Italian Contribution to YOPP-SH

Funded activities in the frame of the Italian Antarctic Programme (PNRA)

Vito Vitale (ISAC-CNR) on behalf of PNRA community
# YOPP Related Activities in the Frame of PNRA

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<td>Meteorology</td>
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<td>2015/ AZ3.02</td>
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<td>Antarctic Precipitation Properties from ground-based instruments (APP)</td>
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- FUNDED AND PLANNING TO DO MORE during YOPP
- ENDORSED by YOPP
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• 15 Automatic Weather Stations (6 WMO, 12 ARGOS, 2 IRIDIUM)
• 1 Snow drift station (Driftometer) and 4 snow depth sensors
• 2 Radiosounding stations
• 12 airstrip weather stations
ITALIAN ANTARCTIC METEO-CLIMATOLOGICAL OBSERVATORY

IAMCO contribution to YOPP:

- IN COLLABORATION WITH UTA FROM 2 TO 3 RADIOSOUNDINGS PER DAY AT MZS AND FROM 1 TO 2 AT CONCORDIA, DURING S.O.P. CAMPAIGN.
- INSTALLATION OF 2 NEW VAISALA CL51 Cелиometers AT MZS AND CONCORDIA.

IAMCO DATA AVAILABILITY:

Grigioni, et al., 2019, Radiosonde and AWS data from Italian Antarctic Meteo-Climatological Observatory during Southern Hemisphere YOPP Special Observing Period,
https://doi.pangaea.de/10.1594/PANGAEA.899643

IAMCO WEB SITE

AWS transported by elicoper (ZORAIDA, 1986)
A JOINT EFFORT

TERRA NOVA HUB

MZS

JBO

Concordia

PNRA 200+ extra-soundings
KOPRI ~ 100 extra-soundings

3 soundings/day (1 extra)

1 extra-sounding/day

2 soundings/day (1 extra)

4 soundings/day (3 extra)

2 soundings/day (1 extra)

4 soundings/day at TNB e CONCORDIA
Accurate Surface Fluxes Measurements of Solar and Thermal Radiation (BSRN) at Dome Concordia

BSRN: Baseline Surface Radiation network

Is a global observatory network providing observations of the best possible quality for short and long-wave surface radiation fluxes in 1 min resolution.

The WRMC is the central archive for all data from the BSRN, since 2008 operated at the Alfred-Wegener Institut in Germany.
Year of Polar Prediction in the Southern Hemisphere (YOPP-SH#4)

Downtown Marriott Hotel, Charleston, June 27-28, 2019, SC, USA

NSF tower LR0330 at 30 meter

Astroconcordia LR0100 and SPN1 backup solution

Albedo Rack LR0300
Clouds effects over the Plateau

Cloudiness produces a negative effect ranging between $-5$ and $-30$ Wm$^{-2}$

The effects appears on average ranging between $+10$ and $+30$ Wm$^{-2}$
THE QA/QC DATASET collected during the SOP period

The BSRN Concordia Station:

ANTARCTIC YOPP SOP

variable
- SWD
- DIR
- DIF
- SWU

variable
- LWD
- LWU

Year of Polar Prediction in the Southern Hemisphere (YOPP-SH#4)
Downtown Marriott Hotel, Charleston, June, 27-28, 2019, SC, USA
Antarctic Precipitation Properties from ground-based instruments (APP)

Estimation of a site specific radar reflectivity-snowfall rate relationship and precipitated quantity.

Investigation on precipitation properties using disdrometer measurements and simulations obtained by DDA and e.m. models (T-matrix).

Comparison between estimated snowfall quantities and model outputs (AMPS and OBJECTIVES

Aims to improve the knowledge on the snow precipitation and particularly understand processes related to the Surface Mass Balance over a coastal area of Antarctica using multidisciplinary methodology.

INSTRUMENTS

- 2 Metek Micro Rain Radar (MRR)
- 2 OTT Parsivel (P1) laser disdrometer
- MPS weighting pluviometer

Mario Zucchelli (MZS)
New instruments were installed for the solid precipitation retrieval during Southern Hemisphere YOPP S.O.P. in order to improve the snowfall estimation in the Terra Nova Bay area.

Sampling of radar reflectivity profiles at different height resolutions with two MRR METEK radars; mean precipitation quantities with MPS weighting pluviometer.

Open data sharing: collected data will be made public in specific open database (PANGEA) after the validation (October–November 2019).

Scarchilli et al., submitted to Atmos. Res.
Surface-Atmosphere Mass and Energy Exchanges at a Coastal Antarctic site (SAMEECA)

 Improve understanding of the surface-atmosphere mass and energy exchanges at an Antarctic coastal site in the Ross Sea through continuous accurate measurements and development/verification of multiscale modelling.

Measurement and analysis of radiation components, atmospheric constituents and energy fluxes, meteorological and micrometeorological parameters, will be implemented jointly by KOPRI, CNR and UNIFI, in a way similar to the collaboration already active in the Arctic.

The project will move along three research lines:
(1) atmospheric boundary layer (ABL) dynamics and surface-atmosphere interaction;
(2) radiative regimes;
(3) processes determining atmospheric composition (aerosol and trace gases).
During January 2019 the following instrumentation was installed in Jang Bogo Station:
• CIMEL CE318 sun-photometer (columnar AOD)
• SPN1 radiometer (total and diffuse SW radiation)
• PM2.5 aerosol sampler (chemical composition)

The sun-photometer had communication problems with the computer and we got no data during SOP. The other measurements were (and are) running continuously.
Italian moorings in the Ross Sea

Long time-series of oceanographic parameters (T, S, V, Torbidity, Sediment Traps, ....) collected by several projects from 1994 (mainly: CLIMA I-V, Bioseso e Abioclear) and in MORSea after 2009.

Active moorings in 2017

A -> 1990-2008
B -> 1995-present
C -> 1995
D -> 1995-present
F -> 1994-98
G -> 2003-present
H1 -> 1995-2008
H2 -> 2002-05
H3 -> 2005-10
K -> 1996-97
L -> 1998-present
O -> 1999
P -> 2006-07

MORSea
Marine Observatory in the Ross Sea

http://morsea.uniparthenope.it/
XBT observations in the ACC

Positions of main ACC fronts south of New Zealand from XBT data from 1994 to 2015. Black lines indicate the position of the NSAF and the SSAF. White and blue lines show the position of the PF and of the sACCf respectively.

Location of the 28 XBT cruises from 1994 to 2016. Color scale indicates the bathymetry.
Lidar Observatory at Dome C

Scientific activities

- Observation and climatology of Polar Stratospheric Clouds (PSC)
- Observation of cirrus clouds and their correlation with PSC occurrence.
- Routine Temperature measurements
- Comparison with and validation of satellite based lidar observations.
- Comparison between ground and satellite based lidar observations and Chemistry Climate Models (CCM).
The lidar installed in Concordia since 2015 (previously at McMurdo from 1991 till 2010).

Thanks to data acquired in McMurdo, a new classification scheme for the CALIOP data has been implemented (Snels et. al., Atmos. Chem. Phys., 19, 955–972, 2019)

Figure 3. The PSC vertical distribution for the 2006 winter as a fraction of the total observations for the four PSC classes (orange denotes STS, green denotes NAT mixtures, red denotes enhanced NAT mixtures and blue denotes ice), the two columns indicate the months of July and August (from left to right). (a) CALIOP v2 product. (b) Ground-based lidar at McMurdo.

Figure 4. Fraction of PSC observations in 2006–2010 centered at McMurdo (calculated as the ratio of the number of data points for each PSC class and the total number of data points) as a function of the difference between the temperature and the equilibrium temperature for NAT. PSC classes are reported in different colors. The purple line indicates the total number of observations (in arbitrary units) at a specific temperature.
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Waves in the MIZ. Modeling and satellite observations

G. DE CAROLIS (IREA – CNR)

MAIN TARGETS: sea ice - gravity waves - models for waves-in-ice

- No significative evidence during SOP of newly formed frazil/grease/pancake ice.

- 29 CosmoSkyMed SAR image acquisitions in the Weddell Sea from 21.03 to 13.05:
  - 6 in March
  - 10 in April
  - 13 in May

- SAR imagery analysis is in progress.

- In the next slide: preliminary SAR sea ice thickness retrievals compared with SMOS thickness estimates.
Preliminary results on sea ice thickness retrieval

Antarctica - Weddell Sea,
March, 30 2019

CosmoSkyMed - satellite 4
Wide Region mode - X-VV
YOPP acquisition

CSK SAR: 6.05 ± 1.87 cm
SMOS (BRE): 4.65 ± 1.49 cm
SMOS (HAM): N/A
GLOBO is a grid-point hydrostatic general circulation model on a uniform mesh in geographic coordinates on the sphere. It shares with BOLAM the equations for the dynamical component and the physical parameterizations. At present GLOBO is run with 1538 x 1026 grid points, implying a grid distance of 19 km in mid-latitudes, and with 60 atmospheric levels and 7 soil levels. An ensemble of lower-resolution GLOBO forecasts is also employed to obtain an experimental probabilistic (ensemble) monthly prediction issued once per week (only N.H. now).
Specific activities of interest for polar regions: a new robust numerical parameterization scheme to represent snow coverage in terms of a dynamic multi-layer element (simulation of snow albedo as well as of snow temperature and density at different depth) (POCHVA)
Ground-based Water Vapor retrieval from GNSS stations over Polar regions

M. NEGUSINI (INAF-IRA)

GNSS for analysis: a global network of about 200 stations

- VLNDEF (ftp://ftp.ira.inaf.it/pub/ogia/)
- POLENET (ftp://data-out.unavco.org/pub/rinex/obs/)
- IGS (ftp://igs.ensg.ign.fr/pub/igs/data/)

20 years of continuous data (1 epoch/30 s)

100+ global sites + ~ 75 Antarctic GPS

16 GNSS stations co-located with RS (5 in Antarctica)

in Antarctica 20 GNSS station with surface meteo information (RINEX file)
selected in Antarctica:
WV retrieval: a matter of analysis

\[ ZTD = ZHD + ZWD; \quad ZHD = ZHD (\varphi, \lambda, t, h) \]

\[ TD = mH_{VMF1} \cdot HD + mW_{VMF1} \cdot WD \]

\[ ZWD \Rightarrow PW \text{ using } T_m \text{ derived by RS} \]

\[ T_m = \frac{\int \left( \frac{p_v}{T} \right) dz}{\int \left( \frac{p_v}{T^2} \right) dz} \]

\[ \Pi = \frac{10^6}{\rho R_v \left[ \left( k_1/T_m \right) + k_2^' \right]} \]

If RS not available, \( T_m \) obtained by ERA-Interim model
Year of Polar Prediction in the Southern Hemisphere (YOPP-SH#4)
Downtown Marriott Hotel, Charleston, June, 27-28, 2019, SC, USA
Data Acquired during SOP by Antarctic and Arctic stations will be analysed to determine PW.

Meteo parameters on Antarctic stations providing them will be also collected.

Potential contribution for a winter SOP.
Figura 2. Interfaccia d’interoperabilità tra il Common Node e i Nodi di I Livello
Thank you for your attention