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MODELLING SHORTWAVE AND LONGWAVE DOWNWARD RADIATION AND AIR TEMPERATURE DRIVING ABLATION AT THE FORNI GLACIER (STELVIO NATIONAL PARK, ITALY)

ABSTRACT: A. SENESE, M. MAUGERI, S. FERRARI, G. CONFORTOLA, A. SONCINI, D. BOCCHIOLA & G.A. DIOLAIUTI. *Modelling shortwave and longwave downward radiation and air temperature driving ablation at the Forni Glacier (Stelvio National Park, Italy).* (IT ISSN 0391-9838, 2016)

We focus here on modelling the meteorological parameters most influencing snow/ice melting over an alpine glacier. Specifically, we consider shortwave and longwave downward radiation, and air temperature. We set up and test a methodology for their accurate distribution at the glacier surface, which can be applied whenever: i) supraglacial meteorological measurements are available or ii) weather data are acquired from a station quite close to the glacier. As a suitable site to test our approach we selected the Forni Glacier, in the Italian Alps, where an Automatic Weather Station (AWS) has been running since autumn 2005 thus giving a robust dataset for developing a field based modeling approach. First, we modelled and distributed the incoming solar radiation by taking into account actual atmospheric conditions, glacier topography and shading. Then, we modelled the incoming longwave radiation considering cloud-cover and air temperature. Third, we investigated a local lapse rate to depict the yearly variability of the vertical air temperature gradient, to assess the actual thermal conditions at different elevations. Finally, we compared the modeled values against data collected on the field. The results display that during the glacier ablation period (i.e.: May-September): i) our approach provides a good depiction of both point incoming solar and infrared radiation fluxes, ii) the spatial distribution of the incoming solar radiation we developed is satisfactory, iii) our tests suggest that the incoming longwave fluxes can be considered constant over the whole glacier ablation area thus neglecting its spatial distribution, and iv) the application of a local lapse rate provides a good distribution of air temperature at the glacier surface.

KEY WORDS: Short- And Long-Wave Downward Radiation; Air Temperature; Ice And Snow Melting; Alpine Glaciers, Stelvio National Park

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RIASSUNTO: A. SENESE, M. MAUGERI, S. FERRARI, G. CONFORTOLA, A. SONCINI, D. BOCCHIOLA & G.A. DIOLAIUTI. *Modellazione della radiazione entrante (ad onda corta e lunga) e della temperatura dell'aria responsabili della fusione glaciale. Caso studio: il Ghiacciaio dei Forni (Parco Nazionale dello Stelvio, Italia).* (IT ISSN 0391-9838, 2016)

Nel presente lavoro viene proposta una metodologia per la modellazione dei parametri meteorologici maggiormente influenti sulla fusione di neve e ghiaccio di un ghiacciaio alpino: la radiazione entrante sia ad onda lunga (atmosferica) che ad onda corta (solare) e la temperatura dell'aria. Per la distribuzione di questi parametri è stato sviluppato un approccio da applicare qualora siano disponibili: i) misure dei parametri meteorologici rilevati sulla superficie del ghiacciaio (che consentano l'acquisizione diretta delle informazioni energetiche e meteorologiche) o ii) dati meteorologici acquisiti nelle immediate vicinanze di esso. Per la verifica del metodo proposto abbiamo scelto il più grande ghiacciaio vallivo italiano, il Ghiacciaio dei Forni, nel Parco Nazionale dello Stelvio, dove dal 2005 è in funzione una stazione meteorologica automatica (AWS), le cui acquisizioni hanno permesso di popolare un lungo e praticamente ininterrotto data-base utile alla validazione. La prima fase della ricerca ha visto la distribuzione della radiazione solare entrante in funzione delle condizioni atmosferiche reali, della topografia glaciale e dell'ombreggiamento. La seconda fase ha riguardato la modellazione della radiazione ad onda lunga