



## **A comparison of the global climatology and trends of total cloud cover from satellite and surface observations, reanalysis and CMIP5 simulations (1984-2005)**

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Clouds are an important regulator of climate due to their influence on the water balance of the atmosphere and their interaction with solar and infrared radiation. At any time, clouds cover a great percentage of the Earth's surface but their distribution is very irregular along time and space, which makes the evaluation of their influence on climate a difficult task. In this study, the cloud cover records provided by different global databases have been compared among them and against the output of the Coupled Model Intercomparison Project Phase 5 (CMIP5) climate models at the global scale. Specifically, databases from several satellite projects (ISCCP, CLARA, PATMOS-x), from reanalysis products (ERA-Interim, NCEP-DOE), and from surface observations (CRU) have been chosen. The study covers also a total of 44 model runs for the period between 1984 and 2005. Other global and regional databases built from observational sources have been selected as additional references for the assessment of the simulations. To quantify the agreement between the databases we use two statistics: the mean bias difference and the skill score, which is based on the probability density functions of the databases. We also use Taylor diagrams to visualize other statistics of the comparison between observations and models. Overall, there is a relatively good agreement between the climatology and the time evolution of cloud cover provided by the ISCCP and other products, especially in some areas of the world. Nevertheless, the reanalyses tend to underestimate cloud cover in most latitudinal bands. In addition, results also indicate an underestimation of cloud cover from the historical climate model simulations as compared to observations, especially at mid-latitudes. These differences highlight the limitations of most climate models when reproducing the cloud cover, in line with previous findings reported in the literature. Using the results of the study, a ranking of the climate models is proposed as the models that more accurately describe the variable analysed in the study area in the past are expected to describe better the future behaviour of this variable.