

## **RadiCA**

### **Radiation Fluxes and Cloud Features from Surface-Based Observations in the Antarctic Peninsula and Weddell Sea Region**



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#### **Areas of contribution**

User-aspects and verification

Polar atmospheric processes

Observations

#### **Summary**

The main goal of our proposal is to characterize the surface radiative budget as well as cloudiness which features at the Argentine Bases Marambio and Belgrano II during the YOPP-SH Special Observing Period (SOP) as well as the YOPP Consolidation Phase.

Specific objectives to secure our main goal during the SOP will be:

- 1 - develop a compact Radiation Measurement UNIT (RMU) robust enough to allow continuous measurements in harsh environment through which to make shortwave, longwave observations as well as to record status of the sky.
- 2 - secure UV measurements at both stations.
- 3 - develop specific tools to analyse on a daily basis (weakly for clouds) collected data and extract parameters of interest. For radiation these will include QA/QC SW and LW downwelling and upwelling fluxes, diffuse and direct components of solar radiation, UV spectral flux and doses. For clouds these will include, on a continuous

base, cloud fraction derived both from radiometric measurement and sky camera observations, cloud type and cloud effect on SW radiation. In addition cloud base (or cloud ceiling) will be obtained by routine observations performed at the two stations. From UV measurements columnar ozone content will be also derived.

Moving forward to YOPP consolidation phase, we plan to:

- 1 - extend dataset and its analysis, start to collect information on seasonal and inter-annual variability, determine Cloud radiative Forcing (CRF)
- 2 - perform extensive comparison between automatic and visual cloudiness observation methods. They being very useful to better understand quality and value of historical datasets at the two stations
- 3 - make comparison with cloudiness regime of Ross Sea and Antarctic Plateau. Make similar comparison for UV fluxes in the Peninsula and at Concordia.

## **Description**

Measurements in Antarctica are always challenging due to the harsh environment. This is particularly true for radiation measurements. Nowadays, instrumental improvements make realistic development of a radiation measurement unit (RMU) able to provide a comprehensive set of accurate radiation measurements and sky information without moving parts, designed to be robust enough for continue operations in the extreme Antarctic environment.

The main goal to fully characterize surface radiative budget as well as cloudiness features at Argentine Bases of Marambio and Belgrano II will be achieved through a two level strategy differencing each the other on the basis of temporal perspective.

Considering YOPP Special Observing Period temporal horizon, we will work to

- A - Realize two examples of Radiation Measurement Unit (RMU), ship them to Argentina and than to Antarctica at the two stations of Marambio and Belgrano II. Each RMU will be equipped with a Delta-t SPN-1, Kipp & Zonen pyranometers and pyrgeometers, and an all sky camera (e.g. Alcor system), data acquisition and communication capabilities.
- B - develop dedicated tools for fast pre-analysis of radiation data following QA/QC procedures developed by BSRN. Also implemented will be procedures to determine cloud coverage, cloud effects on SW and cloud type, using well known methodologies adapted to polar conditions.
- C - to secure UV measurements both in Belgrano II and Marambio, in Belgrano II with a Brewer, in Marambio with a multifilter GUV and a Solar Light 501.
- D - define and secure data provision to YOPP together with Argentine colleagues. In this respect, using approaches applied yet in the Arctic and the support in Italy of specific actions promoted also by PNRA, we are confident to be able provide during SOP radiation data with 1 or 2 days of delay and cloud information on a weekly basis.

Considering the temporal horizon of YOPP Consolidation Phase, we will work to

- E - continue on a routine basis all measurements, provide maintenance and little upgrade of RMUs depending on needs and acquired experiences.
- F- deepen our analysis of acquired data. To this scope we will reduce the pressure on data delivery to YOPP. The cloudiness analysis will be extended to the infrared radiation making use of the Automatic Partial Cloud Amount Detection Algorithm (APCADA) proposed by Durr and Philipona. Information on cloud coverage and type will be also extract from all sky camera data. Comparison of the measured net radiative fluxes under cloudy conditions with model evaluations of the same quantity for clear sky conditions, will allow to estimate year-round the entity and the sign of the cloud forcing (CRF).
- G - perform extensive comparison between results obtained through different methods (radiation measurements,

all sky camera, visual routine observations) as well as between our results and evaluations collected/performed in the Ross Sea Area. Comparison between different methodologies will be very useful in order to better understand quality of historical data and also detect any trend. Data set extending on two years will allow to start analysis of seasonal and inter-annual variability of cloudiness features.

H - add to our results complementary observations carried out at the two stations in order to increase their usefulness for model development and output verification. Moreover, we will connect/compare our results and analysis with those achieved in the frame of similar activities/projects also planned to operate during SOP (e.g. The Antarctic Clouds and Radiation Experiments - ACRE) as well as previous studies/experiments also connected to YOPP (e.g. ARM West Antarctic Radiation Experiment - AWARE).

## **Timeline**

2018-09-01 - 2020-08-31

## **User relevant aspects**

User community for this project will be modelers. We aim to promote with them discussion in order to provide data in a format compliant with rules and protocols identified in the YOPP modeling implementation plan

## **Regional emphasis**

Northern hemisphere: No

Southern hemisphere: Yes

## **Further specification**

field activities will be performed at the Argentine stations of Marambio in the Antarctic Peninsula and Belgrano II at the west boarder of the Filchner-Ronne ice shelf

## **Key project deliverables**

1 - radiation components at the surface, including global, diffuse and direct solar radiation, upwelling SW component, LW downwelling and upwelling fluxes, as well as spectral UV radiation.

2 - Cloudiness features, including, on a continuous base, cloud fraction derived both from radiometric measurement and sky camera observations, cloud type and cloud effect on SW radiation, estimate of Cloud radiative forcing (CRF), cloud base from routine observations performed at the station.

3 - From UV spectral measurements derived quantity as columnar ozone and erythemal dose.

All above parameters and evaluated quantities will be carry out at the two Argentine stations of Marambio and Belgrano II

### **Data management**

Acquired data will be stored on site and transmitted on a daily base in Italy for backup and analysis. We can use in Italy support of Italian Arctic Data Center or support of other projects dedicated by PNRA to secure data flow of Italian endorsed projects to YOPP data portal.

We will discuss with YOPP Data management team modalities and best solutions to provide data as soon as possible to YOPP community, in particular the part engaged in perform modeling simulations and experiments.

### **Is data provided to WMO Global Telecommunication System**

No

### **Real-time provision**

1-2 days for radiation products to YOPP community  
weekly basis for cloud products

### **Other information**

Dead line of PNRA call for proposal is July 3. So, if the case, we should have at disposal YOPP endorsement for the end of June