An energy based ablation model for a debris covered glacier: a case study in the Adamello glacier of Italy

C. Mihalcea (1), G. Diolaiuti (1), D. Bocchiola (2), C. Smiraglia (1), and R. Rosso (2)

(1) Università di Milano, Dept. Earth Sciences, Mangiagalli 34, 20133, Milano, Italy, (2) Politecnico di Milano, Dept. of Hydrologic, Roads, Environmental and Surveying Engineering, L. da Vinci 32, Milano, Italy (daniele.bocchiola@polimi.it)

We here set up, tune and validate an energy based numerical model of ice ablation valid for a debris covered glacier. Ablation process is described using full energy and mass conservation equations, solved through a finite difference solution scheme, and based on a data driven approach. The case study is the Venerocolo glacier, a debris covered tongue of the Adamello glacier of Italy. We use the data set from a field campaign carried during summer 2007, under the umbrella of the CARIPANDA project, aimed to evaluate scenarios for water resources in the Adamello glacier of Italy in a window of 50 years or so (until 2050). We use approximately bi-weekly surveys of ice ablation rate at thirteen stakes with continuous monitoring of debris cover temperature therein, together with continuous air temperature and solar incoming and upwelling radiation from an AWS station. We first used the model for a number of stakes, to evaluate debris cover thermal conductivity, which we found in practice independent from debris cover depth. Validation using the remaining ablation data indicates acceptable performance of the model. We therefore use the so tuned model to evaluate debris temperature and ice ablation from incoming (net) solar radiation, as measured from the AWS station. Because solar radiation is an output of GCMs models, projections of future climate scenarios may be confidently used to evaluate ice ablation.