Polar Space Task Group
Status Report

Peng Zhang (CMA) and Mark Drinkwater (ESA)
on behalf of Polar Space Task Group

Lanzhou, China,
13-14 March, 2013
Contents

- PSTG status
- Observation Highlights
- New & Forthcoming satellites
- CMA polar contributions (to be discussed separately)
- Considerations for EC-PORS
• PSTG established in 2011 under auspices of WMO Exec Council Panel of Experts on Polar Observations, Research and Services
• PSTG comprises members nominated by Heads of Space Agencies, upon invitation by WMO Secretary General;
• Objectives:
  ▪ to contribute to acquisition and distribution of fundamental cryosphere satellite datasets
  ▪ to provide support to development of specific derived products required for cryospheric scientific research and applications
• Actively seek realisation of benefits from the growing constellation of polar orbiting satellites, by mobilising the unique and complementary capabilities of each of the respective participating Agencies, in response to the Polar science priorities
• Secretariat provided by WMO
Collaborative Approach of the PSTG

- Review and understand cryosphere and polar scientific requirements;
- Establish a balanced implementation strategy covering atmosphere, ocean and terrestrial domains;
- Develop a set of key strategic goals and translate them into observational requirements;
- Commitment to support data acquisition, and support for product development and establishment of relevant accompanying scientific studies, as appropriate for the Agency;
- Identify gaps in the existing observation capabilities and formulate recommendations for future satellite missions
Recent Activities

- Established Strategic foci as basis for planning
- Implement through annual meetings and alignment of commitments taken through respective Agency programmes
- CEOS SIT: recognise PSTG and formalise communication link to CEOS
- Documented state of art and cryospheric science priorities at ESA-CliC-EGU Cryosphere Conference – ESA ESRIN, Nov 2012
- Established SAR WG for coordinating acquisition planning activities
  - 1st SAR Coordination WG meeting – Nov 2012 (next slides)
- Established basis for periodic reporting to CEOS, CGMS, EC-PORS, CM

Courtesy F. Paul WGMS
Polar Space Task Group

PSTG Potential Areas of Strategic Focus

- Sea and glacial ice mass variability and contribution to sea level and ocean dynamics
- Glacial ice mass balance contribution to sea level
- Polar atmospheric, ocean, cryosphere and terrestrial products to facilitate improved weather, climate and environmental observation, monitoring and prediction
- 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)
- Physical and biological forcing of atmospheric chemistry in polar atmosphere
- Identifying new opportunities for integrated applications in response to emerging socio-economic issues of polar regions
Established to provide coordination across space agencies with SAR missions, to facilitate acquisition and distribution of fundamental SAR satellite datasets, and to contribute to or support development of specific derived products in support of cryospheric scientific research and applications.

The membership of the SAR Coordination Working Group will be as inclusive as possible and will include:

- All SAR Operating Agencies (thematic experts and mission managers);
- Other agencies - to ensure availability of complementary datasets, necessary ground segment and contribution of thematic experts;
- Members of the science community or scientific team leaders responsible for a specific thematic requirement and who want to ensure that their collective needs are addressed;
- Members of the “commercial arm” of SAR missions – under invitation by their public counter-part.
• Frascati – November 12–13, 2012

• Meeting objectives:
  – Discuss and approve the WG terms of reference, governance structure, and defined elements of a workplan for the next 2-3 year horizon;
  – Hold a planning session on the up-coming and urgent activities and requirements, and establish a response strategy (i.e. continued InSAR monitoring of ice sheets for ice velocity and sea level rise modeling, glacier monitoring);
  – Define activities leading to coordinated inter-agency response to priority ice sheet and ice cap monitoring requirements (in relation to sea level)

• Resulted in Coordinated Ice Sheet planning response (see following examples)
Northern Hemisphere ice sheet/ice cap Regions:

- Greenland, Svalbard and Canadian ice caps: from Jan to April 2013 - to be repeated for 2-3 consecutive years with an increasing number of missions

- Plan: 2013-2015
  - Sensors: RADARSAT-1, TerraSAR-X, Cosmo-Skymed, ALOS2*, Sentinel1*
  - Goals:
    - Full interferometric coverage of Greenland – Jan to April
      RADARSAT-1 F1 mode, 3-4 consecutive coverages
    - Full interferometric coverage of Svalbard – Jan to April
      RADARSAT-1 F1 mode, 4 consecutive coverages
    - Regions included in science TanDEM-X first and second global DEM acquisitions
    - X-Band missions dense time series over Greenland and Antarctica fast flowing glaciers
  - NSC provides the reception of the RADARSAT-1 data using the Tromso receiving station
  - NASA provides support to processing and generation of scientific products through the MEaSUREs Program

* according to ALOS2 BOS and S1 HLOP when missions will be commissioned.
Antarctica:

- Phased implementation approach taking into account the availability of Sentinel 1 and ALOS 2 in the coming years.

Plan: 2013
- Sensors: RADARSAT-2, TerraSAR-X, Cosmo-Skymed
- Goals:
  - Interferometric Coverage of Antarctica – April to Sept (visible area for right looking acquisitions) RADARSAT-2 Standard mode, 3 consecutive coverages
  - X-Band missions dense time series over Greenland and Antarctica fast flowing glaciers
  - TanDEM-X Antarctica acquisitions campaign starting with June 2013
- NASA to provide support for the generation of scientific products through the MEaSUREs Program

- Sensors: ALOS 2, Sentinel 1, RADARSAT-2, TerraSAR-X, Cosmo-Skymed
- Goals:
  - Interferometric Coverage of Antarctica – ALOS2 coverages as defined in the BOS, Sentinel 1 coverages as defined in the HLOP, RADARSAT-2 three consecutive coverages in left looking mode to cover the region south of 80 degrees
  - X-Band missions dense time series over Greenland and Antarctica fast flowing glaciers
- NASA has agreed to provide support to the generation of scientific products through the MEaSUREs Program
Northern Sites: Plans

Frames of TerraSAR-X acquisitions over Greenland outlet glaciers, background Radarsat-1 – 22 rapidly changing glaciers since 2009
Antarctica: Plans

Data acquisition & monitoring: (1) TerraSAR-X, south of 80°S

- Reedy
- Van der Veen and Whillans
- Amundsen Scott
- Shackleton
- Beardmore
- Nimrod
- Byrd
- Kamb
- Bindschadler
- McMurdo
- Crary

TerraSAR-X planned left looking acquisitions 2009 – 2011 Transantarctic Mts
2 overall coverages + 3 coverages at the grounding line

Data acquisition & monitoring: (1) TerraSAR-X, south of 80°S

- Recovery Glacier, Filchner-Ronne ice shelf, ascending coverage
- RWB Glacier, previously acquired
- Support Post Ice Stream
- Foundation Ice Stream
- Unknown Glacier

RADARSAT-2 coverage - 2013

RADARSAT-2 coverage for 2014/15
PSTG Summary

• The multi-agency Polar Space Task Group is established on the foundation laid by the IPY Space Task Group
• In absence of any other similar interagency group - PSTG has been re-established to continue to organise and coordinate future earth observing campaigns in support of Polar and Cryospheric science
• PSTG provides essential link between the Science communities and space agencies for articulating coherent, space-based data requirements in support of the operational implementation
• Facilitates more efficient use of space infrastructure in polar regions
Observation Highlights

- See also GlobSnow presentation by FMI
Science Products

High level geophysical products over glacier areas: (1) the position of the grounding line along Transantarctic Mts. with TerraSAR-X

High level geophysical products over areas south of 80°S: (1) TerraSAR-X velocity maps

Perito Moreno glacier velocity field (March 06-14 2009)
Archived Ice Sheet Products resulting from Inter-agency data collection

http://nsidc.org/data/measures/data_summaries.html

- **NSIDC-0525. PI: E. J. Rignot**
  MEaSUREs InSAR-Based Ice Velocity Maps of Central Antarctica: 1997 and 2009

- **NSIDC-0498. PI: E. J. Rignot**
  MEaSUREs Antarctic Grounding Line from Differential Satellite Radar Interferometry

- **NSIDC-0484. PI: E. J. Rignot**
  MEaSUREs InSAR-Based Antarctica Ice Velocity Map

- **NSIDC-0481. PI: I. Joughin**
  MEaSUREs Greenland Ice Velocity: Selected Glacier Site Velocity Maps from InSAR

- **NSIDC-0478. PI: I. Joughin**
  MEaSUREs Greenland Ice Velocity Map from InSAR Data
GlobSnow: Trends in Northern Hem. June Snow Cover Extent & Sea Ice Extent

- 30 year timeseries of June Snow & Sea Ice, and Sept sea ice
- Bold lines denote 5 year running means
- Relative to 1979-2000 baseline, June snow extent declined by 17.6% by contrast to 13% decline in Sept. sea-ice

Courtesy: C. Derksen & R. Brown, Environment Canada
CryoSat: Arctic Sea Ice Thickness Measurements

Time-series of monthly Arctic sea ice volume from ESA’s CryoSat-2 (△) and from PIOMAS model (solid line and ○) for two winter growth periods (October – April).

From Laxon et al (2013) - GRL
New & Forthcoming Missions

• New satellites launched
  – GCOM-W
  – MetOp-B
  – Landsat Data Continuity Mission

• Forthcoming launches:
  – Sentinel-1A (Oct/Nov’13)
  – ALOS-2
  – FY-3C

• Recently approved Programmes
  – RADARSAT Constellation Mission (C-band SAR)
Considerations for EC-PORS

• For EC-PORS to reflect on the progress in engaging PSTG Members and to emphasise current priorities for Task Teams
• For EC-PORS to express any critical needs or strategic priority inputs to forthcoming PSTG3 meeting in May 2013