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Assessing the contribution of solar proxies to cloud cover, as differentiated by height and season

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Even though decades of thorough studies have passed, there are still contradictions between scientists both concerning the main factors influencing cloud formation, and on cloud contribution to climate. Thus, until not long ago, it was considered that clouds have an overall cooling effect, while the results of the most recent studies show that clouds have a net positive forcing effect, contributing to global warming. Locally, cloud formation is due to a combination between the water uptake and the aerosol distribution and characteristics in the atmosphere. Also, other factors play indirect, but relevant roles on cloud formation and cloud cover, such as local meteorological parameters, ocean currents etc. Globally, the state of the terrestrial atmosphere is influenced by solar activity and galactic cosmic rays through the global electric circuit. This paper investigates the significance of the correlation between cloud cover and various solar proxies, namely: sunspot number (SSN), solar wind speed (SWS), and the associated interplanetary electric and magnetic fields (IEF, IMF). Each of this solar indicators have different mechanisms through which they influence atmospheric electricity and, thus, cloud cover. The study uses the first long-term cloud database, namely that provided by the International Satellite Cloud Climatology Project (ISCCP), since these data had sufficient time for validation. The values for the solar proxies were taken from NASA's OMNIWeb database, as resulted from measurements with instruments onboard several spacecraft with geocentric orbits. Clouds types were individually-investigated as possibly-correlated with solar proxies, as cloud composites-computed global distribution maps. The study reveals that the cloud cover response to changes in various solar indicator depends on local conditions, also varying with season. E.g. high clouds cover exhibited anticorrelation with IEF in January on large areas, while low cloud cover was moderately positively correlated with SWS on extended regions in July.

Primary authors: CONDURACHE-BOTA, Simona (1Dunarea de Jos University of Galati, Faculty of Sciences and Environment; 2Dunarea de Jos University REXDAN research infrastructure, Galati, Romania); Prof. VOICULESCU, Mirela (1Dunarea de Jos University of Galati, Faculty of Sciences and Environment; 2Dunarea de Jos University REXDAN research infrastructure, Galati, Romania)

Presenter: CONDURACHE-BOTA, Simona (1Dunarea de Jos University of Galati, Faculty of Sciences and Environment; 2Dunarea de Jos University REXDAN research infrastructure, Galati, Romania)

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