

ACRE

The Antarctic Clouds and Radiation Experiments



Principal investigator

Simon Alexander

simon.alexander@aad.gov.au

Australian Antarctic Division (AAD)

Areas of contribution

User-aspects and verification

Polar atmospheric processes

Polar-lower latitude linkages

Observations

Data archiving

Summary

A suite of cloud, aerosol and radiation instruments will be deployed to Macquarie Island (54°S) Davis (69°S), and onboard the Australian icebreaker (43°S - 69°S). The data collected will be used to validate satellite cloud retrievals; evaluate weather forecasting and climate models; and aid in model development. ARM deployments to Macquarie Island (MICRE, 2016-18) and onboard the Australian icebreaker (MARCUS, summer 2017-18 season) are a key component of this research project.

Description

The ACRE scientific objectives are (asterisks indicate objectives linking directly to YOPP objectives):

- (1) * Quantify key cloud and radiation properties between sub-diurnal and seasonal time-scales using a suite of ground-based instruments deployed on intensive observational campaigns at Davis and Macquarie Island (these instruments will produce what will collectively be referred to as the 'ACRE dataset').
- (2) Validate satellite cloud observations and products over the Southern Ocean and East Antarctica.
- (3) * Evaluate cloud and radiation products from the Australian ACCESS model against the specific parameters collected or derived from the ACRE dataset and use these results to aid model development.
- (4) * Evaluate high-resolution numerical forecasting models (ACCESS-CP and AMPS-Polar WRF) using the ACRE dataset and ancillary data streams.
- (5) Investigate the structure and evolution of clouds on sub-climate model grid scales in the Davis region.

To achieve these objectives, measurement campaigns will take place at Macquarie Island (54°S, 159°E) from March 2016 - March 2018; at Davis (69°S, 78°E) from November 2018 - November 2019 and aboard Aurora Australis (the Australian icebreaker) from October 2017 - March 2018. Note that the Aurora Australis component is the ARM MARCUS project which links directly with the YOPP-endorsed SOCRATES proposal. Cloud and incoming radiation measurements will also take place at Dumont d'Urville (66°S, 140°E) and Concordia (75°S, 123°E) between 2016 and 2019, subject to funding.

Timeline

2016-03-01 - 2018-11-25

Regional emphasis

Northern hemisphere: No

Southern hemisphere: Yes

Key project deliverables

The following organisations' instruments will allow these datasets to be obtained or retrieved:

- 1) AAD lidars: Raman temperature (Davis), cloud backscatter, cloud depolarization ratio, IWC, optical depth, cloud top height, base height, cloud fraction, 3D cloud volume scans.
- 2) Cloud radar (Australian Bureau of Meteorology): reflectivity, LWC, IWC, ice terminal fall speed, visible extinction, cloud boundaries, thickness, cloud fraction.
- 3) Ceilometer (University of Canterbury): Backscatter, cloud visible extinction, IWC, cloud boundaries, thickness, cloud fraction.

4) BAS Twin Otter at Davis (subject to funding): cloud, aerosol and precipitation particle size spectra, aerosol particles, LW and SW upwelling and downwelling radiation, PTU, RH.

5) CSIRO CCN & CPC: aerosol concentrations.

6) ARM MICRE + MARCUS:

(a) surface radiometers: downwelling and upwelling SW and LW; diffuse SW; direct normal SW,

(b) MWR: measures microwave emission / brightness temperatures. Retrieve: column integrated liquid water path, water vapour path, cloud water content, particle size,

(c) MFRSR: Direct /diffuse narrowband radiances. Retrieve: aerosol and cloud optical depth,

(d) Parsivel disdrometer: Precipitation drop size distribution.

7) ARM MARCUS also will have: (a) up to four radiosonde launches per day onboard the ship; (b) nephelometers, CPC, CCN, 95GHz Cloud Radar, MPL, MWR, etc.

8) Dumont d'Urville & Concordia stations: incoming SW & LW radiation, cirrus clouds.

Data management

ARM MICRE & MARCUS campaign data will be available at the ARM data archive.

All other datasets will be available through the AAD's Data Centre.

Is data provided to WMO Global Telecommunication System

No

Real-time provision

We expect that data from the four-times daily radiosondes to be launched aboard the icebreaker during summer 2017/18 as part of MARCUS to be of high interest to the forecasting community and will make efforts to ensure their data are transmitted back in near real-time.

Some other data sets may be available in near-real time if desired although this depends upon bandwidth and pre-processing limitations. We will endeavour to make additional data available in near-real time as required by the community.

Other information

Some elements have not yet been applied to for funding e.g. BAS Twin Otter to Davis

Timelines

| Location | Latitude | Longitude | Start date | End date | Activity |
|--------------------------------|-----------------|------------------|-------------------|-----------------|---|
| Macquarie Island | | | 2016-03-01 | 2018-03-30 | AAD polarisation lidar, BoM cloud radar, UC ceilometer, ARM MICRE, CSIRO CPC + CCN |
| Aurora Australis | | | 2017-10-01 | 2018-03-30 | ARM MARCUS |
| Davis | | | 2018-11-01 | 2019-11-30 | AAD polarisation lidar, BoM cloud radar, UC ceilometer, possibly CSIRO CPC + CCN, BAS Twin Otter in-situ observations (subject to funding) |
| Concordia, Dumont d'Urville | | | 2016-01-01 | 2019-12-30 | Concordia: lidar observations of (cirrus) clouds to provide a high-plateau climatology; and Dumont d'Urville for clouds as another coastal Antarctic site |