Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04838, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04838
EGU General Assembly 2008

Feedbacks between atmospheric moist convection and surface processes in semi-arid regions

J. Galewsky

Department of Earth and Planetary Sciences, University of New Mexico, Albuqueruqe, NM, USA 87131 [galewsky@unm.edu]

In a classic 1951 paper, Luna Leopold showed that the ratio of rainfall extrema to rainfall averages increases as the climate becomes more arid. This line of thinking has influenced much geomorphology research, but the basic meteorological mechanisms involved remain unknown. The potential for drought to increase both precipitation intensity and slope erodibility, which further decreases soil and vegetation cover, suggests the potential for previously unrecognized feedbacks between climate and landscape dynamics in semi-arid regions. We have used an idealized version of an atmospheric model to explore this phenomenon, and preliminary results show that the precipitation variability (defined here as the average of the 90th percentile of hourly rainfall rates divided by the average hourly rainfall rate) increases with the Bowen Ratio (ratio of sensible to latent heat fluxes) and is thus consistent with Leopold (1951). This modeling approach may therefore provide a useful framework for understanding how continental convection changes as a function of land surface state. The modeling framework is similar to that used for studies of oceanic radiative-convective equilibrium (e.g. Tompkins and Craig, 1998) but uses a land surface parameterization with a fixed moisture availability instead of an oceanic surface. The model is run for ˜30 days until an equilibrium is established between radiative cooling and convective heating in the atmosphere. By varying the moisture availability, a range of climate states are accessible, ranging from humid (low Bowen Ratio) to arid (high Bowen Ratio) conditions. By carefully diagnosing the model output fields, we can gain substantial insight into the links between land surface conditions and convective precipitation.