IEEE Technical Activities Board Ad-hoc Committee: IEEE In the North and South Poles (INSP)

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What is the IEEE?

A GEO Participating Organization since 2005

- Largest Technical Professional Society in the World
  - More than 417,000 members in over 160 countries, more than 50% of whom are from outside the United States
  - Has 39 technical Societies and seven technical councils
- Has produced over 1,300 active standards
- Publishes ~ 200 transactions, journals, and magazines
- Sponsored >1,800 conferences in 98 countries in 2017

Dedicated to advancing technology for the benefit of humanity
The Earth’s Polar Regions

Size of Polar Antarctica
Including all islands and ice shelves, Antarctica covers 13,661,000 km².

Size of Polar Arctic
The area can be defined as north of the Arctic Circle (66° 33’N)

Areas defined by
- geography,
- weather,
- climate,
- population,
- culture,
- history, and
- resources.

Polar Sea Ice Monitoring

<table>
<thead>
<tr>
<th>Variable</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea ice thickness</td>
<td>25 km horizontal resolution, 24 h revisit time, 10 cm accuracy</td>
</tr>
<tr>
<td>Sea ice type</td>
<td>10 km horizontal resolution, 3 h revisit time, 0.25 / Classes</td>
</tr>
<tr>
<td>Sea ice cover</td>
<td>12 km horizontal resolution, 3 h revisit time, 5% accuracy</td>
</tr>
<tr>
<td>Sea ice surface temperature</td>
<td>5 km horizontal resolution, 3 h revisit time, 0.1 K accuracy</td>
</tr>
<tr>
<td>Sea ice motion</td>
<td>25 km horizontal resolution, 3 h revisit time, 1 km / day</td>
</tr>
<tr>
<td>Ocean imagery and water leaving radiance</td>
<td>4 km horizontal resolution, 24 h revisit time</td>
</tr>
</tbody>
</table>
Rapid Changes in the North and South Poles

- Arctic ice coverage declining at substantial rate in the past 39 years.
- Antarctic sea ice coverage increasing slightly, but climate drivers are much different than for the Arctic.
- Sea ice extent in both polar regions continues to be well below typical values for the past several decades.

Increased Ice Sheet Mass Losses and Sea Level Rise

- Combined
- Greenland
- Antarctica

Sea level contribution (mm)

- 1987
- 1992
- 1997
- 2002
- 2007
- 2012

0.27 mm per yr

0.95 mm per year
Gaps in the Observing Systems

Polar data coverage of conventional observations in the ECMWF operational analysis on a particular winter day

Filling the Gaps - Observations and Modeling

WMO 2016 Executive Council Decision on YOPP

- Increasing the frequency of routine synoptic and radiosonde observations;
- Provide logistical support to planned field campaign activities;
- Promote possible additional observations;
- Provide access to remote-sensing observations over and near the Polar Regions;

Promote cooperative international research enabling development of improved weather and environmental prediction services for the polar regions, on time scales from hourly to seasonal.
CryoSMOS - Estimation of Internal Ice-sheet Temperatures

IEEE Ad Hoc committee composition

INSP: Includes these IEEE Societies & Councils

- IEEE Education Society
- IEEE Society on Social Implications of Technology
- IEEE Aerospace and Electronic Systems Society
- IEEE Geoscience and Remote Sensing Society
- IEEE Intelligent Transportation Systems Society
- IEEE Oceanic Engineering Society
- IEEE Vehicular Technology Society
- IEEE Power and Energy Society
- Sensors and Nanotechnology Councils
IEEE in the North and South Poles – INSP Objectives

1. Meet external organizations presently active in both the North and South poles, to better understand the challenges and issues they face, and the role that IEEE can play.
2. Define how to involve other IEEE OUs, transforming the topic into an IEEE-wide self-sustainable initiative: new Community of IEEE members.
3. Deliver a proposal to best partner with existing research groups to contribute to existing activities, and how IEEE can forge new and appropriate opportunities of support.

IEEE in the North and South Poles - INSP Current Drivers

1. New in-situ and remote sensors or networks of sensors,
2. Communications and data from EO sensors for processing and application,
3. communication and Transportation issues of local communities,
4. Climate change and ecological issues associated to an increased human presence in a, so far, pristine environment, and
5. Education and research on the changes that these regions are undergoing and associated engineering challenges.
IEEE in the North and South Poles - INSP Current Initiatives

InuCube Initiative

- Multi-society CubeSat to study atmospheric parameters. Impacting the cryosphere (e.g. "black carbon")
- Limited accuracy may prevent real science, but educational and outreach impact can be significant
- Application for a “free” launch
- Include as priority working with countries with no current access to space
Young Professional in Space – “Sat bootcamp”

- Build a high altitude weather balloon from commercial off-the-shelf parts
- Launch the balloon, track it, and recover the payload.
- This program will be developed to be deployed in YPINSPECE.
- IEEE provides curriculum, content, experiments, equipment, kits and components as a customizable educational bootcamp of 2 to 4 days spanning a total of 20 - 32 hours.

GRSS Student Grand Challenge: drone-based EO & App

- The proposal consists of the design and implementation of an end-to-end observing system to address a problem linked to the observation of the "POLAR" regions.
- 2 teams will be selected
- These teams will each receive a research grant to develop the Project
- At least one of the team must have a demonstrated experience in the field, and will act as coordinator.
- Participation of a University or company mentor and/or sponsor is welcome.
IEEE DataPort

- Like IEEEXplore for data sets
- DoI assigned
- Can be cited in publications


IEEE Section Congress – Sydney, August, 2017

GLOBAL CHANGE IN THE POLAR REGIONS

Promoting IEEE contributions through instrumentation, technical, scientific and educational support to Arctic and Antarctic Agencies and Organisations.

'IEEE should play a role in the activities and challenges that take place in polar regions'
IEEE - Antarctic and Southern Oceans Forum 2018

“The need for technology transfer in the Southern Ocean is particularly clear, where scientists can benefit from new sensors and platforms, while engineers can benefit from complex design requirements”.

“The Southern Ocean community needs to meet more often with the IEEE community. This can be done through cross-invitation to meetings and with inclusion of inter-disciplinary sessions at reciprocal events”. Damien Guihen University of Tasmania.

HiMAC2018 - Observations and Understanding of Changes in High Mountain and Cold Regions

Earth Three Poles are the most sensitive regions to the global temperature and its induced environmental changes, and then it influences the human activities and modulates the societal developments and Benefits. The sound Big Earth Data and new Frontier Technology are much required, the planetary data management, algorithm and tools to support and address the sustainable development.

Academician, Prof Guo Huadong, RADI-CAS

The HiMAC2018 unities research in Earth’s cold regions. The new satellite system are needed for filling the Arctic and High Asia monitoring, and data/variables supporting.

FMI, Finland
Thanks

Inputs, contributions, and participation are welcome!

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