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Comparison of Cloud Diurnal Cycles: Satellite, Synop and Regional Climate Model Data

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Clouds present an important factor in monitoring the climate system. They affect the climate system in many ways, especially the earth radiation budget is definded by clouds. On the other hand clouds are considered to be the largest uncertainty in climate modelling and are furthermore challenging to detect. Great efforts are made to produce useful cloud climatologies, particulary with the aid of multispectral satellite measurements.
In our present work, the two satellite-derived cloud products by ISCCP (International Satellite Cloud Climatology Project; http://isccp.giss.nasa.gov) and CM-SAF (Satellite Application Facility on Climate Monitoring; www.cmsaf.eu) are being compared, especially with regard to the diurnal cycle in cloud amount. To obtain some additional information from ground-based cloud observations, the satellite products are also compared to climatologies based on Synop data (Warren et al.; www.atmos.washington.edu/∼ignatius/CloudMap). Another interesting question to us is, how do climate models account for the diurnal cycle in cloud fraction. Therefore, the observation based cloud cover data sets are compared to a climatology of simulated data by a regional climate model (CCLM; www.clm-community.eu).
A geographical area from 60 E to 60 W and from 60 S to 60 N is analysed. Comparisons with the CCLM are made in an European domain. The investigated time period is primary July 2006 till June 2007, because this is, at present, the largest time period covering both, ISCCP and CM-SAF, data. The satellite products are aditionally compared to climatologies of CCLM and Synop data. Finally, it is distinguished between high and low clouds in ISCCP and CM-SAF, to get an idea of how differences might be explained and what might be the outcome of the existing diurnal cycle.
Work is still in progress, but some conclusions can already be drawn. Over the ocean, in higher latitudes, no diurnal cycle is detected in either analysed dataset contrary to the subtropics, where a distinctive diurnal cycle in cloud amount with early morning maxima exists. But generally, CM-SAF shows higher cloud amounts than ISCCP over the ocean. Over land, in higher latitudes during summer, a diurnal cycle with afternoon maxima can be found. No general agreement between datasets in cloud diurnal cycle is found over land in the subtropics. Especially, in the Saharan region, the detected diurnal cycles are partly contradictory. Synop oberservations exhibit less intensiv diurnal cycles compared to the satellite derived values. The regional climate model CCLM seems to strongly unterestimate the diurnal cycle in Europe in summer.
Although clouds are an important factor in the climate system, still clouds are not consistently defined. The continuation in producing homogeneous cloud climatologies is therefore essential for being able to determine future variations in cloud amount and in diurnal cycle.