Status Report on the Global Regional ATOVS Retransmission Service (RARS)

Presented by David Griersmith (ABoM) on behalf of RARS participants and contributors

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Acknowledgements

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- Hironobu Yokota and colleagues JMA
- Gary Weymouth, Ian Grant, Xihong Li, Mike Willmott (ABoM)
- Colleagues in China, Korea, Singapore, USA, Sth America, NZ

Talk outline

- What is RARS?
- Status
- Developments
- Input and feedback required

What is RARS?

- RARS is the Regional ATOVS Retransmission Service
- It comprises operational arrangements for rapid delivery of satellite data to the global community (especially NWP Centres). Purpose is to improve availability and timeliness of time-critical polar-orbiting satellite data for the global domain to meet global and regional requirements
- RARS involves acquisition of polar-orbiting satellite data from a global network of NOAA/METOP ground reception stations.
- NOAA ATOVS data are locally processed and passed to a regional Processing Centre that handles coordination, and rapid delivery to users, regionally and worldwide.
- impact of global RARS system has been significant via improvements in NWP modelling since much larger quantities of sounder data have become available for assimilation.
- Better availability and use of satellite data – a WMO Space Programme priority

Global RARS – 27 HRPT receiving stations

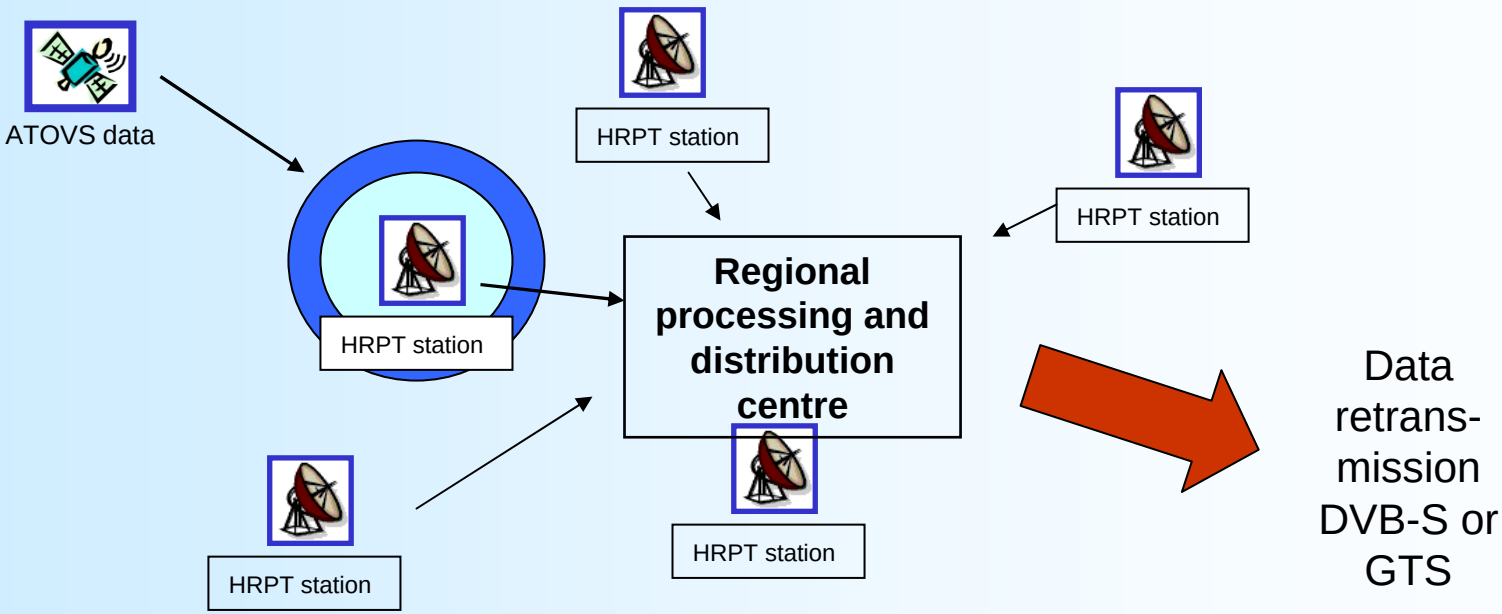
- Global RARS comprises three RARS regional networks that distribute ATOVS data:
  - EARS, the EUMETSAT Advanced Retransmission Service: network of ~10 receiving stations in Europe, North America, Canada, Greenland, Arctic and Canary Is. Established 2002.
  - Asia-Pacific RARS: ~12 HRPT stations in Australia, NZ, Antarctica, Japan, China and Singapore - coordinated by Australian Bureau of Meteorology.
  - South American RARS: ~5 stations in Brazil and Argentina - coordinated by National Institute for Space Research (INPE) and Argentina.

Global effort: WMO, CGMS, ITSC, satellite operators

- EARS : *EUMETSAT, NOAA, KSAT, DMI, HNMS, INTA, MSC/CMC, Météo-France*
- Asia-Pacific RARS : *JMA, ABoM, KMA, CMA, MSS, MetService/NIWA*
- South American RARS: *INPE/CPTEC, INMET, SMN, CONAE*

RARS model of operation

Real time HRPT data sent to processing centre which distributes files globally to NWP centres



Background

- The global RARS network had its origins in the EUMETSAT ATOVS Retransmission Services (EARS) with satellite broadcast (2001-02)
- WMO CBS & EC, ITSC and CGMS, requested the implementation of a global network of RARS
- 3 Global RARS workshops (2004,2005,2006) followed by WMO RARS Implementation Group meetings (July 2007, 20-21May 2008);
- The global RARS network implementation and expansion are monitored and assisted by the RARS IG

RARS characteristics

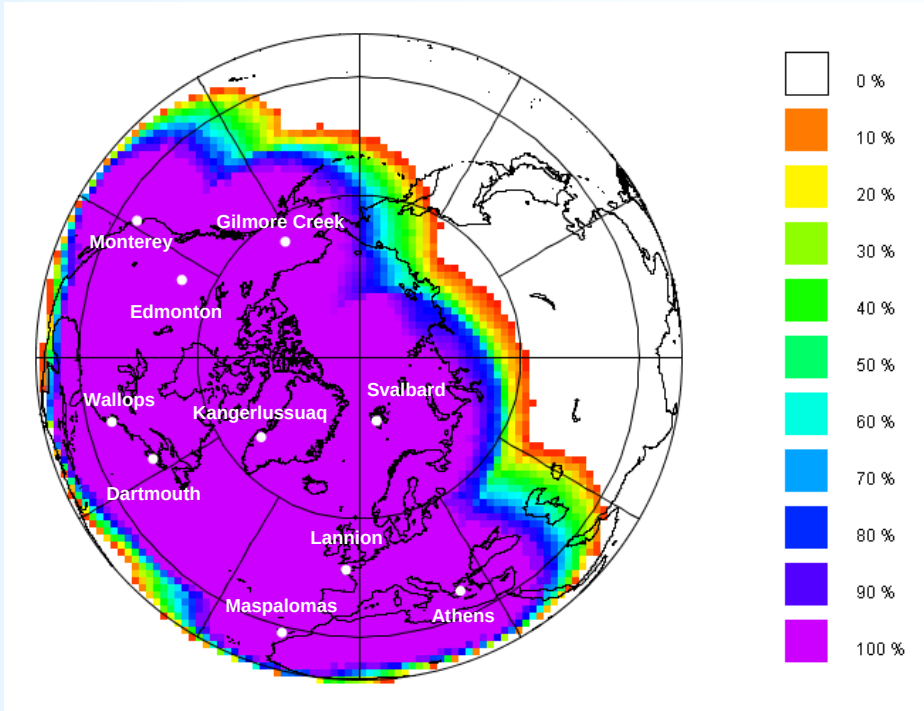
- RARS data content:
  - *AMSU-A*
  - *AMSU-B* or *MHS* for NOAA-N or MetOP
  - *HIRS*
  - *AVHRR* on HIRS grid (20.3 km) for local cloud information
- Global NWP requirement for soundings requires 30 min timeliness, BUFR format and consistency of data calibration.

RARS characteristics

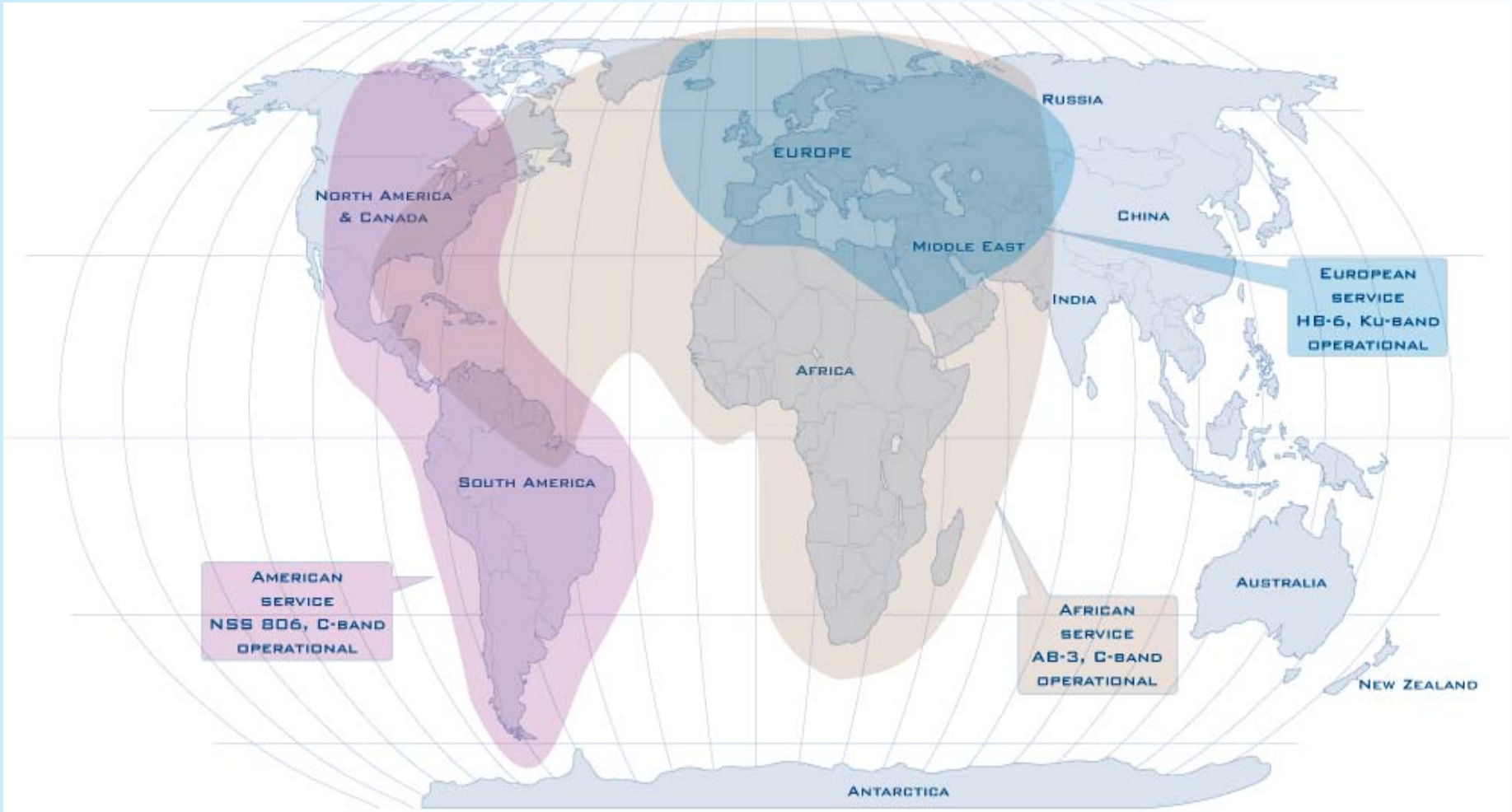
- **Timeliness** : target is 90% global coverage available within 30 minutes (instead of 3-6 hrs) in NWP centers through GTS and/or Alternative Dissemination Methods (ADMs)
- **Data quality and consistency**:
  - Use of common pre-processing software (AAPP)
  - Standardisation of products formats, quality tagging and service management
  - Data monitoring with support of EUMETSAT SAF on NWP
- **Cost effectiveness**
  - Relatively inexpensive HRPT stations ensure near-global coverage
  - comms costs are decreasing
  - GTS or ADMs allow low-cost access e.g. satellite broadcast systems
  - Initially doubled satellite data for NWP centres (highly cost-effective)

EUMETSAT RARS (EARS)

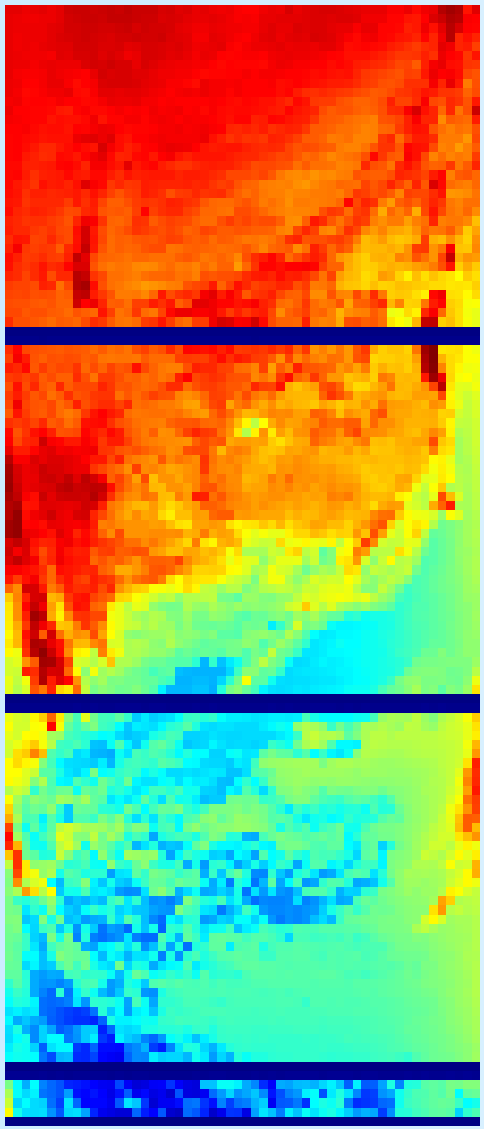
- ATOVS retransmission from ~10 HRPT stations
- AVHRR retransmission from 5 stations
  ‘1 minute’ segments disseminated within 10 min
- capability for ASCAT and IASI
- Info via www.eumetsat.int



EUMETCast Overall Coverage



EARS ATOVS

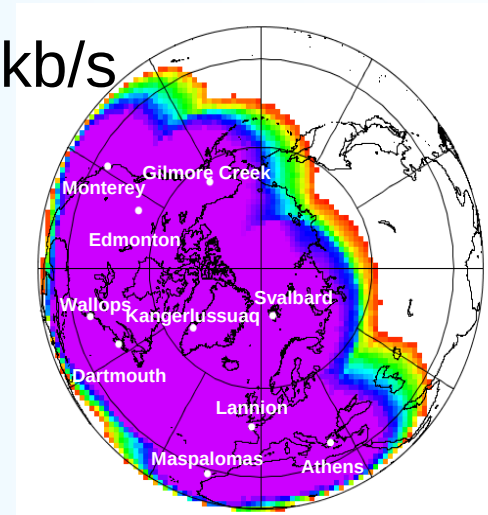


HIRS data visualised using EPSView

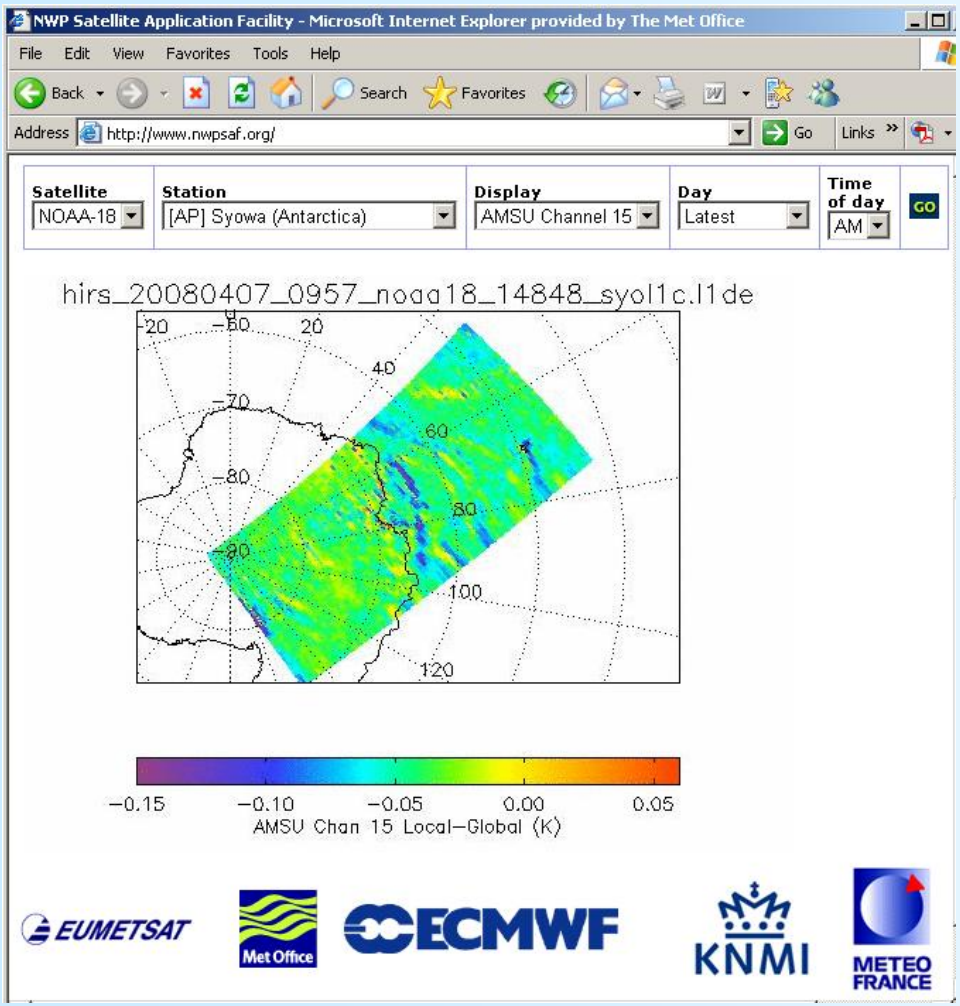
Satellites: NOAA KLM, NOAA NN', Metop

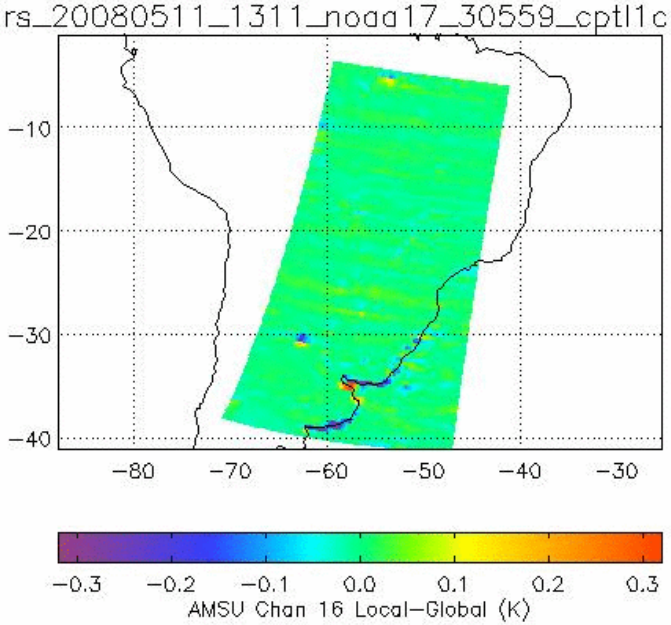
Instruments: HIRS, AMSU-A, AMSU-B, MHS

Data Rate: ~10 kb/s



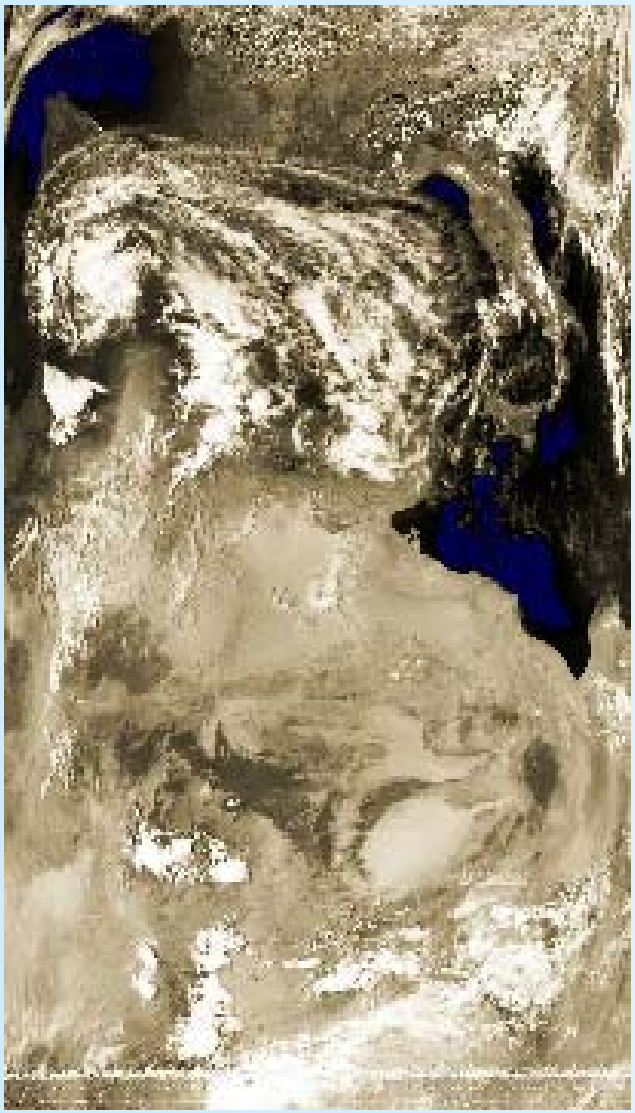
RARS NWP SAF monitoring: daily summary emailed to RARS operators (see www.nwpsaf.org)






```
-Asia Pacific RARS
-=================
-                    Totals
-station  noaa15 noaa16 noaa17 noaa18
- mel        6      0      4      5
- pth        6      3      4      5
- dar        4      0      3      5
- tvl        1      0      3      1
- kiy        0      0      5      5
- syo        2      0      2      5
- seo        0      0      0      0   WARNING
- pek        0      2      7      7
- sgp        4      2      4      3
- kel        3      0      3      5
- hkg        4      2      2      0
```

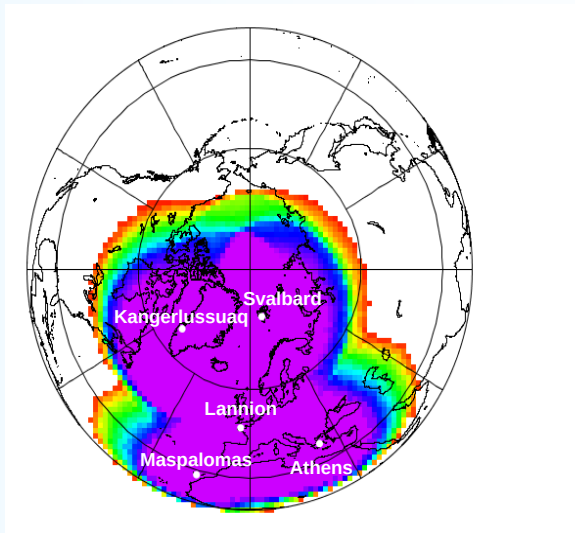
EARS AVHRR



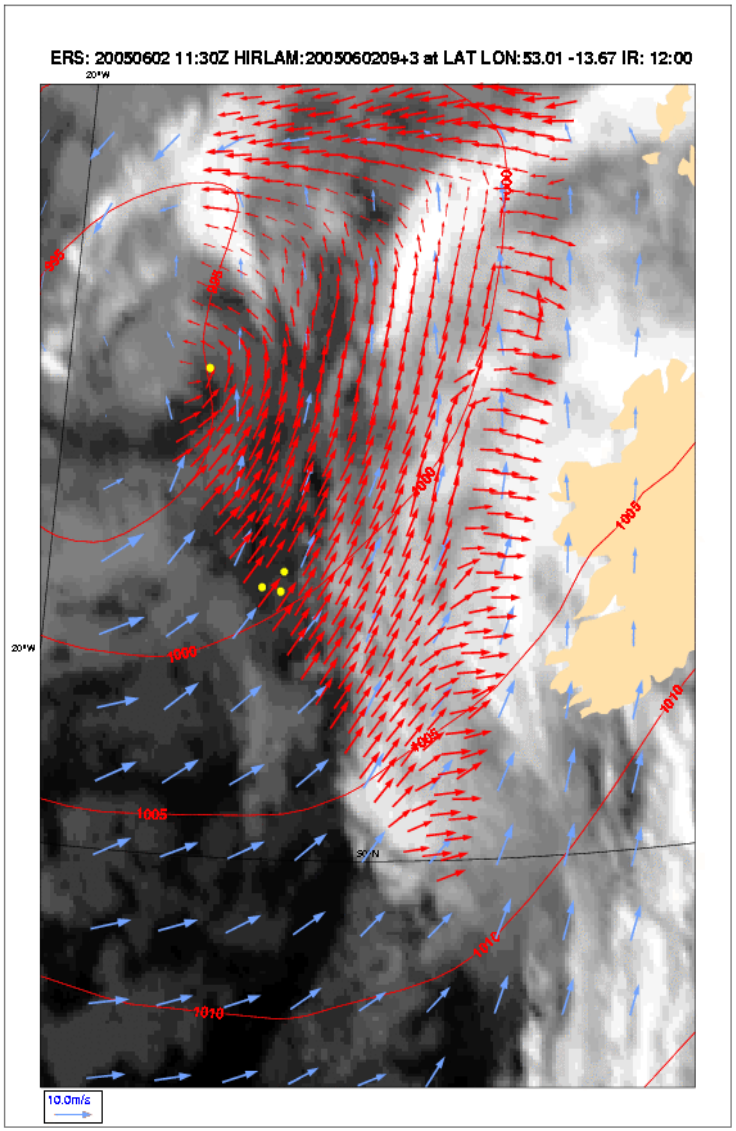
NOAA-18 received by EARS

Satellites: NOAA KLM, NOAA NN', Metop

Data Rate: 622 kb/s



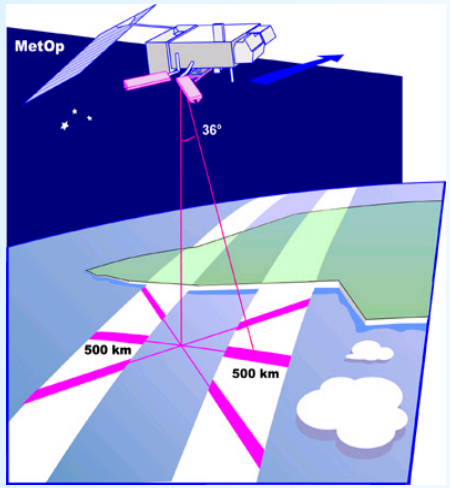
EARS ASCAT

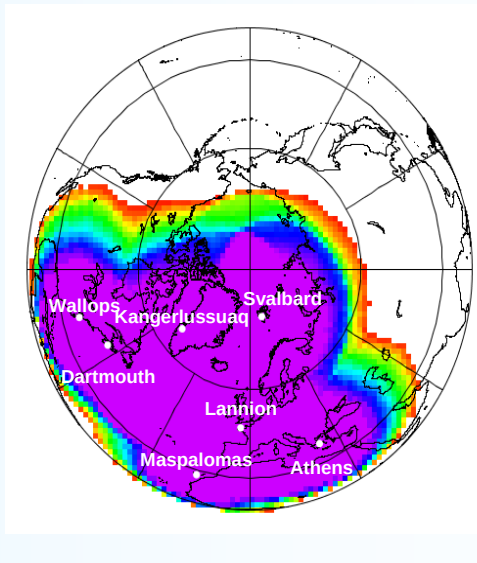


ERS-2 SCAT by KNMI

Satellites: Metop

Data Rate: 60 kb/s





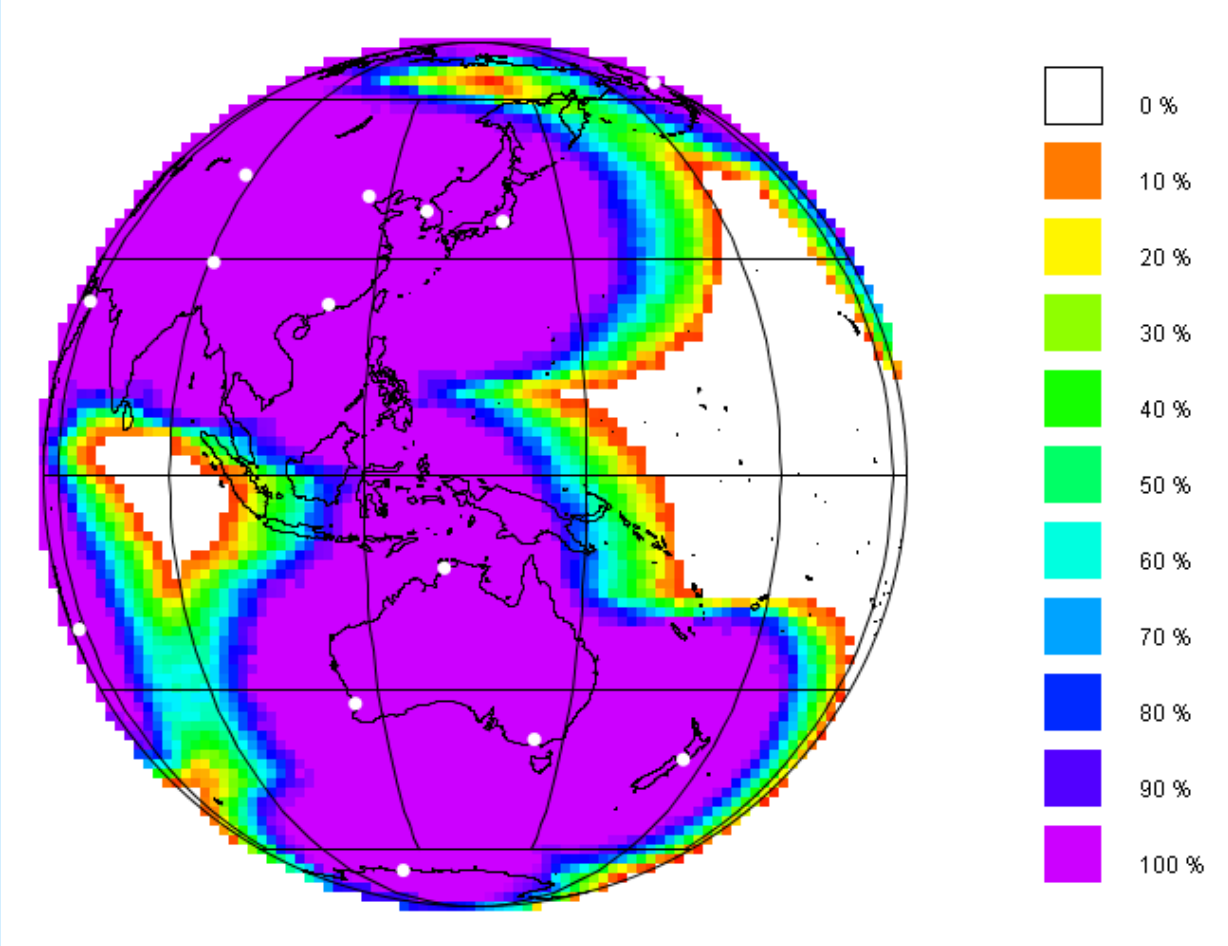
EUMETCast User Reception Terminal Costs

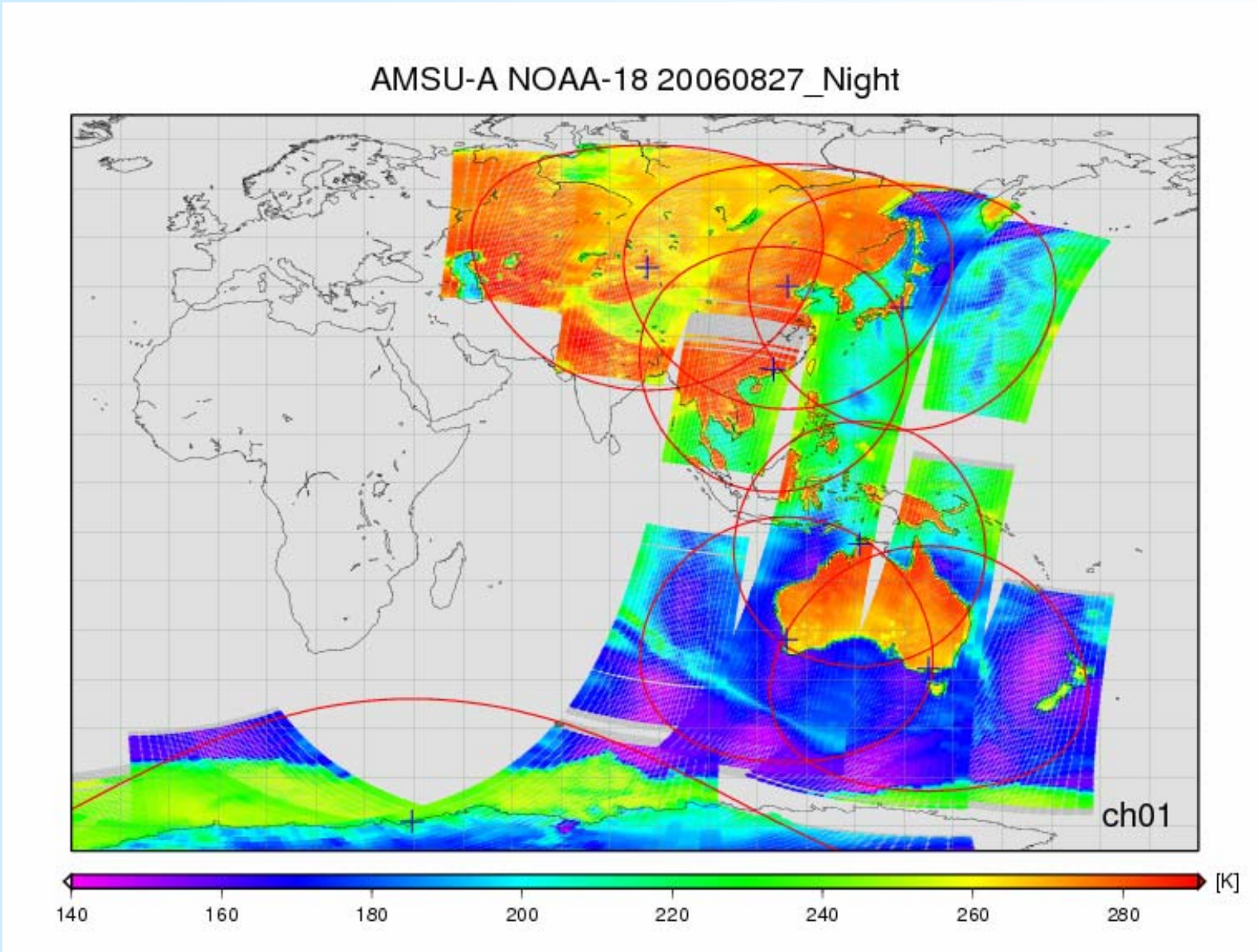
DVB Standard Hardware	
LNB Ku-/C-band & Satellite Dish	200/1500 EUR
DVB PCI Card	100 EUR
DVB Multicast Client Software	60 EUR
EUMETCast Key Unit (EKU)	40 EUR
PC, Hard Disk, Ethernet	1000 EUR
	1400/2700 EUR

Asia-Pacific RARS

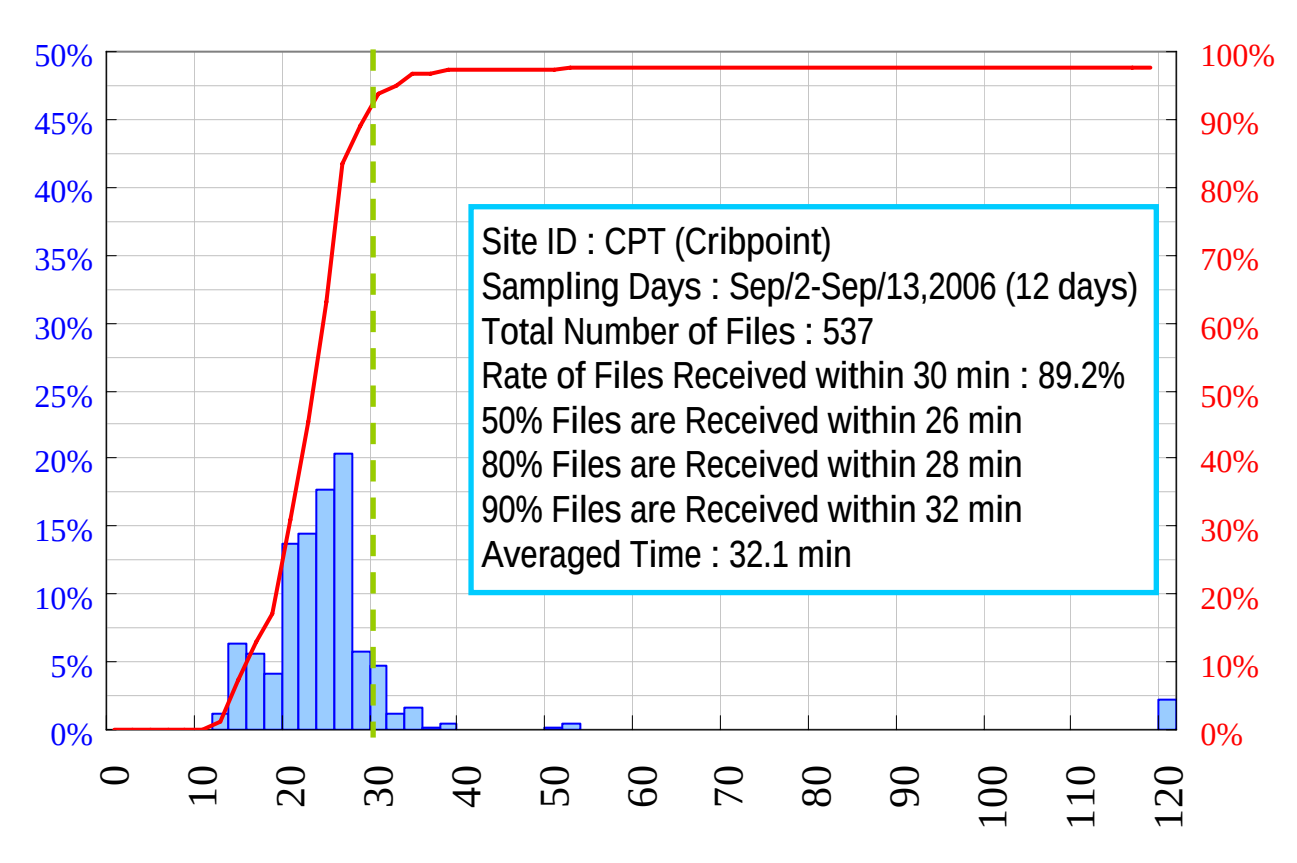
- Coordinator: D. Griersmith (Australia)
- 12 HRPT stations from Japan, Singapore, NZ, China, Australia.
- Melbourne and Tokyo are the processing/distribution centres that inject ATOVS data into GTS
- feedback is positive impact on NWP e.g. JMA, ABoM, UKMO, ECMWF
- from 2 to 7 more HRPT stations planned by end 2008 e.g. Casey, Davis, Honolulu, Fiji, Guam, Vladivostok, Jincheon.

Asia-Pacific RARS



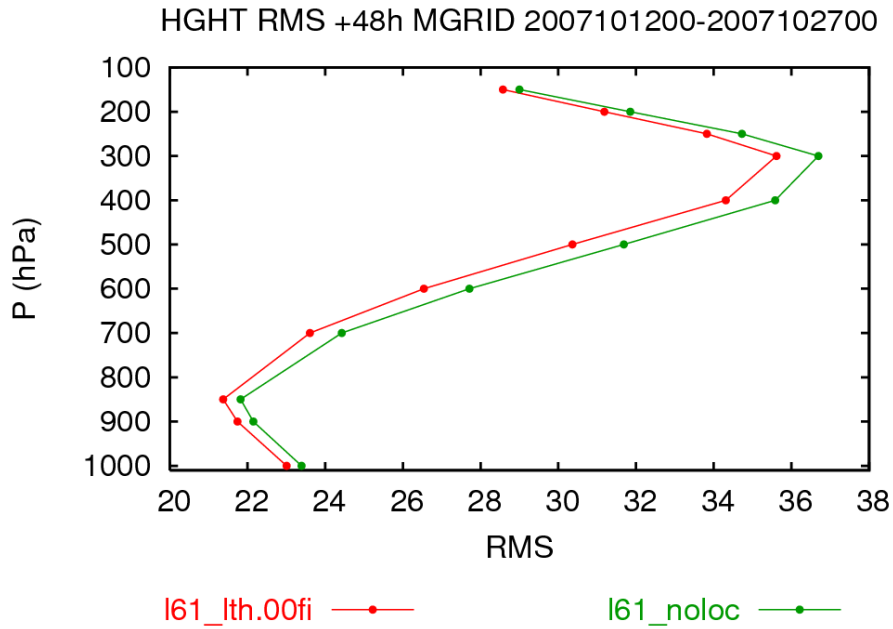

AMSU-A NOAA-18 20060827_Night
ch01
140
160
180
200
220
240
260
280
[K]

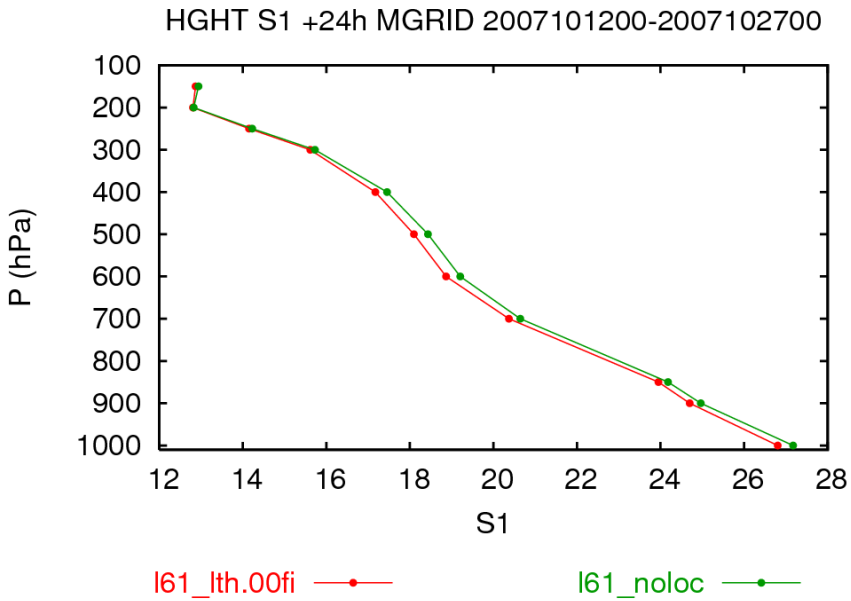
Available Time at Tokyo



Elapsed time from compilation of a file to reception at RTH Tokyo: 2 to 5 minutes

ABoM model improvements over Australian region with/without local ATOVS (RARS) data





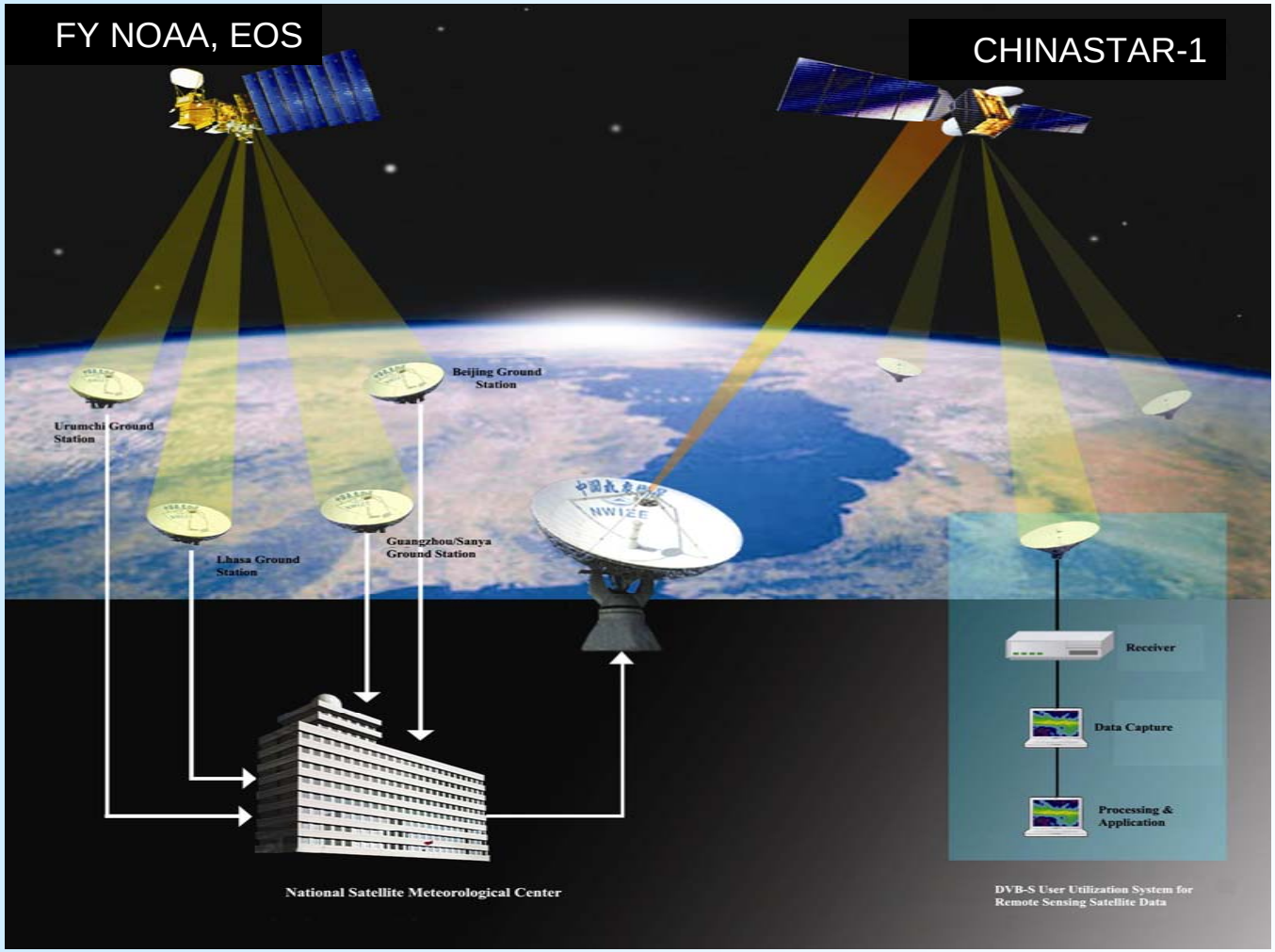
FengyunCast – ADM for Asia-Pacific Region

China Meteorological Administration

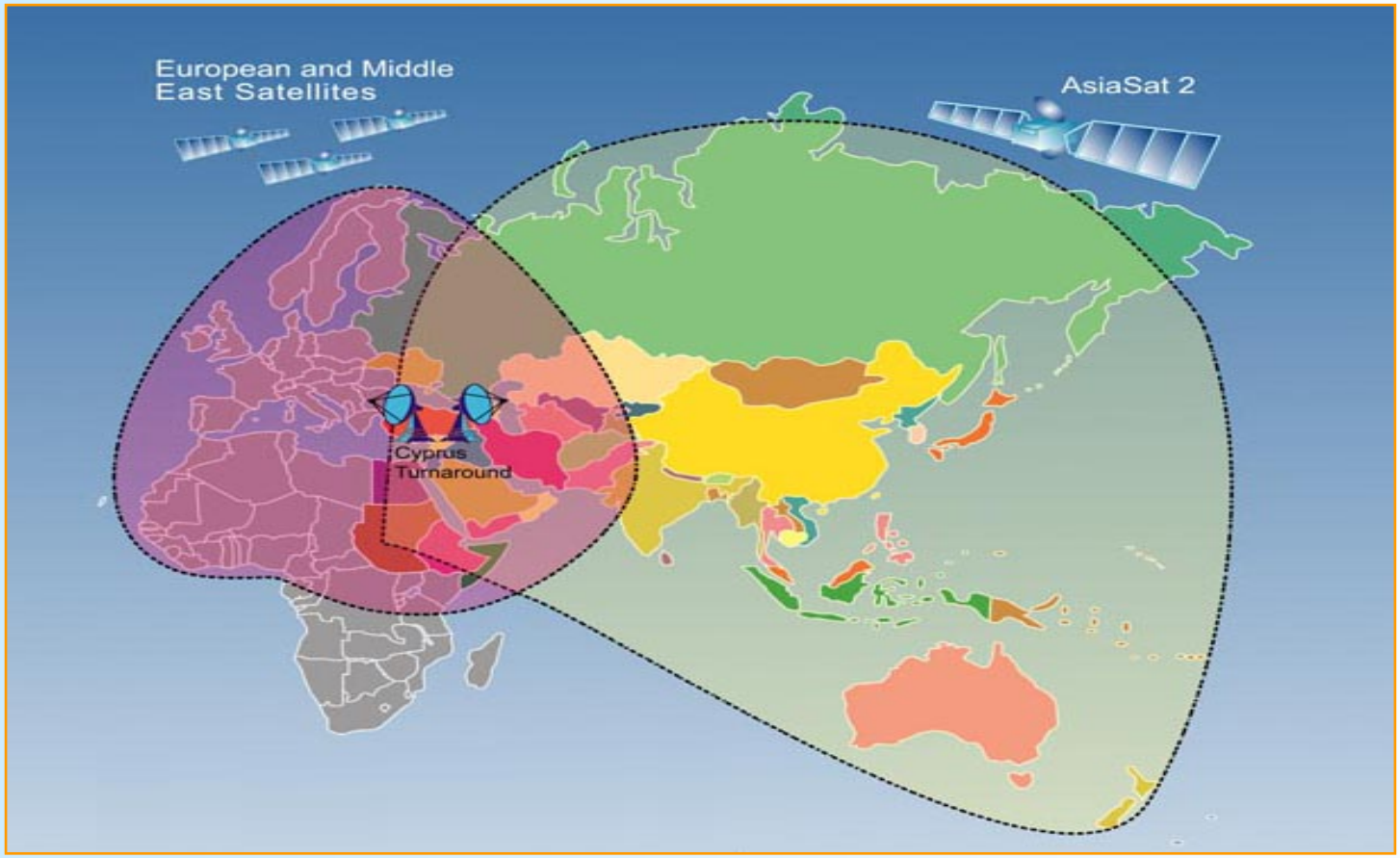
Advantage of ADM using commercial satellite Digital Video Broadcast (DVB-S)

Access to multiple satellite data and products in near real-time using a low-cost single ground antenna

Basic Concept of CMA DVB-S



A revolution: Data Exchange with EUMETCAST



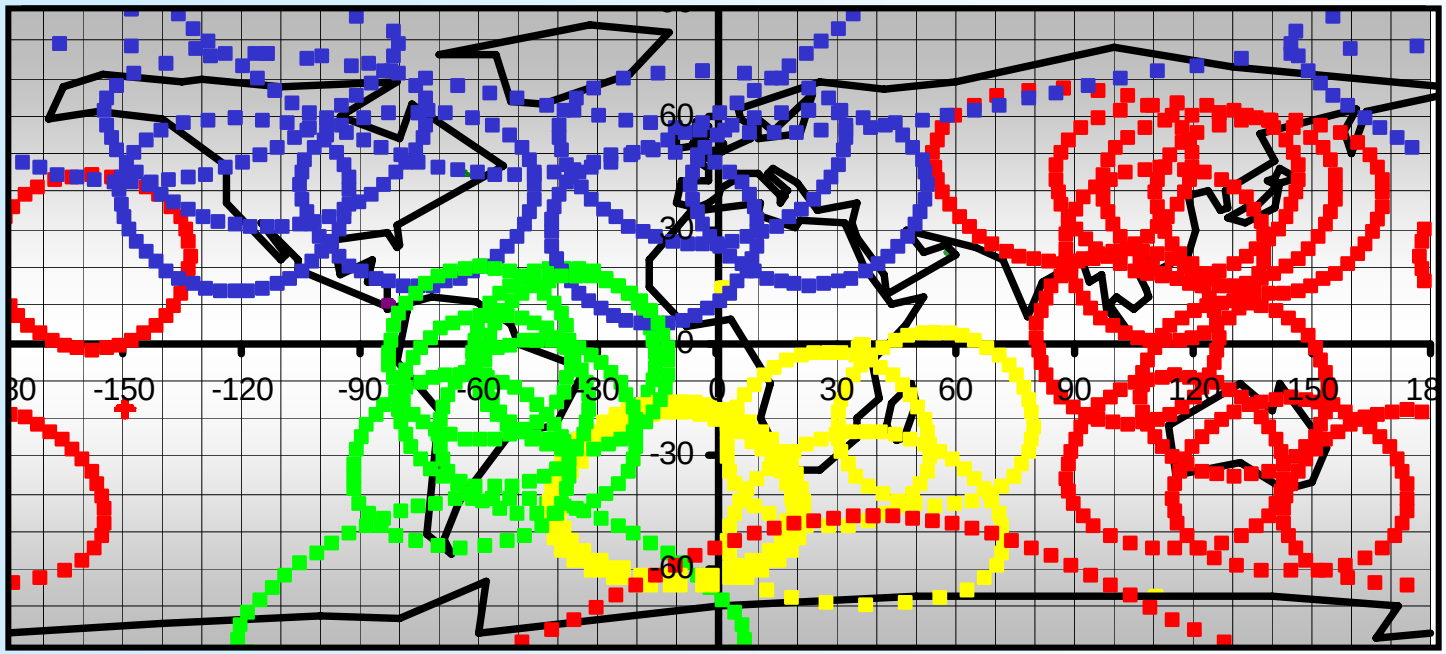
South American RARS

- Coordinators Sergio Pereira (CPTEC/INPE) and Gloria Pujol (SMN, Argentina)
- 5 stations operational, with ~4 more planned by end 2008

Processing and distribution centre	HRPT stations operational	Expected expansion 2008
Brazil	Cachoeira Paulista Brasilia Cuiaba	Manaus – late ‘08 Fortaleza – late ‘08 Natal – June ‘08 Manaus – mid ‘08 Boa Vista – 2009
Argentina	Cordoba Marambio (Antarctica)	Santiago de Chile Punta Arenas Base Presidente Frei

Towards global coverage

- EARS covers a large part of the Northern hemisphere
- Asia Pacific RARS and South American RARS are growing



Asia Pacific RARS

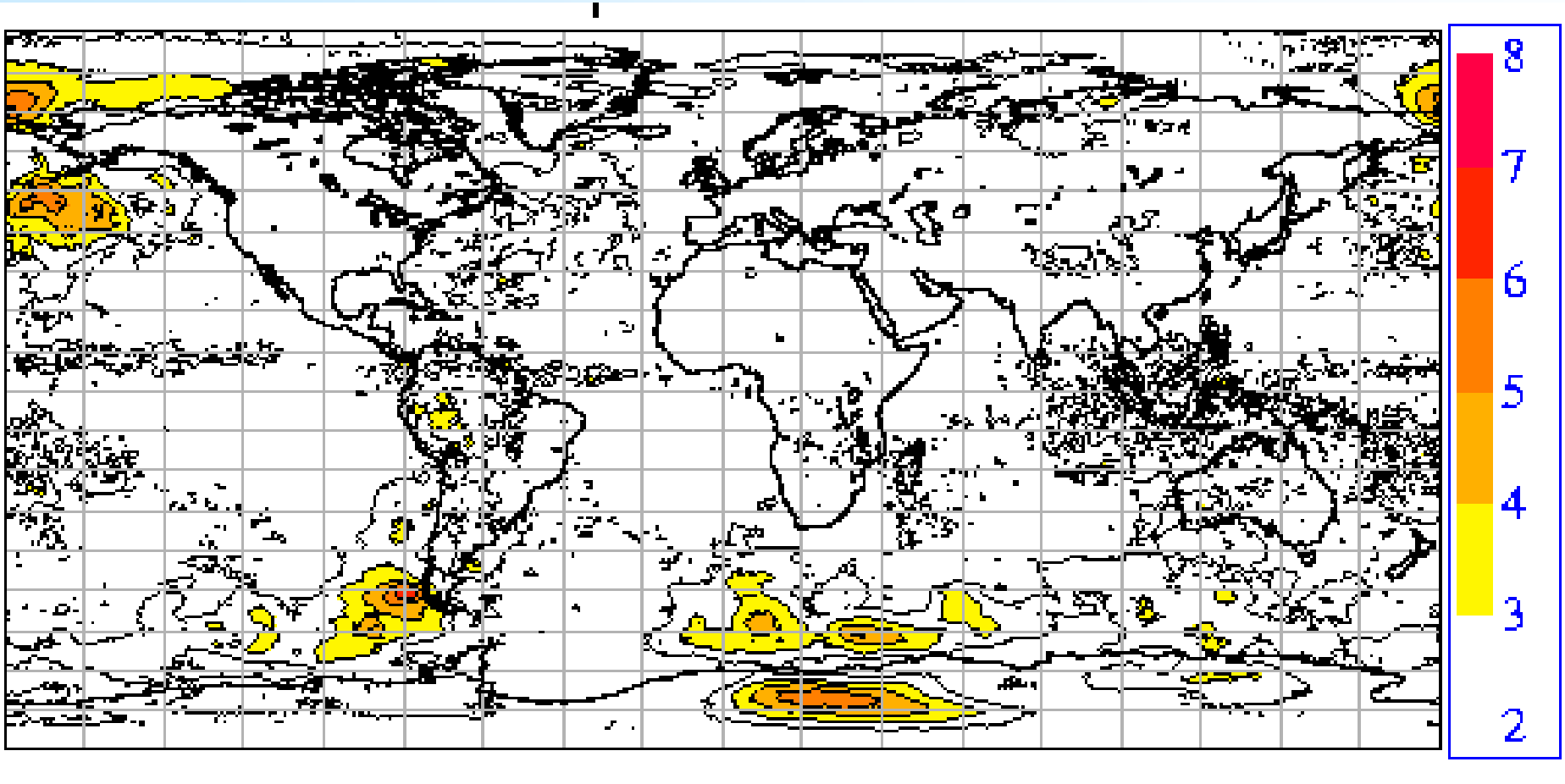
South American RARS

EARS

Gough and Marion Islands, Reunion, Pretoria

→ Gaps over Africa, Pacific, Sthn Ocean, W of India and Antarctica

UKMO modeling study at 500 hPa height. RMS difference between analyses with all ATOVS and operationally-available ATOVS. ATOVS data missing cut-off would benefit N Pacific and S Hem



RARS developments

- Short-medium term
- coverage is extending over Pacific, South-America, Africa, and Indian ocean, to fill gaps
- % of coverage of earth's surface steadily increasing: ~70→80% in 2yrs
- substantial effort being made towards standardised filenames and headers for global data exchange over the GTS/WIS
- Improved timeliness, quality, information and availability (see web sites for contacts to access GTS, EARS data)
- Medium-long term: expansion beyond ATOVS
  - **Advanced sounders**: Similar requirement for IASI (after suitable data compression/channel selection); NPP under discussion
  - **Scatterometer data:** RARS can provide the wider coverage required for ASCAT data processing
  - **AVHRR imagery**: RARS can provide full resolution AVHRR data compared to 4km NOAA GAC data. EARS already provides AVHRR.

RARS user input required

- feedback from user community is important
- examples of impact of RARS data on NWP
- user requirements concerning coverage, formats, level of data, quality, timeliness, type of data, calibration;
- Feedback from NWP community on overlap of data from stations e.g. Asia-Pacific
- Send feedback to JLafeuille@wmo.int; robert.husband@wmo.int; d.griersmith@bom.gov.au.

Websites for RARS monitoring, information and contacts

- WMO RARS web site (site(http://www.wmo.int/pages/prog/sat/RARS.html)
- EUMETSAT EARS web site http://www.eumetsat.int/Home/Main/What_We_Do/Satellites/EARS_System/index.htm?l=en
- JMA (includes comparisons with global data for all A-P RARS)
  - http://mscweb.kishou.go.jp/rars/index.htm
- Australian Bureau of Meteorology site for AP-RARS
  - http://www.bom.gov.au/weather/satellite/RARS/index.shtml
- NWP SAF (All EARS, AP-RARS, SA-RARS)
  - http://www.metoffice.gov.uk/research/interproj/nwpsaf/ears_report/index.html
- MeteoFrance EARS monitoring http://www.meteo-spatiale.fr/nwpsaf/cgi-bin/index.pl
- ITSC WG on Satellite Sounder Science and Products
  - http://cimss.ssec.wisc.edu/itwg/sssp/direct_broadcast/ears.html

Thank you

Special thanks to all the contributors to this presentation and to the global RARS