

Ground-based radars and the IPY/IHY

Tony van Eyken, EISCAT Scientific Association (Tony.van.Eyken@eiscat.se)

Ground-based radars expected to play a major role in the IPY include: mesosphere and lower thermosphere (including MST and meteor scatter) radars, VHF coherent radars (primarily the SuperDARN arrays), and incoherent scatter radars (ISR). ICESTAR, IHY and 27 other consortia, including the activities of the ground-based radars, were formed into one of the IPY core projects: Heliosphere impact on geospace (63). There are three Science Themes in the project:

1. Coupling processes between the different atmospheric layers and their connection with the solar activity
2. Energy and mass exchange between the ionosphere and the magnetosphere
3. Inter-hemispheric similarities and asymmetries in geospace phenomena

The ground-based radars expect to make important contributions to all three themes and are preparing programs of extended observations to cover the IPY interval.

The SuperDARN radars, and many of the MST instruments, already run essentially continuously while the ISRs operate for 1-2000 hours per year. The ISRs plan to expand their coverage such that high latitude ISR data (initially plasma density, ion and electron temperatures, and plasma velocity) should always be available. The primary coverage will be provided by the EISCAT Svalbard Radar, with the Sondrestrom and Resolute Bay Radars also making significant contributions.

Most instruments already distribute their data through individual, web-based data portals¹ but such distributions will be expanded and coordinated, particularly through the ICESTAR data portal initiative. The first steps involve efficient data browsers collecting availability information from the various existing distributed sources, with more extensive virtual observatories planned for later implementation.

Arctic MST radars are located at Erange in Sweden, Andennes and Tromsø in Norway, Svalbard, Dixon Island, and at Resolute Bay, Yellowknife, and Barrow in Canada, while Antarctic stations include South Pole, Scott Base, Davis, Syowa, and Rothera.

The existing sixteen SuperDARN radars² are located at King Salmon and Kodiak in Alaska, Goose Bay, Kapuskasing, Prince George, and Saskatoon in Canada, Pykkvibaer and Stokkseyri in Iceland, Hankasalmi in Finland, Kerguelen Island in the Indian Ocean, Tasmania in Australia, Invercargill in New Zealand, and at Halley, Sanae, and Syowa (2) in Antarctica. New radars at Inuvik and Rankin Inlet in the Arctic, and at Dome-C, Halley, and South Pole are planned to be completed before the start of the IPY.

¹ See <http://sisko.colorado.edu/TIMED>, <http://superdarn.jhuapl.edu>, and <http://www.openmadrigal.org/>

² See <http://superdarn.jhuapl.edu/sites/index.html>

High latitude ISRs include the three EISCAT radars, on Svalbard and at Tromsø (2) in Norway, the Sondrestrom Radar in Greenland, and the Poker Flat Radar in Alaska. The Millstone Hill Radar in Massachusetts also covers substantial relevant areas.

A new ISR, funded by the NSF, will be installed at Resolute Bay (74N, 94W) beginning in 2007.

The Japanese National Institute for Polar Research also intends to start construction of the PANSY radar during 2007. PANSY, at Syowa Station (69S, 39E), will be the first MST/IS radar in the Antarctic and will be able to observe the Antarctic atmosphere with fine resolution and good accuracy between 1-500 km.

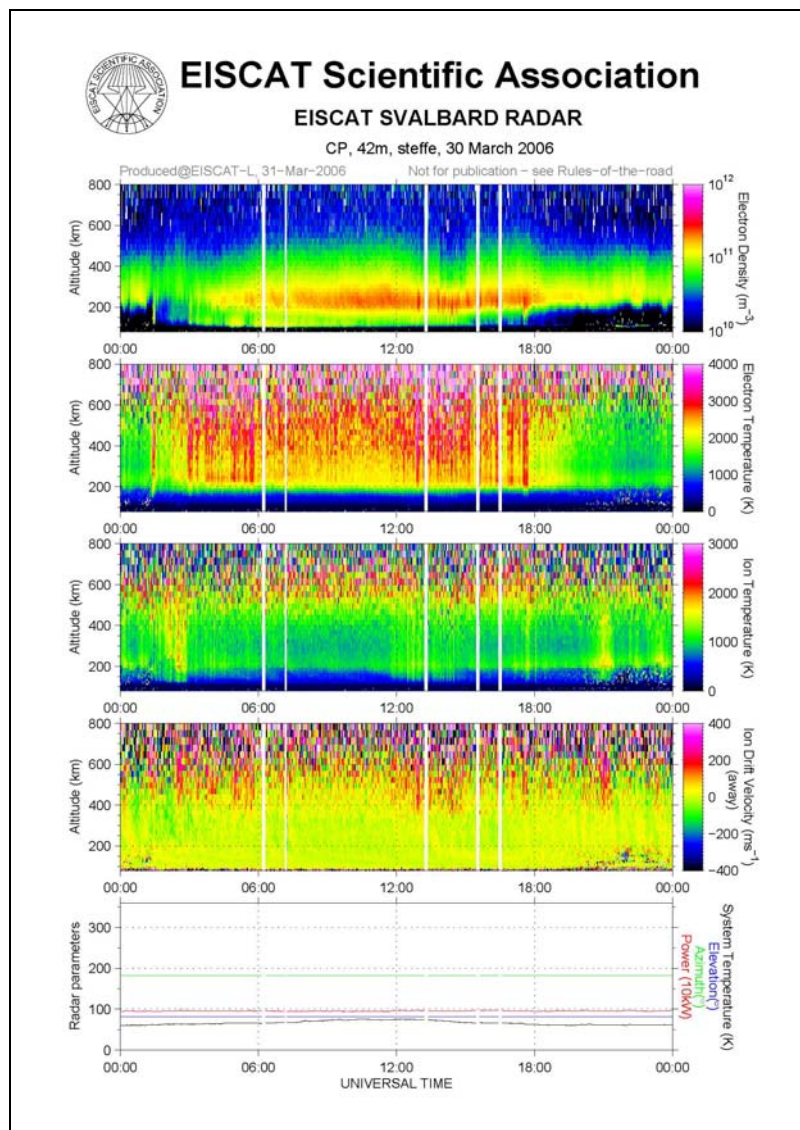


Figure 1: EISCAT Svalbard Radar field-aligned data from the recent 30-day World-wide coordinated observation interval. Incoherent Scatter Radars provide such detailed, high quality data in near real-time.

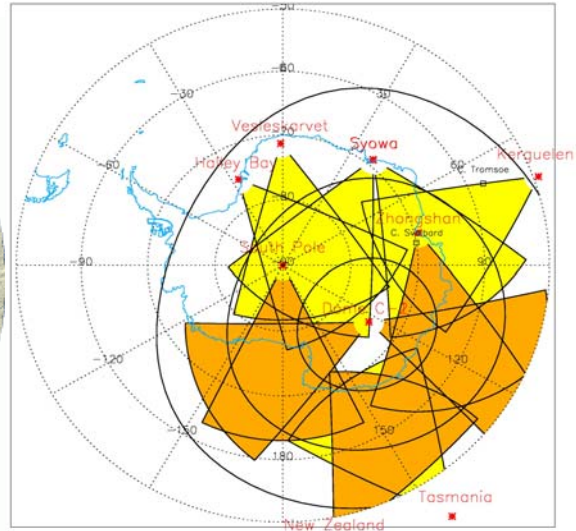
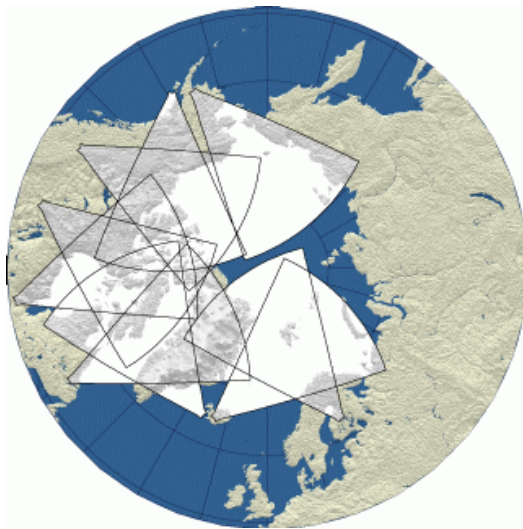


Figure 2: Maps of the Super Dual Auroral Radar Network (SuperDARN) arrays over the Northern (left) and Southern (right) polar regions. The Antarctic map shows fields-of-view for existing (yellow) and planned (orange) radars.

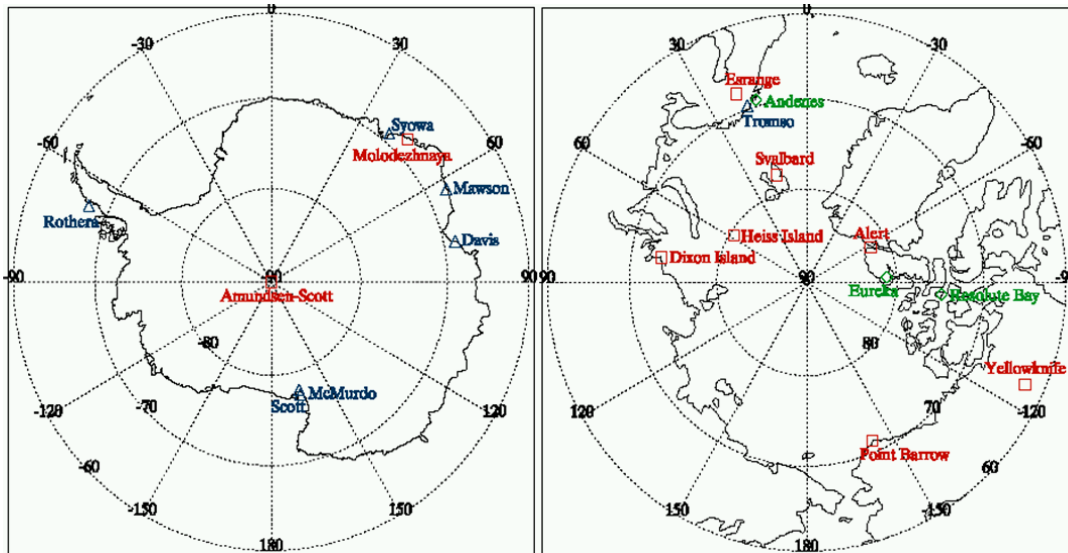


Figure 3: Present locations of Arctic (left) and Antarctic (right) Mesosphere and lower Thermosphere radars

Acronyms used

| | |
|-----------|---|
| EISCAT | European Incoherent SCATter |
| ICESTAR | Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research |
| IHY | International Heliospheric Year |
| IPY | International Polar Year |
| ISR | Incoherent Scatter Radar |
| MST | Mesosphere-Stratosphere-Troposphere |
| NSF | National Science Foundation of the United States |
| SuperDARN | Super Dual Auroral Radar Network |