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Long-term trends of surface reflectance derived from models, satellite and in-situ observations over polar areas

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Nowadays, an increasingly amount of remote sensing and in-situ data are extending over decades. They contribute to increase the relevance of long-term studies aimed to deduce the mechanisms underlying the climate change dynamics. The aim of this study is to investigate the coherence between trends of different long-term climate related variables including the surface albedo (A) and land surface temperature (LST) as obtained by remote sensing platforms, models and in-situ observations.

Directional-hemispherical and bi-hemispherical broadband surface reflectances as derived from MODIS-MCD43 (v006) and MISR, and the analogous products of the Copernicus Global Land (CGLS) and C3S services derived from SPOT-VEGETATION, PROBA-V and AVHRR (v0 and v1), have been harmonized and, together with the ECMWF ERA-5 model, assessed with respect ground data taken over polar areas, over a temporal window spanning the last 20 years.

The benchmark was established using in-situ measurements provided from the Baseline Surface Radiation Network (BSRN) over four Arctic and four Antarctic sites. The 1-minute resolution datasets of broadband upwelling and down-welling radiation, have been reduced to directional- and bi-hemispherical reflectances, with the same time scale of satellite products (1-day, 10-days, monthly).

A similar approach was used to investigate the fitness for purpose of Land Surface Temperature as derived by MODIS (MOD11), ECMWF ERA-5, with respect to the brightness temperature derived using BSRN measurements over the longwave band.

The entire temporal series are decomposed into seasonal and residual components, and then the presence of monotonic significant trends are assessed using the non-parametric Kendall test.

Preliminary results shown a strong correlation between negative albedo trends and positive LST trends, especially in arctic regions.