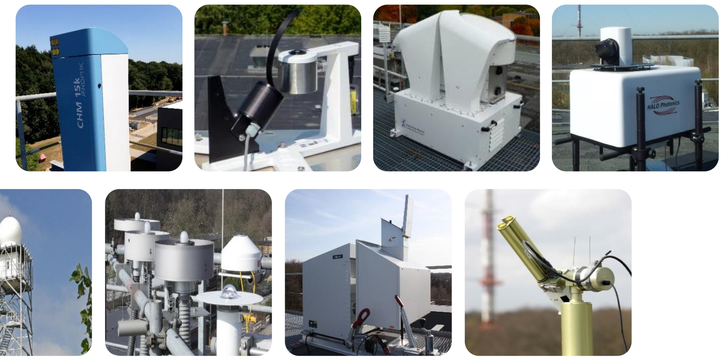
JOYCE - CF



Juelich ObservatorY for Cloud Evolution – Core Facility

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JOYCE – CF instrumentation:

JOYCE – CF offers **long-term observations** from **multiple remote sensing** and other ground based measurement instruments to guaranty optimal observations of the atmosphere. Fig. 1 shows the location of all measurement sites within JOYCE – CF. Additionally we invite scientists worldwide to **exploit our data** and give them the possibility to **install additional instruments** either long-term, or temporary.

Our **current major instrumentation** includes a large variety of different atmospheric observations with:

- Microwave profiler
- Two cloud radars (35 GHz and 96 GHz)
- Two polarimetric X-band radars
- Microwave rain radar
- Two ceilometer
- Doppler – LIDAR
- Infrared spectrometer
- Pluviometer
- Laser distrometer
- Radiation sensor
- Cloud camera

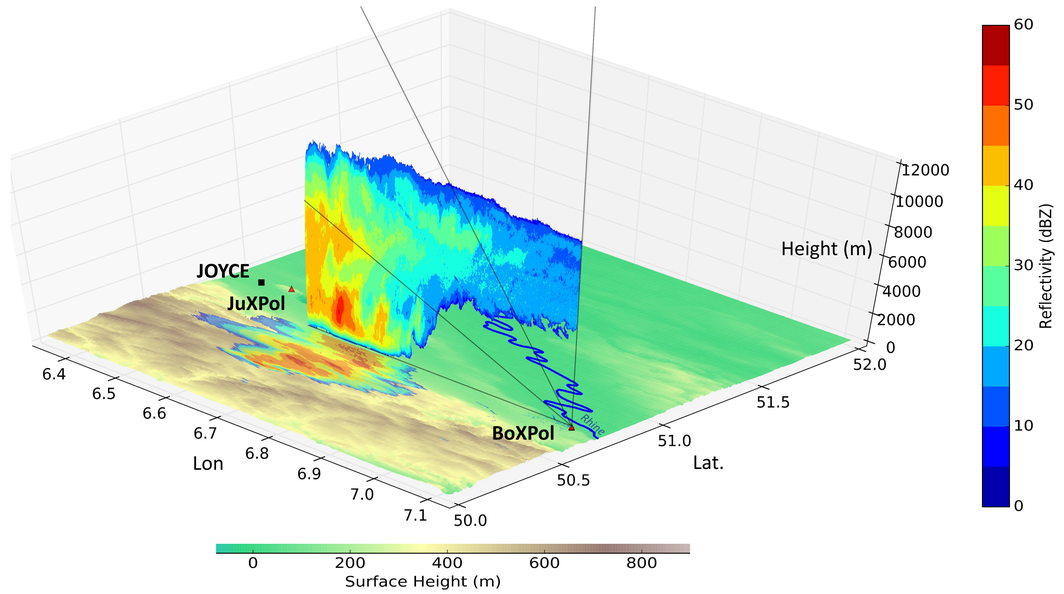
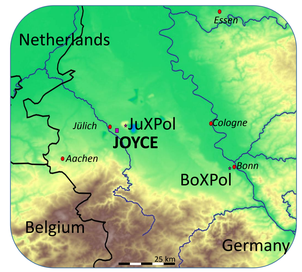


*Fig. 1: Observation of a mesoscale convective system (MCS) on 09 June, 2014 in Bonn, western Germany. Presented is the **JOYCE – CF** location with both polarimetric X-band radars Bonn (**BoXPol**) and Juelich (**JuXPol**) and the measurement Platform **JOYCE**. Reflectivity (Z) is shown in colors in lowest PPI and RHI. Black lines show the isolines of 0°, 10°, 30° and 90° elevation. Background colors present the orography in the JOYCE area with the river Rhine.*

Setup twin X-band radars:



- Two polarimetric X-band radars
- 50 km distance
- 1°, >25 m resolution
- 5 min schedule
- >7 PPIs at different elevations (> 1°)
- RHI
- Vertical pointing scan at 90° elevation
- 9.3 GHz frequency

This twinset of polarimetric radars offers a well setup for research topics. The close location of both radars offers a large overlapping domain. Both sites are equipped with co-located additional instruments. **Data can be requested at any time.**

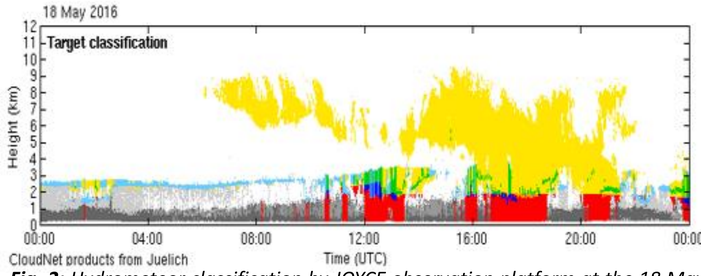


Fig. 2: Hydrometeor classification by JOYCE observation platform at the 18 May, 2016. Colors indicate different types of precipitation.

Instrument synergy:

Hydrometeor classifications offer much information about cloud development and precipitation type. Fig. 2 shows an example for a passing frontal system in May, 2016. **Target classifications** from cloud radar offers additional information towards radar based classifications due to the different wavelengths.

In Trömel et al (2017) multi-sensor observations from JOYCE were used to **characterize mammatus clouds** in a developing mesoscale convective system. Decreasing Z and RHOHV and high ZDR could be explained by a fast growth of pristine dendrites in a supercooled layer seen by a Doppler LIDAR and Ka-band cloud radar. The **synergistic monitoring offered an optimal basis** for detection of these microphysical processes.

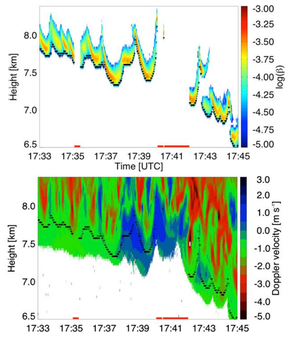


Fig. 3: JOYCE measurements of the underside of the anvil with intense mammatus lobes at 09 June, 2014 by Doppler LIDAR and 35 GHz cloud radar. Top panel shows the backscattering coefficient and lower panel the Doppler velocity.

Calibration of polarimetric X-band radars:

Self-consistency

Calibration of reflectivity with the self-consistency method based on specific attenuation A and radar reflectivity Z. A is calculated with the ZPHI-method. The difference between measured and recalculated reflectivity can show large differences in Z due to miscalibration.

Vertical pointing

Observation of vertical pointing radar measurements for calibration of differential reflectivity ZDR in stratiform events where ZDR is close to zero (Fig. 5).

Instrument synergy

A synergistic comparison with co-located microwave radar and laser distrometers offer a possibility to compare reflectivity.

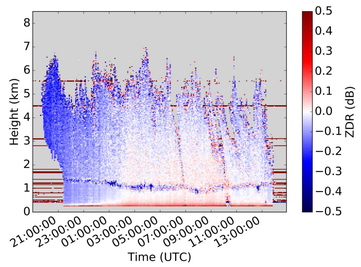
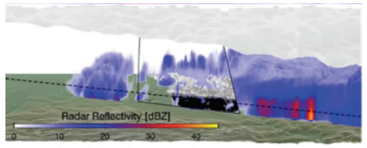


Fig. 5: BoXPol vertical scan (elevation 90°) for stratiform precipitation from 15 Nov 2014 to 16 Nov 2014.



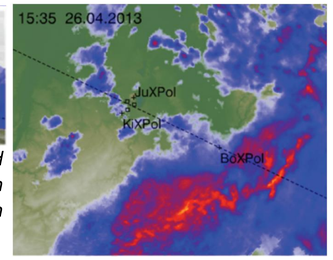


Fig. 4: 3D Composite of JuXPol and BoXPol 26 April, 2013. Cross section (left) with hydrometeor classification and near surface reflectivity.

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