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**PSTG Strategic Plan 2015-2018 (Draft):  
Summary of Strategic Priorities based on  
User Requirements**

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# *Scientific Foci of PSTG*

- The list of priority is based on key science requirements and grand challenges identified by authoritative polar science and application stakeholder groups (i.e. WCRP, EC-PORS, GCW and related forums):
  - Sea ice mass balance and mass variability
  - Ice sheet, ice caps and glacier mass balance contribution to sea level
  - Freshwater budget closure at high latitudes (snow and permafrost impact on polar hydrological cycle)
  - Circumpolar changes in permafrost and terrestrial biosphere (consequences for carbon and hydrological cycles)
  - Polar atmospheric products to facilitate improved NWP
  - Cryospheric forcing of atmospheric chemistry in polar atmosphere (surface/troposphere, and troposphere/stratosphere coupling)
  - Ecosystem response to cryospheric variability and change
  - Identifying opportunities for new integrated applications of polar satellite data in response to emerging socio-economic issues .



# *Strategic Priorities 2015-2018: Permafrost*

For addressing the scientific requirements for studying permafrost and related parameters (Bartsch and others, 2014), to:

- Establish coordination and acquisition planning needed to achieve routine high-resolution circumpolar coverage for monitoring variability in carbon pools
- Establish multi-sensor monitoring around key research locations where GTN-P and in-situ measurements are made (“cold spots”) (supplement existing T-SAR-X acquisitions; Bi-weekly InSAR for permafrost modeling)
- Obtain <1m summer (July-Aug) optical images around each Arctic Cold Spot for up-scaling/downscaling of local periglacial processes
- Quantify rates of pan Arctic coastal erosion (Annual circumpolar Arctic coastline mapping at < 10m optical resolution; InSAR estimates of erosion/degradation)
- Establish SAR monitoring of Arctic permafrost transects on routine basis to supplement existing 30-300m pan-Arctic multispectral imaging (Antarctic Peninsula covered by sea ice requirements)



# *Strategic Priorities 2015-2018: Permafrost (cont'd)*

- Derive SAR DEM and custom land surface classification map suitable for permafrost community needs
- Use snow extent/snow-water equivalent (SWE), frost depth, soil moisture, and Land Surface Temperature (LST), products developed elsewhere.



# *Strategic Priorities 2015-2018: Floating Ice*

For addressing the scientific requirements for studying floating ice and related parameters (Falkingham and others, 2014), to:

- Establish a multi-agency plan for acquiring contiguous (seamless) six days repeat pan-Arctic SAR imaging at consistent polarization combination (with view to expanding to an intermediate goal of less than three days repeat in future with right-looking Sentinel-1 (S-1), RADARSAT Constellation Mission (RCM), etc.; and subsequently sub-daily data with C-, X-, S-, L-band SAR combined data sources)
- Establish Arctic Tundra lakes and river monitoring sites, as extension of sea ice coverage.
- Assure continuity in all-weather ice concentration, extent, motion and thickness data in support of the sea ice climate data time to secure the sea ice Essential Climate Variable (GCOS, 2010)
- Coordinate with field campaigns, ice camps and drifting buoys to maximise synergies and product validation possibilities (and uncertainty estimates).



# *Strategic Priorities 2015-2018: Snow*

For addressing the scientific requirements for studying terrestrial snow, snow melt and related parameters (Luoju and others, 2014, and Small and others, 2014), to:

- Assure continuity in routine continental scale monitoring of snow areal extent and SWE data in support of GCW Snow Watch and snow applications and service development
- Plan SAR data as complement to passive microwave and 300m optical data for continental scale snow extent/SWE – and in Alpine regions and rugged topography where other methods fail
- Establish less than three day repeat SAR monitoring (ascending/descending combinations) of European Alpine region and other selected mountain regions (Scandinavia, Canadian Pacific mountains) during seasonally-limited snow melt time window
- Establish common polarization/mode observation strategy between SAR missions
- Demonstrate routine snow melt data processing
- Pilot a snow melt service (seasonal snow melt/runoff/hydropower/water resource availability)
- Expand temporal/spatial revisit to operationalize services.



# *Strategic Priorities 2015-2018: Snow (cont'd)*

For addressing the scientific requirements for freshwater budget and reducing uncertainties in solid precipitation and mass balance in the polar regions, to:

- Develop new methods for snow depth retrievals on sea ice
- Develop snow product intercomparison exercise in connection with GCW CryoNet to assure product validation, and quality assurance (via member engagement in activities such as SnowPEX)



# *Strategic Priorities 2015-2018: Ice Sheets, Ice Caps and Glaciers*

For addressing the scientific requirements for ice sheets and ice caps (Scheuchl and others, 2013), to:

- Follow through the coordinated acquisition plan of SAR/InSAR imagery over Antarctica and Greenland, initiated in 2013 ([SAR CWG, 2013](#)).
- To extend Ice Sheet Mass Balance Intercomparison Exercise (IMBIE) beyond 2009, to reduce uncertainties in ice sheet mass balance and to reconcile altimetry, SAR and gravimetric ice sheet mass balance estimates
- To provide complementary data on ice sheet surface accumulation and albedo
- To secure continuity in gravimetry data for mass change estimates
- To develop SAR altimeter swath mapping capability and products.





# *Strategic Priorities 2015-2018: Ice Sheets, Ice Caps and Glaciers (cont'd)*

For addressing the scientific requirements for glaciers and ice caps, to:

- To extend optical imaging and stereo image data for generation of digital elevation models, glacier and ice cap outlines and hypsometry
- To investigate capabilities of SAR altimetry over mountain glaciers and ice caps.



# *Strategic Priorities 2015-2018: Atmosphere*

For addressing the scientific requirements for improved understanding of the polar atmosphere, and cryosphere–atmosphere coupling, to:

- Expand the reception of polar winds at direct broadcast sites in the Arctic and Antarctic, both in terms of number of sites and types of data used
- Establish satellite Doppler wind lidar profiling capability
- Coordinate availability of satellite-based products from all sources to initialise and validate NWP models in Polar Regions (e.g., on sea ice extent and thickness, snow mass, surface temperature, polar winds)
- Monitor polar atmospheric composition (aerosols and trace gases such as ozone, methane and carbon dioxide) to understand impact of permafrost degradation and critical feedbacks.



# *Strategic Priorities 2015-2018: Polar Prediction*

- During the period of this strategy (2015-2018), a basic pan-Arctic observing strategy shall be developed to secure routine, regular, and robust year-round all-weather active microwave acquisitions at resolutions greater than 50m, complemented by seasonal cloud-free coverage using Vis/IR optical systems. Routine, daily pan Arctic coverage is needed to characterise the dynamic and thermodynamic processes governing sea-ice, snow and permafrost variability.
- These plans shall be established to support the Year of Polar Prediction (YOPP) in the mid 2017-mid 2018 timeframe, in order to improve polar prediction capability. As part of this effort, plans are being developed for a comprehensive set of complementary multi-scale satellite and airborne remote sensing measurements of the atmosphere and surface in support of the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAIC: [www.mosaicobservatory.org](http://www.mosaicobservatory.org)).



# *Strategic Priorities 2015-2018: Polar Prediction (con'd)*

- Satellite observations performed during YOPP in conjunction with MOSAiC will support an improved and integrated process understanding of the atmosphere-ice-ocean systems that impacts the sea-ice mass and energy budgets. Meanwhile, the planned in-situ observations together with aircraft campaigns (e.g. Operation Ice Bridge and CryoVEx) and satellite systems would provide critical information with which to facilitate improved modelling of the sea ice, weather and Arctic climate system.
- PSTG shall furthermore:
  - Review of the planned missions;
  - Evaluate where critical gaps exist in the polar and cryosphere observing system, particularly in relation to observing network initiatives such as the SAON and SOOS;
  - Assessing the impact of the satellite data sets in YOPP model data assimilation and in relation to improving predictive skill;
  - PSTG shall, and to bring the gaps in the observing system to the attention of space agencies in CEOS and CGMS.





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# Thank you for your attention

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