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Assessment of Total Cloud Amounts and Analysis of Cloud Cover Climatology over the Arabian Peninsula

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Numerous global products of cloud characteristics exist with performances that often vary region-wise. Due to the significant effects clouds have on climate, and the variety of model outputs regarding cloud feedbacks, establishing records of cloud characteristics is of critical importance to better understanding their impacts .The objectives of this study are to analyze the consistency of three cloud cover products, and establish a climatology of cloud cover over the Arabian Peninsula region. The study's importance lies in the need to identify the differences between cloud cover estimates, in order to then investigate the underlying causes.

Two satellite-based measurement records are utilized: the International Satellite Cloud Climatology Project (ISCCP) D2 and the CM SAF cLoud, Albedo and surface RAdiation (CLARA) A2, in addition to the reanalysis data product from the National Centers for Environmental Prediction–Department of Energy (NCEP–DOE) R-2. These products are validated with ground-based measurements of cloud cover for six airport stations in the United Arab Emirates. Monthly total cloud cover measurements are used for this purpose, for the period 1983-2009. The validation effort using statistical analysis indicates that NCEP-DOE R2 provides the strongest agreement with the surface observations over the UAE, while ISCCP exhibits the lowest. The detrended products and surface records exhibit high positive correlations for all stations.

Spatial and temporal trends of total cloud amounts for the Arabian Peninsula are developed and analyzed using the three products. Temporal analyses results indicate a decreasing shift in cloud averages over the study area. A noticeable change point is detected in cloud cover between the years 1997 and 1999, which could be attributed to various factors related to artifact of satellite viewing geometry, and dominant climate oscillations. Spatial analyses displayed the distribution of cloud amounts over the study area and corroborated its dependency on local topography and climate circulations. The highest spatial variation in cloud cover distribution occurs during the summer season (June-August), increasing towards the south-western side of the Peninsula. The strongest agreement between the three products in spatial distribution of cloud cover is found during the summer, while the least agreement is exhibited during the spring (March-May).