

SOCRATES Cloud Phase Product, Version 1.0

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Overview

This dataset contains cloud phase classifications derived at 1-Hz frequency from in-situ probes installed on the G-V aircraft during the Southern Ocean Clouds, Radiation, Aerosol Transport Experimental Study (SOCRATES). As described in D'Alessandro et al. (2021), cloud (or precipitation) phase is defined as liquid, mixed, or ice, for all research flights conducted between 15 Jan 2018 and 24 Feb 2018. The product is only defined for subfreezing temperatures.

Instrumentation

The phase product utilizes measurements from the Cloud Droplet Probe (CDP, Lance et al, 2010), Two-Dimensional Stereo Probe (2DS, Lawson et al. 2006), Two-Dimensional Optical Array Cloud Probe (2DC, Jensen and Stith 2021), and Rosemount Icing Detector (RICE, Cober et al. 2001), with a Rosemount Temperature Probe used to determine temperature.

Data Collection and Processing

Phase identification was derived using a combination of measurements taken by the aforementioned instrumentation mounted aboard an NCAR/NSF G-V aircraft. Additional variables are included to provide context to the data (see "Data Format" section). The original data and point of contact for further information concerning the data processing can be found at UCAR/NCAR - Earth Observing Laboratory (2022).

Data Format

Data is in netCDF4 format. All variables are provided at 1-Hz resolution, and have one dimension (time). All 15 flights are combined into one file, with a “flight_number” variable. The below table gives information about each variable:

Variable name	Data type	Description	Units
time	int32	seconds since 00 UTC on flight start date (does not reset to zero at midnight for flights spanning multiple days)	seconds
phase	int8	cloud/precip phase: 0 = no cloud/precip, 1 = liquid, 2 = mixed, 3 = ice. The phase product is not valid for above freezing temperatures, so a value of -1 is used if temperatures are above freezing.	unitless
flight_number	int8	Number of research flight (15 flights total)	unitless
day	int8	Day of month	days
month	int8	Month of 2018	months
lat	float32	Aircraft latitude	degrees North
lon	float32	Aircraft longitude	degrees East
altitude	float32	Aircraft altitude above sea level	meters

Data Remarks

Some errors in the original classification used in D’Alessandro et al. (2021) were fixed based on an extensive manual analysis of 2DS images. 2DC data were used only in cases where the 2DS probe was not functioning correctly (e.g. between 3:10:41-4:42:40 UTC on RF08).

References

Cober, S. G., G. A. Isaac, and A. V. Korolev. (2001). Assessing the Rosemount icing detector with in situ measurements, *J. Atmos. Oceanic Technol.*, 18, 515-528.
https://airbornescience.nasa.gov/content/Assessing_the_Rosemount_icing_detector_with_in_situ_measurements.

D’Alessandro, J. J., McFarquhar, G. M., Wu, W., Stith, J. L., Jensen, J. B., & Rauber, R. M. (2021). Characterizing the occurrence and spatial heterogeneity of liquid, ice and mixed phase

low-level clouds over the Southern Ocean using in situ observations acquired during SOCRATES. *Journal of Geophysical Research: Atmospheres*, 126, e2020JD034482. <https://doi.org/10.1029/2020JD034482>.

Jensen, J. and Stith, J. (2021). Two-Dimensional Optical Array Cloud Probe (2DC). UCAR/NCAR - Earth Observing Laboratory. <https://www.eol.ucar.edu/instruments/two-dimensional-optical-array-cloud-probe>

Lance, S., Brock, C. A., Rogers, D., and Gordon, J. A. (2010). Water droplet calibration of the Cloud Droplet Probe (CDP) and in-flight performance in liquid, ice and mixed-phase clouds during ARCPAC. *Atmospheric Measurement Techniques*. <https://amt.copernicus.org/articles/3/1683/2010/amt-3-1683-2010.pdf>.

Lawson, Paul & O'Connor, Darren & Zmarzly, Patrick & Weaver, Kim & Baker, Brad & Mo, Qixu & Jonsson, Hafliði. (2006). The 2DS (Stereo) Probe: Design and Preliminary Tests of a New Airborne, High-Speed, High-Resolution Particle Imaging Probe. *Journal of Atmospheric and Oceanic Technology*, 23. 1462-1477. 10.1175/JTECH1927.1. <http://hdl.handle.net/10945/42267>.

UCAR/NCAR - Earth Observing Laboratory. 2022. SOCRATES: Low Rate (LRT - 1 sps) Navigation, State Parameter, and Microphysics Flight-Level Data. Version 1.4. UCAR/NCAR - Earth Observing Laboratory. <https://doi.org/10.5065/D6M32TM9>.