An approach for developing surface albedo product from seven MODIS land bands at 250m spatial resolution over Canada and the Arctic circumpolar region

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Abstract:

An independent technology was developed at the Canada Centre for Remote Sensing (CCRS) for generating Canada wide and the Arctic circumpolar region clear-sky surface albedo data based on observations from MODIS sensor onboard TERRA and AQUA satellites. The data include all seven MODIS land bands (B1-B7) mapped at 250m spatial resolution and 10-day temporal interval from year 2000 through 2008. The MODIS Level 1B (MOD02) swath level data were used as input to circumvent the problems with image distortion in Canada and polar regions inherent to the sinusoidal (SIN) projection utilized in the standard MODIS data products. The new projections are the Lambert Conformal Conic (LCC) projection for Canada and the Lambert Azimuthal Equal-Area (LAEA) projection for the Arctic circumpolar zone. The MODIS 500m land bands B3 to B7 are downscaled to 250m using an adaptive regression and normalization scheme for compatibility with 250m bands B1 and B2. A new method was developed to produce the mask of clear-sky, cloud and cloud shadow at 250m resolution using a combination of MODIS land bands. The clear-sky compositing scheme employs a scene-dependent multi-criteria technique. It is demonstrated that this new approach provides better results than any scheme based on a single criterion, such as maximum NDVI or minimum visible reflectance. To account for surface bi-directional properties, two clear-sky composites for the same time period are produced for pixels with the sun-satellite relative azimuth angles within 90-270 degree and outside this interval. The clear-sky composites at 10-day interval are then employed for producing spatially continuous albedo/BRDF product that includes all surface types (land, water, snow/ice). In this process a landcover-based fitting (LBF) algorithm was developed to retrieve the bi-directional reflectance distribution function (BRDF) parameters. The new albedo product presents an important spatial enhancement as well as an improved retrieval of water fraction and snow characteristics. Further applications of this product include mapping of snow cover (fraction and grain size), the fraction of absorbed photo-synthetically active radiation (fAPAR), ecosystem productivity, water and energy budget, as well as impact of various disturbances, such as wildfires, and long term climate induced trends.

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