CryoNET and Japanese contribution

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And

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Possible contribution to GCW from Japan

– A country with small cryosphere, but with large global interest–.

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Japanese CryoNET sites: Information forwarded this time.

(**): Part of Intl. Network.

(1) Ice sheet: 4 sites in Antarctica and Greenland.

(2) Glaciers: 1 site in Mongolia

(3) Snow cover: 5 sites in Japan

(4) Terrestrial (Permafrost, snow cover): 9 sites and network in Siberia and Alaska
   (GTN-P, Asia Flux, CEOP(DIAS), INTERACT)

(5) Others: Svalbard station
Observation network in north-eastern Eurasia and Alaska in collaboration with Japanese institutions

(Prepared by Iijima)
Super site

Tower (mast)
Meteorology
H₂O, CO₂, CH₄ fluxes
Ecology
Hydrology
Permafrost
Permafrost Observation Network

Borehole (5-10 m)
soil temperature
soil moisture (AL)
Active layer thickness
Mainly in the mountain regions
Other potential sites for CryoNET

Did not have enough time to ask people to submit CryoNET informations. Totally, it would double.

(1) Ice sheet:
   . Inland station in Antarctica
(2) Glaciers:
   . Several in mid-latitude, Himalaya and Patagonia
(3) Snow cover, others:
   . JMA observation sites
      (WMO station and AMeDAS network)
   . Network of hydrological division, MLIT, Japan
(4) Frozen ground, snow, others: Stations of MAFF, Japan.
(5) Forest/ecological directed sites.
Japanese data archive activities: (Recent Several Years)

(1) CrDAP (Cryosphere Data Archive Project) at JAMSTEC

(2) ADS (Arctic Data System) at NIPR being developed.

Presently, there is an old system, which is very weak.

Mainly developed with the effort of H. Yabuki and H. Kawamoto
Arctic Data archive System

http://ads.nipr.ac.jp/

New version launched in November 2012
Questions related to implementation in general and in Japan.

(1) What is the criteria for being an CryoNET site.
   - Continuous, important?
   - Quality.

(2) Authorized listing or registration of the sites in CryoNET.
   - How will the crynoNET list prepared by peoples be treated in the present work? GCW direct contact (document to be presented to) to all contributors, or through brokers in each country.
   - Credit of listing at CRyoNET for contributors.

(3) Past data:
   - What do we do with past taken data, terminated ones.
     If clear direction is built up, people may re-start observation.
(4) How can we maintain the sustaining observation, which is needed for high quality data-sets for GCW. Quite many are made under research activity with limited short-term fund.

(5) National functions: Is there any national function (discussion) in each country.
    this may be the barometer of interest to GCW.

(6) Duplication may be arising at the listing for some large observation and ones done by international cooperation, listed up by several countries.

(7) Necessity of “Guideline”, showing the optimum network of cryosphere.
Possible contribution to GCW from Japan for areas of Antarctica, Svalbard and Greenland

Teuo Aoki
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Tsukuba, Japan

<table>
<thead>
<tr>
<th>Region</th>
<th>Period</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antarctic</td>
<td>1957</td>
<td>ice sheet</td>
</tr>
<tr>
<td>Himalaya</td>
<td>1970s~</td>
<td>Nepal, Bhutan: glaciers</td>
</tr>
<tr>
<td>Patagonia</td>
<td>1980s~</td>
<td>Chile and Argentine: glaciers</td>
</tr>
<tr>
<td></td>
<td>(1980s -&gt; 1990s)</td>
<td>glacier, afterwards China</td>
</tr>
<tr>
<td>Siberian Region</td>
<td>1996~</td>
<td>Russia: permafrost, snow cover, glacier</td>
</tr>
<tr>
<td>Mongolia</td>
<td>2003~</td>
<td>Mongolia: glacier, permafrost</td>
</tr>
<tr>
<td>Alaska</td>
<td>2000~</td>
<td>USA (Univ. Alaska), permafrost, snow cover</td>
</tr>
<tr>
<td>Greenland</td>
<td>1950s~ -&gt; 1990s</td>
<td>ice sheet, ice caps, glaciers</td>
</tr>
<tr>
<td>Svalbard</td>
<td>1991~</td>
<td>glacier, ice cap</td>
</tr>
<tr>
<td>other regions in Arctic</td>
<td>1990s, and strengthened after 2011 including</td>
<td></td>
</tr>
</tbody>
</table>
Syowa Station in Antarctica

Location: 69° 0.3' S, 39° 34.8' E, 21.8m
Landscape type: Antarctic coastal
Onsite technical staff: Yes (~30 in winter, ~100 in summer)
All-year round observations: Yes
Year established: 1957
Solid precipitation: No
Snowfall: Snow depth
Trace gases: CO₂, CO, CH₄, O₂, ozone and aerosols (GAW station)
Aerosols: Sunphotometer, and skyradiometer
UV, stratospheric ozone: UVB spectral, broadband), UVA (broadband), ozonesonde, total column ozone, umkehr
Radiation: Downward and upward radiant flux densities for SW and LW, and direct solar radiation (BSRN site)
Meteorology: Air temperature, relative humidity, wind speed and direction, air pressure, and aerological observation with radiosonde
Research area in east Dronning Maud Land, Antarctica

Study area 2010-2015

- Sør Rondane mountains
  - glacial geology and geomorphology survey
  - ice radar observation
- Lützow Holm Bay and southern Ocean Obs.
  - bottom of the sea
  - geology and geomorphology survey
  - sampling of marine sediments
- Syowa station
- Middle depth ice core drilling
- Shirase glacier area
  - Unstable glacier flow lowering 10-50cm/year
- Dome Fuji station (3,810m)
  - Shallow ice core drilling & firn air sampling
  - Deep borehole measurement

Map Scale 1:7,500,000
Rabben Station in Ny-Alesund, Svalbard

Location: 78°55′ N, 11°56′ E, 8 m
Landscape type: arctic coastal
Onsite technical staff: No
All-year round observations y/n: Yes
Year established: 1991
Solid precipitation: No
Snowfall: Snow depth
Trace gases: CO₂, CH₄, N₂O, SF₆, and O₂
Aerosols: Sky radiometer
Radiation: Ground-based Spectral Albedo and Flux radiometer (GSAF) to measure downward and upward spectral flux at selected wavelengths
Others: All sky camera and micro pulse lidar
Site SIGMA-A in Greenland
Location: 78°03' 06" N, 67°37' 42" W, 1,490 m
Landscape type: Ice sheet (accumulation area)
Onsite technical staff: No
All-year round observations y/n: Yes
Year established: 28 June 2012 (new!)
Snowfall: Snow depth
Radiation: Downward and upward SW, NIR and LW
Mass balance: Relative snow level with ultrasonic snow gauge
Meteorology: Air temperature, relative humidity, wind speed and direction, and air pressure at two heights (Argos data transmission)

Site SIGMA-B in Greenland
Location: 77°31' 06" N, 69°03' 43" W, 959 m
Landscape type: Ice cap (ablation area)
Onsite technical staff: No
All-year round observations y/n: Yes
Year established: 19 July 2012 (new!)
Snowfall: Snow depth
Radiation: Downward and upward SW and LW
Mass balance and meteorology: Same as SIGMA-A at one height (Argos data transmission)
SIGMA sites in northwestern Greenland

(SIGMA project: Snow Impurity and Glacial Microbe effects on the abrupt warming in the Arctic)

SIGMA-A (1,490m)
SIGMA-B (959m)

Qaanaaq

Map showing the locations of SIGMA-A and SIGMA-B sites in northwestern Greenland.
Extreme melt across the Greenland ice sheet in 2012

Figure 1. Composite maps of melt extent from OS2, SSMIS, and MODIS satellite data for: (a) 8 July, (b) 12 July, (c) 22 July, and (d) 29 July 2012. In the red areas, two or more of the satellites detected melt while in the orange areas only one satellite detected melt. No melt was detected in the white areas, black indicates insufficient data, green and dark grey show land, and light grey represents ocean.

Nghiem et al. (2012), GRL

Newspaper July 17, 2012

 mes=-22cm (6.29-7.10), -16cm (7.10-8.10)

SIGMA-A
Regional model simulation for IOP: July 8 – 13, 2012

Mixing ratio (water and ice)

Hashimoto et al. (to be submitted)
IOP2012 Validation for SIGMA-A (1,560 m a.s.l.)

Global solar radiation

Wind speed at 10 m

Air pressure

Air temperature at 2 m

Relative humidity
Effects of frost and icing on broadband

- Frost and icing are serious problem for radiation measurements.
- Web camera will be used for quality check.
- Effective defrost method without AC power is needed.
Summary

✓ Syowa Stations in Antarctica and Rabben Station in Svalbard, where comprehensive observations are being made for atmosphere, snow/ice and ocean, are potentially super sites of CryoNet.
✓ Sites SIGMA-A and -B are AWS site without on site technical staff and electric power except for solar panel.
✓ Unmanned instruments sometimes encounter the serious troubles such as frost, icing and malfunction in cryosphere. The knowledge and technical know-how for protecting and reducing those problems are important. -> Standards, guidelines and training for observations in CryoNet activities.
Environmental conditions under the ice sheet

- **High reflection:** Subglacial water
- **Internal layer**
- **Bedrock**

*Diagram showing reflections and layers.*
Annual accumulation from 1993 to 2010

(69 to 77.2 deg south)
Regional model simulation for IOP: July 8 - 13, 2012

Model: JMA Non-Hydrostatic Model (NHM)

Grids and layer: 450 x 550 x 50L
Integration time: 390 hours (1 run = 30 h x 13), FT = 6-30 (24 hours)/1 run (30 hours) is used.

Resolution: Horizontal: 5 km, Vertical: 40 - 886 m, Time interval: 20 sec

Initial and boundary: Global Objective Analysis Data of JMA (GANAL), June 30, 2012, 18 UTC – July 13, 2012, 24 UTC (6 hourly)
Validation sites for regional simulation
July 8 - 13, 2012