Geophysical Research Abstracts
Vol. 12, EGU2010-3968-1, 2010
EGU General Assembly 2010

Thermal Orbits for Annual Temperature in Cold Environments

Volker Rath (1), Victor Fierro-Gama (1), Jason E. Smerdon (2), and J. Fidel Gonzalez-Rouco (1)

(1) Universidad Complutense de Madrid, Departamento de Física de la Tierra, Astronomía y Astrofísica, Madrid, Spain (vrath@fis.ucm.es), (2) Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, USA (jsmerdon@ldeo.columbia.edu)

When investigating subsurface temperatures at different depths, thermal orbits are are a useful tool to visualize and analyze the propagation of the annual surface air temperature (SAT) wave into the subsurface. Under linear conditions the hodograph of SAT against subsurface temperature at a given depth can be approximated by an ellipse, equivalent to a linear transfer function in the Fourier domain. In this case a simple inverse problem can be formulated to invert for average thermal diffusivities between the observation levels, and the orbits can be used to show long-term temporal changes in the coupling between SAT and subsurface conditions. When freezing/thawing is involved, e.g. in permafrost environments, the relation is no longer linear due to the processes associated with the phase change of water. Numerical experiments are used to demonstrate the use of thermal orbits in this case, and to explore the possibility of including these effects in a nonlinear sequential inversion scheme. First results from field data will be shown.