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SHORT NOTE

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EVALUATION OF ANISOTROPIC CORRECTION FACTORS FOR THE CALCULATION OF LANDSAT 8 OLI ALBEDO ON THE ICE SHEETS

ABSTRACT: TRAVERSA G. & FUGAZZA D., *Evaluation of anisotropic correction factors for the calculation of Landsat 8 OLI albedo on the ice sheets.* (IT ISSN 0391-9838, 2021).

The calculation of ice and snow albedo on the ice sheets from remote sensing has always been an important objective in climate research, especially at a high spatial resolution. In this study, a model of albedo retrieval based on Landsat 8 OLI satellite data is validated by comparing ground observations from Antarctica and Greenland, with a particular focus on the anisotropic correction of satellite data. Different correction factors for the anisotropy of snow and ice were considered, as well as two different conversion formulas from narrowband to broadband albedo. Our findings point out that existing anisotropic-correction models are unable to adequately account for albedo variations at high solar zenith angles, which is a relevant factor in Greenland and especially in Antarctica. Thus, the present study suggests that the anisotropic correction may be omitted when calculating ice and snow albedo on the ice sheets, as on average worse statistics were found when using the correction.

KEY WORDS: Albedo, Landsat, Antarctica, Greenland, Anisotropy.

RIASSUNTO: TRAVERSA G. & FUGAZZA D., *Valutazione dei Fattori di Correzione Anisotropa per il calcolo dell'albedo da Landsat 8 OLI sulle Calotte di Ghiaccio.* (IT ISSN 0391-9838, 2021).

Il calcolo dell'albedo di ghiaccio e neve sulle calotte glaciali tramite telerilevamento è sempre stato un obiettivo importante nella ricerca sulle variazioni climatiche, soprattutto ad alta risoluzione spaziale. In questo studio, un modello di albedo basato sui dati del satellite Landsat 8 OLI viene convalidato confrontando le misurazioni al suolo in Antartide e Groenlandia, con un focus particolare sulla correzione anisotropa dei dati satellitari. Sono stati considerati diversi fattori di correzione per l'anisotropia di neve e ghiaccio, nonché due diverse formule di conversione da albedo *narrowband* a *broadband*. I nostri risultati sottolineano che i modelli di correzione anisotropa esistenti non sono in grado di spiegare adeguatamente le variazioni dell'albedo ad alti angoli dello zenit solare, che risulta essere un fattore importante in Groenlandia e, soprattutto, in Antartide. Pertanto, questo studio suggerisce che la correzione anisotropa può essere omessa quando si calcola l'albedo di ghiaccio e neve sulle calotte glaciali, poiché mediamente si ottengono risultati peggiori quando tale correzione viene applicata

TERMINI CHIAVE: Albedo, Landsat, Antartide, Groenlandia, Anisotropia.

INTRODUCTION

On the Antarctic Ice Sheet (AIS) and Greenland Ice Sheet (GrIS), where snow is the main type of surface, the albedo (or bi-hemispherical reflectance, Schaepman-Strub & *alii,* 2006) has an important impact on the surface energy balance. Specifically, in the polar regions, the albedo depends on various factors, i.e., snow metamorphism (Grenfell & Warren, 1994; Gay & *alii*, 2002; Warren & *alii*, 2006; Gallet & *alii*, 2011), snow density and stratigraphy and snow roughness, owed to the presence of different peculiar morphologies and surfaces (e.g., sastrugi, glazed snow, blue ice) (Bintanja, 1999; Frezzotti & *alii*, 2002; Scambos & *alii*, 2012; Traversa & *alii*, 2021a, 2022). Additionally, the rate of snow metamorphism is affected by temperature, relative humidity, wind and the overburden pressure (Pirazzini, 2004; Picard & *alii*, 2012; van Kampenhout & *alii*, 2017). While field campaigns for albedo acquisition using e.g., Automatic Weather Stations (AWSs) require a relevant logistic economical effort for Antarctica and Greenland, the calculation of this variable from remote sensing allows covering large areas and can exploit free imagery. Thus, this work aims at contributing to the knowledge of albedo variations of ice and snow covered surfaces from remote sensing and it complements a recent paper by Traversa & *alii* (2021b), which provided a model (based on previous

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