Geophysical Research Abstracts, Vol. 9, 03765, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03765

Comparison of ground based and ASTER derived measurements of surface temperature and supraglacial debris thickness on Miage Glacier, Mont Blanc Massif, Italy

C. Mihalcea, (1), B.W. Brock, (2), G. Diolaiuti (1), C. D'Agata (1), M. Citterio (3), M.P. Kirkbride (2), C. Smiraglia (1), M.E.J Cutler (2)

(1) University of Milan , "A. Desio" Earth Science Department, via Mangiagalli 34, 20133 Milano, (Italy) (2) University of Dundee (Scotland, UK), Geography, School of Social Sciences, (3) Politecnico of Milano (Italy), Lecco Campus (Contact Email claudia.mihalcea@unimi.it)

The thickness and distribution of supraglacial debris are key variables for applying energy and mass balance models to debris-covered glaciers. Direct measurement of glacial debris cover is problematic, time consuming and applicable only to a few accessible glaciers, and simpler and faster methods to collect such data are required. Debris surface temperature is primarily dependent on debris thickness, and temperature can thus be used to map patterns of debris cover if the temperature-thickness relationship is known. Furthermore, surface temperature can be measured using remote sensing techniques without extensive and expensive field campaigns. To test the potential of this technique, the spatial distribution of surface temperature and debris depth was recorded on Miage Glacier, an 11 kmˆ2 debris-covered glacier on the Italian side of the Mont Blanc Massif, by means of direct (ground based) and indirect (satellite remote sensing) measurements during the summer season 2005. Further debris depth data were collected during the summer season 2006 to test the satellite-derived debris thickness values. ASTER-derived surface temperatures of Miage Glacier (TIR data, acquisition time 10:40 a.m. of 01-08-2005, in the frame of GLIMS project) were compared with ground measurements acquired at the same time using thermistors at 21 sites spread along the whole glacier tongue (from 1800 to 2400 m a.s.l) and the relationships between surface temperature, elevation and debris thickness analyzed. The

ground- and remotely-sensed temperatures correlate over continuously debris-covered areas (r = 0.8), while on partially debris-covered ice (crevassed areas and ice cliffs) the correlation is weaker resulting in a 0.5 correlation value over the glacier tongue as a whole. Both ground and satellite-derived temperatures predict well the high (>1 m) debris thickness at the terminus and its upstream decrease. A map representing the spatial distribution of debris cover on Miage glacier is derived from ASTER data at 90 m resolution using debris thickness vs surface temperature relationships, calculated for different elevation bands. The debris thickness map agrees well with the values and spatial pattern in the 2006 field measurements, supporting the performed analysis and the use of surface temperature as a proxy for debris distribution.