integration of nonlinear partial differential equations the only way to tackleatmospheric complexity. Or do cascade dynamics repeating scale after scale lead to simplicity? Using 1000 orbits of Tropical Rainfall Measuring Mission (TRMM) satellite radiances from 10 bands representative of the short wave (visible, infra red) and long wave (passive microwave) regions and 8.8 to 20,000 km in scale, we find that the radiance gradients follow the predictions of cascade theories to within about $\pm 0.5\%$, $\pm 1.25\%$ for the short and long waves respectively and with outer scales varying between $\approx 5,000$ to $\approx 28,000$ km depending on the band. Since the radiances and dynamics are strongly coupled, we conclude that weather can be accurately modeled as a cascade process.