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Evaluation of ERA-5 reanalysis data with respect to the humidity in the UTLS region, using the in-situ data set IAGOS

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With their frequent abundance in the tropopause region, cirrus clouds and their potential formation regions, the so-called ice-supersaturated regions (ISSRs), may have a significant impact on the tropopause structure by diabatic processes that result from latent heating, driven by phase transitions and interaction with radiation. This may lead to an alteration of the structure of potential vorticity(PV), leading to changes of large scale dynamics and the stratosphere-to-troposphere exchange.

One of the most important long-term in-situ data set to study water vapor content at the tropopause level is provided by the European Research Infrastructure 'In-service Aircraft for a Global Observing System' (IAGOS) (Petzold et al., 2020). Along the flight tracks of commercial passenger aircrafts, atmospheric state parameters and chemical properties of the surrounding air are recorded by compact instrument packages. In general, the cruising altitude of these aircraft ranges between 9 and 13 km, making this data set especially viable for studies of the upper troposphere/lowermost stratosphere (UTLS). However, due to the sparsity of these measurements, IAGOS on its own cannot provide three-dimensional water vapour fields with a high temporal resolution in the UTLS region, which are necessary to gain a deeper understanding of the cirrus cloud life cycle. Instead, we use these measurements to evaluate the quality of the well-known ERA-5 data set with regards to e.g. a seasonal cycle of the vertical distribution of water mixing ratio, the relative humidity and the fraction of ice-supersaturated regions. Additionally, the benefit of the higher resolution of ERA-5 over its predecessor ERA-Interim will be quantified.