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A new atmospheric observatory: JOYCE - The Jülich ObservatorY for Cloud Evolution

JOYCE is a unique site for investigating the processes leading to cloud formation and cloud evolution. To this end, various instruments have been set up at the Research Centre Jülich, which continuously monitor water vapour, clouds, and precipitation over many years. JOYCE is operated jointly by the University of Cologne, the Research Centre Jülich and the Transregional Collaborative Research Centre *Patterns in Soil-Vegetation-Atmosphere-Systems: Monitoring, Modelling and Data Assimilation*. The core instruments of JOYCE are a scanning cloud radar, a micro rain radar, a ceilometer, a pulsed Doppler lidar, a scanning 14-channel microwave radiometer (MWR), an infrared spectrometer, a Doppler sodar, a total sky imager and radiation sensors. These measurements are supplemented by the standard meteorological measurements from the 120 m measurement tower. In addition, the polarimetric weather radar of the Research Centre Jülich provides information of the spatial distribution of precipitation. These collocated measurements of multiple wavelength active and passive remote sensing instruments allow for the combination of the different sensors in an optimal way in order to derive the best estimate of the thermodynamic and cloud properties as well as their uncertainties. Furthermore, a 3D picture of water vapour and clouds is provided by the hemispheric scans of the cloud radar and MWR. Thus, the JOYCE instrumentation is ideally suited for the analysis of water vapour variations, the development of boundary clouds, cloud radiation interaction, and precipitation formation.