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Global Sunshine Duration Estimation on a daily basis using Geostationary Satellite Imagery

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Hydrological modelling in un-gauged or data sparse catchments has always been a complicated issue due to little or non availability of the measured data related to the key hydrological phenomena (river flow, evapotranspiration, infiltration, etc). Therefore, researches and practitioners have to rely on various techniques of estimating these parameters. Solar radiation is the driving force not just for the hydrological cycle, but also for different energy sources (e.g., solar and wind), the need of which is constantly increasing in the modern world. With the solar radiation information (e.g., intensity and sunshine hour), evapotranspiration at un-gauged catchments can be better estimated.

This study presents a novel technique for the estimation of daily global sunshine duration using Meteosat Geostationary satellite images at a temporal resolution of one hour for the Brue Catchment in the southwest England. The methodology consists of the derivation of Cloud Index from satellite images by incorporating the cloud cover information, back scatter, air mass and sun-satellite angle effects along with a small trend correction for the mean seasonal variation. Also, a statistical relationship has also been established between the Cloud Index and atmospheric transmission factor (under all skies). This relationship is then used in the Angstrom equation that relates the atmospheric transmittance factor and daily fractional bright sunshine hours, for global sunshine duration estimation for a particular day. It is believed that this technique will provide a new alternative approach for the estimation of global sunshine duration and solar radiation estimation in data sparse catchments.