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MISR Arctic and Antarctic Sea Ice Albedo 2000-2019 Product Creation and Trend Analysis

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Sea ice albedo is a key climate variable that affects the Earth's radiation budget. Spatio-temporal variation of sea ice albedo can be retrieved from pre existing satellite observation processing chains such as the CLARA2-SAL product. However, currently there is only one albedo product which is derived from instantaneous multi-angle measurements and that is from MISR [1]. The accuracy of surface albedo products is usually affected by error accumulation from atmospheric corrections to the top-of-atmosphere bi-directional reflectance factor (BRF) and the modelling of bottom of the atmosphere BRF and subsequent modelling to bi-directional reflectance distribution function (BRDF) using these BRFs. Sea ice surfaces being both anisotropic and dynamic have satellite product accuracies that also depend on the length of deployed time window, thus requiring sufficient numbers of observations over a short period of time. In this study, we present a data fusion method using the high accuracy near simultaneous sampling of the Multiangle Imaging SpectroRadiometer (MISR) generated at the Langley Research Center applying a Rayleigh atmospheric correction, with the MOD35 cloud mask which is part of the MOD29 Surface Temperature and Ice Extent product derived from the Moderate Imaging Spetroradiometer (MODIS), both onboard the Terra satellite.

We assume that the MISR bi-hemispherical reflectance (BHR) albedo is independent of solar angle, a crucial condition for instantaneous albedo products. As the accuracy of MOD29 cloud mask is assessed at >90% [1], this synergistic method can retrieve an improved BHR of the Arctic sea ice between April and September of each year from 2000 to 2019, and of the Antarctic sea ice between September and March of each year from 2000 to 2019. This study is a follow-on from Kharbouche and Muller (2018), that developed this method and focused on the Arctic region for the time span between March and September from 2000 to 2016.

For both polar regions, we create four daily sea ice products consisting of different averaging time window (±1 day, ±3 days, ±7 days and ±15 days), each containing the number of samples, mean and standard deviation. For all four MISR cloud-free daily sea ice products, we derive 1km, 5km and 25km spatial resolutions. We perform an assessment of the day-of-year trend of sea ice BHR between 2000 and 2019 for the Arctic, and between 2000 and 2019 for Antarctic, confirming a continuing decline of sea ice shortwave albedo in the Arctic depending on the day of year and

length of observed time window, and providing a novel sea ice shortwave albedo product analysis for Antarctica.

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[1] https://doi.org/10.3390/rs11010009