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Water vapor, clouds and precipitations: exploiting remote sensing and machine learning to better understand the atmospheric water cycle

In a changing climate a thorough understanding of the water cycle and especially the local availability of water resources is crucial. This holds especially for desert areas where often very view measurements are available. Modern remote sensing techniques and in particular recent satellite launches provide unique possibilities to study water vapor, clouds and precipitation from the satellite perspective. However, satellite measurements are especially challenging close to the surface calling for ground-based and airborne measurements to allow a complete assessment. With more and more data from observations but also high-resolution modelling intelligent methods are necessary to extract the essential information.

The talk will start with an introduction to the Center for Earth Observation and Computational Analysis (CESOC; hcesoc.net) which has been founded between the Universities of Bonn and Cologne and the Research Center Jülich. CESOC drives the integration of Earth System Science with Computer Science and connects the European Center for Medium Range Weather Forecast (ECMWF), specifically its Bonn location. Next I will give a short overview on the activities of the Atmospheric Water Cycle and Remote Sensing (AWARES) group before providing specific example from two "dry" regions: 1) The Arctic where the strongest changes in the coupled climate system are observed and studied within the Collaborative Research Center (CRC) "Arctic Amplification", 2) The Atacama desert, the driest place on Earth whose evolution is investigated within the CRC "Earth at the dry limit" and where the westward located stratocumulus deck seems to be connected to a region of cooling opposite to the global trend. Arctic