EMS Annual Meeting Abstracts
Vol. 18, EMS2021-314, 2021
EMS Annual Meeting 2021

Clouds and aerosol effects on solar energy in Cyprus

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Cyprus focuses on increasing the share of its renewable energy resources from 13.9% in 2020 to 22.9% in 2030, with solar energy exploitation systems to be one of the main pillars of this effort, due to the high solar potential of the island. In this study, we investigated the effect of clouds as well as aerosols, and especially dust, on the downwelling surface solar irradiation in terms of Global Horizontal Irradiation (GHI) and Direct Normal Irradiation (DNI). In order to quantify the effects of clouds, aerosols and dust on different surface solar radiation components, we used the synergy of satellite derived products for clouds, high quality and fine resolution satellite retrievals of aerosols and dust from the newly developed MIDAS dataset, and radiative transfer modeling (RTM). GHI and DNI climatologies have been also developed based on the above information. According to our findings, clouds attenuate ~25 – 30% of annual GHI and 35 – 50% of annual DNI, aerosols attenuate 5 – 10% and 15 – 35% respectively, with dust being responsible for 30 – 50% of the overall attenuation by aerosols. The outcomes of this study are useful for installation planning and for estimating the PV and CSP performance on a short-term future basis, helping towards improved penetration of solar energy exploitation systems in the electric grid of Cyprus. Furthermore, they are strongly linked to Affordable and Clean Energy (SDG 7) which has a central role in national climate plans and requires services in energy meteorology, climate applications of satellite data, and providing high quality wind and radiation data.

Acknowledgements

This study was funded by the EuroGEO e-shape (grant agreement No 820852) and EXCELSIOR (grant agreement No 857510)