BSRN IDENTIFIED AS A GCOS BASELINE NETWORK

Ellsworth G. Dutton
NOAA/CMDL

The GEWEX Baseline Surface Radiation Network (BSRN) has been invited to contribute to the Global Climate Observing System (GCOS) global baseline network system. BSRN has agreed to participate with GCOS in this capacity. In order to be designated as a GCOS baseline network, it is expected that the network will abide by the ten climate monitoring principles developed by GCOS. BSRN has reviewed its operations to evaluate its compatibility with the monitoring principles and GCOS has agreed that BSRN's fundamental operation and inherent value satisfy the requirements for a GCOS global baseline surface radiation network. BSRN will continue to function as a research project of GEWEX and will be identified within GCOS as the GEWEX/BSRN.

BSRN was formed under the auspices of the World Climate Research Programme (WCRP) in 1988 for the purpose of acquiring ground-based surface irradiances of the highest possible quality for use by WCRP supported projects. BSRN began by inviting participation of World Meteorological Organization (WMO) member nations that had demonstrated expertise in the area of surface irradiance measurement to participate in the new network with a contribution of appropriate observing sites. In addition, there would be a commitment of a portion of the radiation expert's time and resources to help develop and perpetuate the network. The project was initiated with two evaluations, first to determine the required measurement accuracies, and secondly to identify the present measurement capabilities. The next step was to specify measurement techniques, including calibration methods and reference standards that would be required to meet the research needs for these data. Measurements at nine widely distributed BSRN sites began in 1992. A central data archive was established in Zurich, Switzerland at the Swiss Technical Institute, ETHZ.

As of January, 2,561 station months of surface irradiance data from 35 sites have been acquired according to BSRN specifications and have been submitted to and accepted by the archive. BSRN continues to concentrate on expanding the network into under-represented regions and to promote general advances and improvements to irradiance measurement capabilities, especially in the development of internationally recognized measurement reference standards. For additional information and access to the BSRN data, see http://bsrn.ethz.ch.

ICE SUPERSATURATION IN THE UPPER TROPOSPHERE

Klaus Gierens and Ulrich Schumann

DLR, Institute of Atmospheric Physics, Oberpfaffenhofen, Germany

In recent years it has become evident that the relative humidity with respect to the ice phase of water (RHi) in the upper troposphere (UT) is often above saturation (i.e., RHi > 100 %). Regions containing air masses with RHi > 100 % have been termed "ice-supersaturated regions" (ISSR) (Detwiler and Pratt, 1984; Gierens et al., 1999). As a phenomenon in the water vapor field, essential for weather and climate, and because of their importance as cirrus formation regions, ISSRs should be a topic both in the GEWEX Global Water Vapor Project and the GEWEX Cloud System Study.

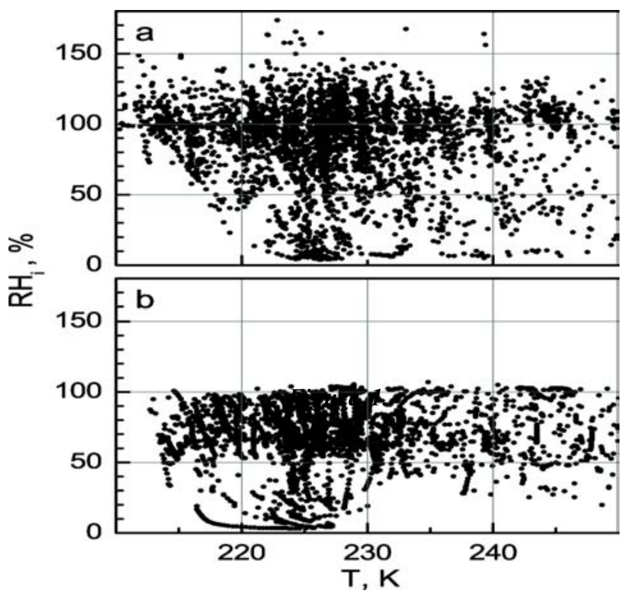
Although the first detection of ice supersaturation in the UT dates back at least to the 1940s, it was generally believed that ice supersaturation occurs only exceptionally and that clouds of ice particles form soon after the humidity exceeds saturation. Also, most weather and climate models still assume that cirrus clouds form immediately when the humidity reaches ice saturation. Examples include the operational weather prediction model of the European Centre for Medium-Range Weather Forecasts (ECMWF) and climate models derived from it (see figure on page 7).

The existence of ice-supersaturated air masses in the UT has been confirmed by airborne measurements with various types of hygrometers during several campaigns (e.g., Airborne Arctic Stratospheric Expedition (AASE)/Airborne Antarctic Ozone Experiment (AAOE), First ISCCP Regional Experiment (FIRE), Pollution from Aircraft Emissions in the North Atlantic Flight Corridor (POLINAT), Measurement of ozone from Airbus in-service aircraft (MOZAIC). Radiosonde measurements in the past, mostly underestimate relative humidity in the UT. However, carefully calibrated and corrected RS80A radiosondes can now be used to detect ice supersaturation (Spichtinger et al., 2003a). More than 40% of all data collected during POLINAT over the North Atlantic and more than 15% of all MOZAIC data were taken in ISSRs (Schumann et al., 2000; Gierens et al., 1999).

Ice supersaturation occurs both inside and outside cirrus clouds as simultaneous measurements of humidity and particles have shown during such campaigns as Subsonic aircraft contrail and cloud effects special study (SUCCESS), ozone and NOx experiment (SONEX) and Interhemispheric differences in cirrus properties from anthropogenic emissions (INCA).

Ice particles in cirrus clouds form by homogeneous or heterogeneous freezing, depending on the availability of ice nuclei and speed of vertical motions. When a stratiform cold (T<-40°C) cirrus forms by homogeneous freezing of aqueous solution droplets, the cloud must form in highly supersaturated air, because such solutions freeze only at ice supersaturation exceeding 40% (and the supersaturation necessary for freezing increases with decreasing temperature). Heterogeneous nucleation probably needs less (but finite) supersaturation, but the existence of cloud-free supersaturated air masses indicates that there is often a lack of suitable ice nuclei.

Evidence for ice supersaturation occurring in the UT is provided by cirrus fallstreaks that grow while falling through supersaturated air layers and by contrails. Contrails can decorate the sky when no cirrus clouds are around. Since contrail persistence requires ice saturation, a sky full of contrails but without cirrus shows that there must be ice-supersaturated air above. The potential coverage of contrails in the northern midlatitude agrees well with the fractional coverage of ISSRs determined from MOZAIC data (namely about 15–20%). The average horizontal extension of ISSRs is of the order 150 km.



a) One minute averages of relative humidity obtained on research flights during the INCA campaigns with a frostpoint hygrometer vs. temperature. Ice supersaturation occurs often and at all temperatures in the plot.

b) Relative humidities from the ECMWF analyses for the locations and times of the INCA flights. The model shows practically no ice supersaturation, because it assumes cirrus to be present as soon as saturation is reached.

Global distribution maps of ISSRs on the nominal pressure levels 147 hPa and 215 hPa have been produced from MLS RHi data (Spichtinger et al., 2003b). Annual and seasonal distributions have been derived. Geographical regions where ISSRs occur most frequently are the tropics on both pressure levels, the midlatitude storm belts on 215 hPa in the respective hemispheric summer and fall seasons, and Antarctica in southern winter and spring. There is a remarkable similarity between the features of the global distribution of ISSRs and the global distribution of high clouds, which points to the role of ISSRs as cirrus formation sites.

Additional information on the subject of ice supersaturation and a full set of references for the results and conclusions mentioned above can be found in the quoted papers as well as on http://www.pa.op.dlr.de/issr.

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