EMS Annual Meeting Abstracts
Vol. 16, EMS2019-407-1, 2019

Quality assessment of several methods to estimate Ultra-Violet from satellite imagery at two ground stations in Uruguay and France

Claire Thomas (1), Agustín Laguarda Cirigliano (2), William Wandji Nyamsi (3), Antti Arola (3), Uwe Pfeifroth (4), Jörg Trentmann (4), Thierry Ranchin (5), and Lucien Wald (5)

(1) TRANSVALOR, Mougins, France (claire.thomas@transvalor.com), (2) Laboratorio de Energía Solar, Universidad de la República, Uruguay (agu.laguarda@gmail.com), (3) Finnish Meteorological Institute, Kuopio, Finland (William.Wandji@fmi.fi and Antti.Arola@fmi.fi), (4) Deutscher Wetterdienst, Satellite Application Facility on Climate Monitoring, Offenbach, Germany (Uwe.Pfeifroth@dwd.de and joerg.trentmann@dwd.de), (5) MINES ParisTech, PSL University, OIE, Sophia Antipolis, France (thierry.ranchin@mines-paristech.fr and lucien.wald@mines-paristech.fr)

This communication analyses the performance of several methods to estimate Ultra-Violet A and B (UV-A and UV-B) from satellite imagery. The benefits and harms of the UV on human health are studied since long. UV may have also adverse effects by stressing plants.
Due to high costs of UV radiometers, measurements are spatially and temporally scarce. An alternative is to derive this information from satellite imagery. Researchers propose for instance to apply empirical models to compute UV from the broadband irradiation derived from satellite imagery. The first method is empirical and exploits the HelioClim-3 version 5 database of broadband irradiation. The second method is the CAMS-UV (Copernicus Atmosphere Monitoring Service) which supplies on demand time series of UV-A and UV-B generated by the numerical weather model of the European Centre for Medium-Range Weather Forecasts (ECMWF).
The two other methods rely on a better modelling of the atmosphere in cloud-free conditions, by working on a limited number of spectral bands as defined by Kato et al. (1999). The third method exploits the implementation of this Kato distribution available in CAMS McClear, another outcome of the CAMS service. The last method rely on SPECMAGIC that runs operationally to generate SARAH product of the Climate Monitoring Satellite Application Facility (CM-SAF) program. Both methods propose a series of weights to apply on the Kato bands lying in the UV range.
Two datasets of UV-A and UV-B collected from terrestrial sites were used to assess the performance of each method. The first dataset consists of 15 min data from end of 2015 until January 2019 for a site located in Uruguay. The daily maintenance of two coupled radiometers enabled to limit the number of non-plausible values to discard in this dataset. The second dataset consists of 1 min data acquired every 1 nm by a spectrometer located in Lille, north of France. 15 min UV-A and UV-B irradiances have been generated by averaging 1 min samples only if 85 % of the samples were available, providing more than six years of reliable data.
Preliminary results for the UV-B component indicate a relative bias in percent that ranges between -5 and 28 %, a relative root mean square error (RMSE) of 24 to 60 %, and a correlation coefficient between 0.930 and 0.975 for all methods. Respective results for the UV-A components are a bias in [-10, 5] %, a RMSE in [20, 37] % and a correlation coefficient very close to 0.96 for all methods. Kato-based approaches outperform other models, and we expect enhanced performance by the date of the conference .