Geophysical Research Abstracts,
Vol. 11, EGU2009-5031-1, 2009
EGU General Assembly 2009

Morphological and eco-hydrological controls on land surface temperature in an Alpine catchment

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In mountain areas, accurate modeling of the surface energy and water budgets is needed to predict the effects of climate and landscape management changes on water resources, vegetation and ecosystems.
Land Surface Temperature (LST) is a key parameter in the surface energy budget and, through the evapotranspiration, of the water budget as well.
Since LST is a quantity available from remote sensing, the comparison of modeled and observed LST patterns offers the possibility to address to which extent distributed models can represent the land surface interactions in complex heterogeneous terrain.
In this contribution, the LST spatial distribution of the Stubai Valley in the Austrian Alps is simulated by the eco-hydrological model GEOtop and compared with ground observations and a LANDSAT image in order to evaluate the relative importance and the linkages of the different environmental controlling factors as topography, incoming radiation, climate, land cover, vegetation, and soil moisture distribution.
The agreement between model and observations and the correlations of the observed LST with elevation, aspect, land cover, and soil moisture distributions are discussed. Results show that, for the humid climatic conditions considered in this study, the major factor controlling the LST spatial distribution is the incoming solar radiation distribution, while the second relevant factor is land cover spatial variability, with distinct thermal responses of grasslands and forests in north and south facing slopes, being roughness length and albedo the main model parameters controlling the thermal status of different land covers. The soil moisture distribution exerts a minor control on LST along mountain ridges and riparian areas.
The analysis gives useful insights on how to improve distributed models in order to accurately, but parsimoniously, simulate the surface energy and water budgets in Alpine environments.