Geophysical Research Abstracts
Vol. 19, EGU2017-7009, 2017
EGU General Assembly 2017

Upper tropospheric water vapour and its interaction with cirrus clouds as seen from IAGOS long-term routine in-situ observations

Andreas Petzold (1), Martina Krämer (2), Patrick Neis (1), Christian Rolf (2), Susanne Rohs (1), Florian Berkes (1), Herman G.J. Smit (1), Martin Gallagher (3), Karl Beswick (3), Gary Lloyd (3), Darrel Baumgardner (4), Peter Spichtinger (5), Philippe Nédélec (6), Volker Ebert (7,8), Bernhard Buchholz (7,8), Martin Riese (2), and Andreas Wahner (1)

(1) Forschungszentrum Jülich, IEK-8 Troposphere, Jülich, Germany (a.petzold@fz-juelich.de), (2) Forschungszentrum Jülich, IEK-7 Stratosphere, Jülich, Germany, (3) University of Manchester, Manchester, UK, (4) Droplet Measurement Technologies, Boulder, USA, (5) Institute for Atmospheric Physics, Johannes Gutenberg University, Mainz, Germany, (6) Laboratoire d'Aérologie, CNRS, Toulouse, France, (7) Physikalisch-Technische Bundesanstalt, Braunschweig, Germany, (8) Technische Universität Darmstadt, Institute of Reactive Flows and Diagnostics, Darmstadt, Germany

IAGOS (In-service Aircraft for a Global Observing System) performs long-term routine in-situ observations of atmospheric chemical composition (ozone, CO, NO_x, NO_y, CO_2, CH_4), water vapour, aerosols, clouds and temperature on a global scale by operating compact instruments on board of passenger aircraft. The unique characteristics of the IAGOS data set originate from the global-scale sampling on air traffic routes with similar instrumentation such that the observations are truly comparable and well suited for atmospheric research on a statistical basis. Here, we present the analysis of 15 months of simultaneous observations of relative humidity with respect to ice (RH_{ice}) and ice crystal number concentration in cirrus (N_{ice}) from July 2014 to October 2015. The joint data set of 360 hours of RH_{ice} – N_{ice} observations in the global upper troposphere and tropopause region is analysed with respect to the in-cloud distribution of RH_{ice} and related cirrus properties. The majority of the observed cirrus is thin with $N_{ice} < 0.1$ cm^{-3}. The respective fractions of all cloud observations range from 90% over the mid-latitude North Atlantic Ocean and the Eurasian continent to 67% over the subtropical and tropical Pacific Ocean. The in-cloud RH_{ice} distributions do not depend on the geographical region of sampling. Types of cirrus origin (in situ origin, liquid origin) are inferred for different N_{ice} regimes and geographical regions. Most important, we found that in-cloud RH_{ice} shows a strong correlation to N_{ice} with slightly supersaturated dynamic equilibrium RH_{ice} associated to higher N_{ice} values in stronger updrafts.