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Distribution of water vapour in the UTLS - comparison between IAGOS (in-situ data) and ERA-Interim

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Cirrus clouds and their potential formation regions, so-called ice-supersaturated regions (ISSRs) occur frequently in the tropopause region. It is assumed that ISSRs and cirrus clouds can change the tropopause structure by diabatic processes, driven by latent heating due to phase transitions and interaction with radiation. These effects may also alter the distribution of potential vorticity (PV) in the upper troposphere, thus leading to changes in large scale dynamics and stratosphere-to-troposphere exchange.
The measurement of water vapour at the tropopause level is not trivial. Beside radiosonde data the most important in-situ dataset is provided by in-service passenger airplanes. The European Research Infrastructure 'In-service Aircraft for a Global Observing System' (IAGOS) (Petzold et al., 2015) provides long-term in-situ measurements on board commercial passenger aircraft. Along its flight track every aircraft is monitoring the chemical composition of the surrounding air and atmospheric state parameters by compact instruments. Especially in the upper troposphere/lowermost stratosphere (UTLS) these measurements are very valuable as most flight tracks are situated in heights between 9 to 13 km, depending on the actual weather conditions, seasons and geographic region.
However, for many research questions a three-dimensional picture including a sufficient temporal resolution of the water vapour fields in the UTLS region is required. Hence, in our study we use the in-situ data from IAGOS to quantify the quality of the established and often used ERA-Interim data set. The underlying IFS-model of this reanalysis data allows explicitly ice-supersaturation in cloud free conditions and is therefore suitable for comparison. For instance, we compare properties such as the seasonal cycle of the vertical distribution of water vapour mixing ratio, relative humidity and the fraction of ice-supersaturated regions.