The overall Italian contribution to YOPP-SH activities

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

Vito Vitale (ISAC-CNR) on behalf of Italian community involved in YOPP-SH
MARKED RED – Italian PI
MARKED GREEN – Relevant Italian participation
YOPP-SH related activities in the frame of PNRA

- 10 endorsed projects (1 the Arctic), 8 of them supported by PNRA
- 5 of the 8 projects funded through a dedicated call
- 1 educational project CAPIRE-YOPP
- large extra sounding activities both during SUMMER and WINTER SOP (thanks international cooperation); additional contrib. From not endorsed projects

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>LEAD(S)</th>
<th>TITLE</th>
<th>TOPIC(S)</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>OSS-06 Angelo LUPI</td>
<td>Accurate surface fluxes measurements of solar and thermal radiation at the plateau Station Concordia (BSRN site)</td>
<td>Radiation (SW, LW, UV), Clouds radiative effects</td>
<td>FUNDED since 2016 (extra activities)</td>
</tr>
<tr>
<td>4</td>
<td>2015/ AZ3.02 Nicoletta ROBERTO</td>
<td>Antarctic Precipitation Properties from ground-based instruments (APP)</td>
<td>precipitation</td>
<td>FUNDED since 2016</td>
</tr>
<tr>
<td>5</td>
<td>OSS-12 Marcel SNELS</td>
<td>Lidar Observatory at Concordia (LOC)</td>
<td>Polar stratospheric clouds</td>
<td>FUNDED since 2016</td>
</tr>
<tr>
<td>6</td>
<td>OSS-13 Giorgio BUDILLON</td>
<td>Marine Observatory in the Ross Sea (MORSea)</td>
<td>Physical oceanography</td>
<td>FUNDED since 2016</td>
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</tbody>
</table>

- a large coordinate project for WINTER SOP funded, integrating research activities carried out yet by 5 observatories and in the frame of 7 PNRA projects to improve knowledge on water budget and precipitation
## Projects funded through the 2018 dedicated call

<table>
<thead>
<tr>
<th>PI</th>
<th>Title</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vito Vitale - CNR</td>
<td>RadiCA - Radiation fluxes and cloud features from surface-based observations in the Antarctic Peninsula and Weddell Sea Region</td>
<td>radiation budget and its components - cloudiness features - spectral UV fluxes at surface and ozone - Antarctic Peninsula</td>
</tr>
<tr>
<td>Giacomo De Carolis - CNR</td>
<td>WAMIZ - Waves in the MIZ. Modeling and satellite observations</td>
<td>sea ice - gravity waves - synthetic aperture radar - models for waves-in-ice - SAR data</td>
</tr>
<tr>
<td>Pace Giandomenico - ENEA</td>
<td>CLARA2 - CLouds And Radiation in the Arctic and Antarctica</td>
<td>Polar Clouds - Radiative budget - Satellite observations - Microwave profiler</td>
</tr>
<tr>
<td>Davide Zanchettin - UniVE</td>
<td>IPSODES- Investigating the predictability of the Southern Ocean dynamics through ensemble simulation hindcasts</td>
<td>Antarctic circumpolar current - ocean circulation models - ensemble simulations</td>
</tr>
<tr>
<td>Doroteaciro IOVINO - CMCC</td>
<td>INVASI- INterannual Variability of the Antarctic Sea Ice/ocean system from ocean reanalyses</td>
<td>Antarctic sea ice variability - sea-ice/ocean interplay - ocean reanalyses - eddying resolution - prediction capability</td>
</tr>
</tbody>
</table>
1 - Specific line devoted to YOPP was included in the 2018 PNRA call. Projects who aimed for PRNA funding were required to receive formal YOPP endorsement prior to their proposal submission.

2 – ENEA supported during SUMMER SOP 2018-2019 extra soundings. More than 100 extra-soundings were launched from Mario Zucchelli and Concordia stations by personnel of the Meteo Observatory (RMO) and winter overs. These activities where also coordinated with the similar activities carried out by the KOPRI colleagues at the Jan BoGo station;

3 – CNR and BICOCCA UNIVERSITY (Milan) promoted a large Educational activity, CAPIRE-YOPP, in connection with the Summer SOP, involving about 400 students from intermediate and high school. CAPIRE-YOPP also supported extra soundings (about 30) at Concordia station;

4 – being a PNRA call for project not open, contribution to WINTER SOP was organized through the special support to a dedicated large project aiming to (i) better sustain winter ground-based activities during YOPP campaign and (ii) provide resources for extra soundings that time planned at three stations: Jan BoGo (TNB area - in cooperation with KOPRI), Concordia, Marambio (in cooperation with IAA and SMN);

5 – the National Antarctic Data Centre (NADC) is engaged to provide support for metadata and datasets and make concrete the bridge with the YOPP-SH Data management system. This activity and contribution can be quite relevant in relation to YOPP-SH legacy.
Extra-soundings during SUMMER SOP

- **TERRA NOVA HUB**
  - **MZS**
  - **JBO**
  - **Concordia**

  - **3 soundings/day (1 extra)**
  - **1 extra-sounding/day**
  - **2 soundings/day (1 extra)**
  - **4 soundings/day (3 extra)**
  - **2 soundings/day (1 extra)**

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

- **4 soundings/day at TNB e CONCORDIA**
Extra sounding during WINTER SOP (and beyond)

**TERRA NOVA BAY**
- **JBOgo**
  - up to 30 lunches with SLWC sondes
  - up to 25 extra-soundings
  - thanks to KOPRI

**Concordia**
- up to 30 lunches with SLWC sondes
- up to 25 extra-soundings

**Marambio**
- up to 40 lunches with SLWC sondes
- thanks to IAA

During summer 2021-2022 up to 10 SLWC sondes will be lunched when weather conditions are are the most suitable for the scientific purposes of the project. During summer 2022-2023 a similar of higher number of sondes will be at disposal at Concordia and Terra Nova Bay.
**Motivation**

CAPIRE is the acronym of the Italian title of the project “Comprendere IA PrevIsione meteoRologica in antartidE sostenendo YOPP” - Understand Antarctic weather forecast sustaining YOPP.

Promote an educational activity, based on a concrete connection of high school students with researchers involved in YOPP.

Use data collected in Antarctica (and the corresponding interest of students for) as a strong base to build a wide educational activity, articulate in different way depending on the level of knowledge of involved students.

**Approach**

- include students over a wide range of ages and skills
- actively involve teachers in identify and develop tools to bring students closer to YOPP targets and topics
- provide a concrete contribution to YOPP goals and research activity
Participation/Involvement

7 schools
(1 primary)
(1 intermediate)
(5 high-school)

17 classes

18 school teachers

340 students

age from 10 to 16 years old

high-schools organized in 20+ groups

primary and intermediate individual work

3 meteorologists from meteo AM service with Antarctic experience

4 researchers from UNI Bicocca, CNR, ENEA
Implementation

**In Antarctica:**
- Support 30 extra-sounding with a well defined research strategy/target
- Personalize lunches involving the youngest students
- Meet by virtual meeting people on field and dialogue with them

**In Italy:**
- Organize a lunching event (November 27)
- Organize the work to personalize lunching (best drawing competition)
- Connect with people on field (January 14)
- January to April organize seminars and visits to AM operation center in Milan (Linate) as well as to the ICE core laboratory in UNI Bicocca.
- Develop home work at individual or group level along classes
- Organize a final event where to reward the best products and leave a reminder to all students
Tools to keep engaged

• Events and connection with Antarctica
• Visits laboratories and meteo operational centers
• Classical seminars with different content/scope depending from student age
• Drowing competition (winners on sounding balloons)
• Compose small poems on meteorology
• Create artistic products (for example dioramas) or technical (orthogonal projections)
• Relize multi-media products
• Analyze data and present results

Starting ideas proposed on the base of the long experience of a successfull activity developed in Bologna – LINGUAGGIO DELLA RICERCA - http://www.bo.cnr.it/linguaggiodellaricerca/

Ideas in any case further developed and enriched by Teachers
Legacy – A memory of participation

To any participant, students, teachers, Meteorologists a memory of the project.

To competition winners (about 50) a copy of

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Legacy - Communication

A BLOG

https://volarebeyondyopp.blogspot.com/

press articles


photos and video
among the science objectives planned for Winter Special Observing Period, precipitation and water budget are of high relevance

scientific topics are expected to be addressed with a regional approach

Italian contribution to YOPP-SH summer SOP 2018-2019 included several activities related to these issues

in particular, comprehensive analysis of the water budget over the Dome C (Concordia, Antarctica) were performed thanks to a cooperation of Italian and French groups (Ricaud et al., ACP, 2020)

with this in mind, we discussed and elaborate a plan to further develop research activity on these topics.

Project pillars are:
(i) develop the activity from austral summer 2021-22 to austral summer 2022-23, also thanks a strong cooperation
(ii) gain the regional perspective coordinating activities at TNB and Concordia and connecting Victoria Land with the Peninsula
(iii) accomplishing science goals through a better integration of ongoing ground-based measurements and extra vertical profiles
Ground-based Activities at Concordia

- The Water Budget over Dome C (H2O-DC) project integrated observations of the HAMSTRAD Micro-wave radiometer, a tropospheric depolarization lidar, BSRN radiometers, and radiosondes launched twice per day during YOPP-SH SOP, to (1) detect the presence of SLW clouds, (2) analyse the formation and evolution of such SLW clouds, and (3) estimate the radiative impact of SLW clouds.

- With the aim to increase datasets for analysis and extend science targets, several other activities beneficial for clouds observation and water budget analysis will be integrated:
  (I) a second depolarization lidar will extend the vertical range up to the stratosphere
  (II) a Micro Rain Radar (MRR2 - Metek) will provide some information on precipitation quantities and the vertical structure of precipitating or non-precipitating clouds in the low troposphere
  (III) a disdrometer and precipitation gauges will provide an independent measure of precipitation quantities and estimation of particle size distribution at ground.
  (IV) precipitation samples will be collected using a wooden platform covered by a polystyrene/Teflon plate standing 1 m above the snow surface and a tablet placed on the snow surface. Precipitated crystal typology and isotopic analysis will be performed.

- Integrated Water Vapour (IWV) will be evaluated from all soundings and cloud coverage, radiative forcing estimated from radiation measurements.

Datasets and results will be compared with weather model output, namely ERA5, ARPEGE, and PolarWRF, thanks cooperation with French colleagues. They will develop a Supercooled Liquid Water Cloud (SLW-CLOUD) project in summer 2021-22 and 2022-23
Ground-based Activities at Terra Nova Bay

- Two MRRs operate with different vertical profile extension and resolution, to identify the vertical structure of TNB precipitating clouds.
- Laser disdrometers (OOT Parsivel P1) allow to assess particle size distribution. Synergy with MRRs allows the development of reliable particle classification methods.
- Instrumental setup is planned to be improved: (a) the weighing snow gauge will be upgraded for stand-alone winter measurements. (b) A new affordable video disdrometer will provide information on shape and volume of hydrometeors in addition to size and fall velocities collected by laser disdrometers.
- Cooperation with KOPRI will help not only to carry out extra-sounding during winter SOP, but also will bring in: (i) radiation fluxes measured by the BSRB candidate station jointly implemented in Jang Bogo (ii) Measurements by celiometers and rain, snow gauges.
A network of more than 70 GNSS permanent stations located in the Antarctica can be used to retrieve Integrated Water Vapor (IWV).

- ~ 10 GNSS stations co-located with RS
- 20 GNSS station with surface meteo information (RINEX file)

Daily observations are processed using the Bernese GNSS software using a double-difference approach. Very accurate time series of hourly Zenith Wet Delay (ZWD) are estimated through a very cautious approach, taking into account many source of error. ZWD can be converted into Precipitable Water (PW).
Data Acquired during winter SOP by Antarctic and Arctic stations will be analysed to determine PW with a very high time resolution and continue temporal coverage on a regional scale and along a transect connecting Ross Sea to the Peninsula.

When at disposal, meteo parameters will be also collected and put a disposal.

The whole dataset from 1998-99 will provide an historical perspective and help to identify changes.
PNRA web portal

Metadata catalog

Data Management and NADC

Metadata information and link to data

YOPP-SH related metadata
Thank you for your attention