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# Direct Readout Acquisition and Relay System for LEO Satellite Data, (From RARS to DBNet)

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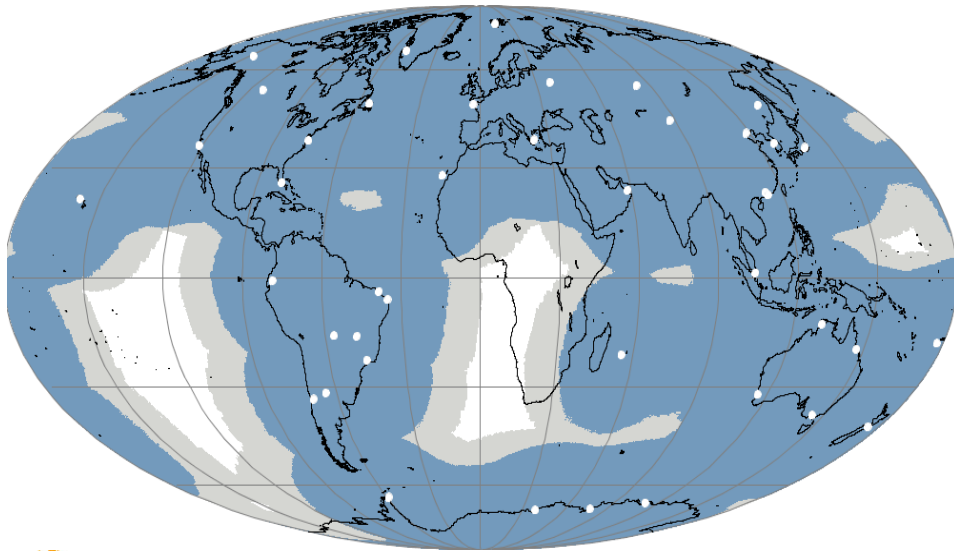
# Background: RARS/ATOVS implementation

- In 2001, EUMETSAT initiated the EUMETSAT ATOVS Retransmission Service (EARS) project to improve timeliness/availability of ATOVS data in Europe
- In 2004, WMO launched the global RARS network (RARS = Regional ATOVS Retransmission Service), modelled on EARS but expanded to the globe
- Global RARS workshops held in Dec 2004, Dec 2005, Sept 2006, addressing:
  - Requirements for a global ATOVS retransmission service
  - Initiation of a RARS in the Asia-Pacific region and a RARS in South America
  - Established a RARS Implementation Group
- **RARS Implementation Group meetings 2007-2010**
  - July 2007: agreed file naming convention, BUFR identifiers, data categories/subcategories recorded in WMO Manual on Codes
  - May 2008: implementation plan for extended coverage, software (AAPP)
  - Feb 2009: priorities for filling gaps, guidance for monitoring
  - Mar 2010: initial plan for extension to hyperspectral sounders, user outreach (RARS Poster at ITSC-17, Monterey)



# Initial WMO RARS concept and objective

- Sharing polar-orbiting satellite data received by a collection of Direct Readout stations distributed around the world
- Dissemination by the WMO GTS or otherwise (e.g. satellite broadcast)
- Ensuring data consistency by common pre-processing software (AAPP), common product definition, common coding and file naming, and quality monitoring



- Initial objective:  
ATOVS sounding data (L1b)  
from NOAA and Metop series  
over 90% of the globe  
available on the GTS in 30 min

ATOVS= HIRS, AMSU-A, AMSU-B, MHS



# RARS/ATOVS implementation status

Regional components	January 2009	March 2014	March 2015 (TBC)
<b>EARS</b>	10 stations 23%	18 stations 40%	19 stations 41%
<b>Asia-Pacific</b>	14 stations 28%	16 stations 30%	19 stations 36%
<b>South-America</b>	5 stations 10%	8 stations 14%	9 stations 17 %
<b>Overall network</b>	29 stations 61%	42 stations 77%	47 stations 84%

The percentages are the fraction of the globe (except polar caps) above which the DB signal emitted by a sso satellite is received by at least one station of the RARS network

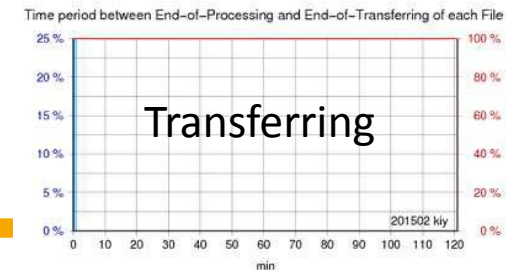
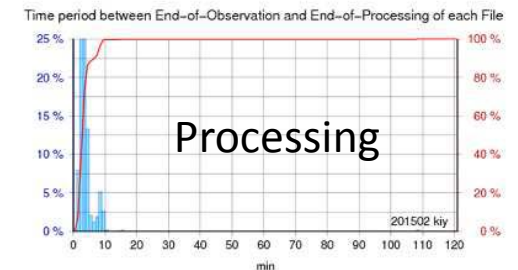
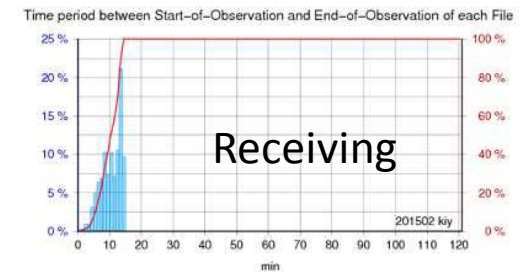
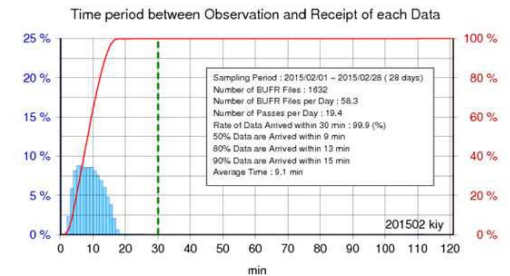


# Typical Timeliness monitored in Tokyo (JMA)

<http://ds.data.jma.go.jp/mscweb/data/rars/index.html>

Overall latency between start of reception and availability in Tokyo through the GTS is of the order of 15-20 minutes in most cases for RARS/ATOVS data

Hyperspectral sounding data and imagery data require much higher data rates – telecommunication cost must be justified by user needs.



# Discussions on RARS evolution (1/2)

- **2010-2012:**
  - Launch of Suomi-NPP, Metop-B and FY-3B
  - New sensors and new communication channels available for DB users
- **May 2011- Oct 2012: Further IG meetings and ITSC-18 sub-group highlighted:**
  - Required consistency between RARS products and global products
  - Required extension of RARS to hyperspectral sounders and FY-3 sensors
  - Preliminary roadmap for integrating METOP/IASI and NPP/CrIS
  - Coding, data volumes and dissemination issues for these new sensors
- **2013: NOAA launches DB initiative following Sandy**
  - To establish a network of NPP (X-band) receiving stations and associated processing to provide improved timeliness sounding products for NWP
- **July 2013: CGMS-41 (Tsukuba) discussed RARS and the NOAA DB initiative**
  - CGMS asks NOAA and WMO to discuss the relation of the Direct Broadcast Data Initiative to RARS, and how RARS can take advantage of this initiative



# Discussions on RARS evolution (2/2)

- **April 2014: RARS Technical Subgroup at ITSC-19 (Jeju)**
  - SSEC, NOAA, EUMETSAT, WMO should coordinate on data formats, software versions, and latency requirements and come up with a plan to provide the DBRTN products for inclusion in RARS
  - The draft Guide on RARS which defines the RARS procedures, software, formats, data exchange convention, service requirements, etc. should be finalized, published, and shared widely with potential data providers
  - The RARS Implementation Group within WMO should be reactivated with a broader scope to include NOAA DBRTN



# From RARS to DBNet

*Coordination meeting in Geneva, 11-13 March 2015*

- Participation:
  - RARS Asia-Pacific (KMA, IMD, JMA, BoM, CMA, Meteo-France)
  - RARS South America (SMN Argentina) and RARS Europe/EARS (EUMETSAT)
  - RARS central monitoring unit (EUMETSAT NWPSAF)
  - NOAA DBRTN project
  - WMO
- Reviewed status of RARS and outstanding issues
- Reports on NOAA DBRTN initiative for Suomi-NPP support in X-band
- High-level specifications for new services (NPP, Metop, JPSS, FY-3)
  - living with evolving user needs, potential inclusion of other sensors
- Reviewed the areas of harmonization/standardization required to support new services
- Agreed to rebrand the overall initiative as

**“DBNet – Direct Broadcast Network”**





# DBNet Components (Regional and Sub-regional)

Regional Network	Regional Node	Sub-regional network	Sub-regional Node
<b>DBNet - Europe</b>	EUMETSAT		
<b>DBNet - Asia-Pacific</b>	BOM	DBNet – Asia Pacific/North	JMA
		DBNet – Asia Pacific/South	BoM
<b>DBNet- South America</b>		DBNet - South America/North	INPE
		DBNet - South America/South	SMN Argentina
<b>DBNet – North America</b>	NOAA		

Global monitoring of product consistency is performed by the NWPSAF



# Current and potential DBNet services

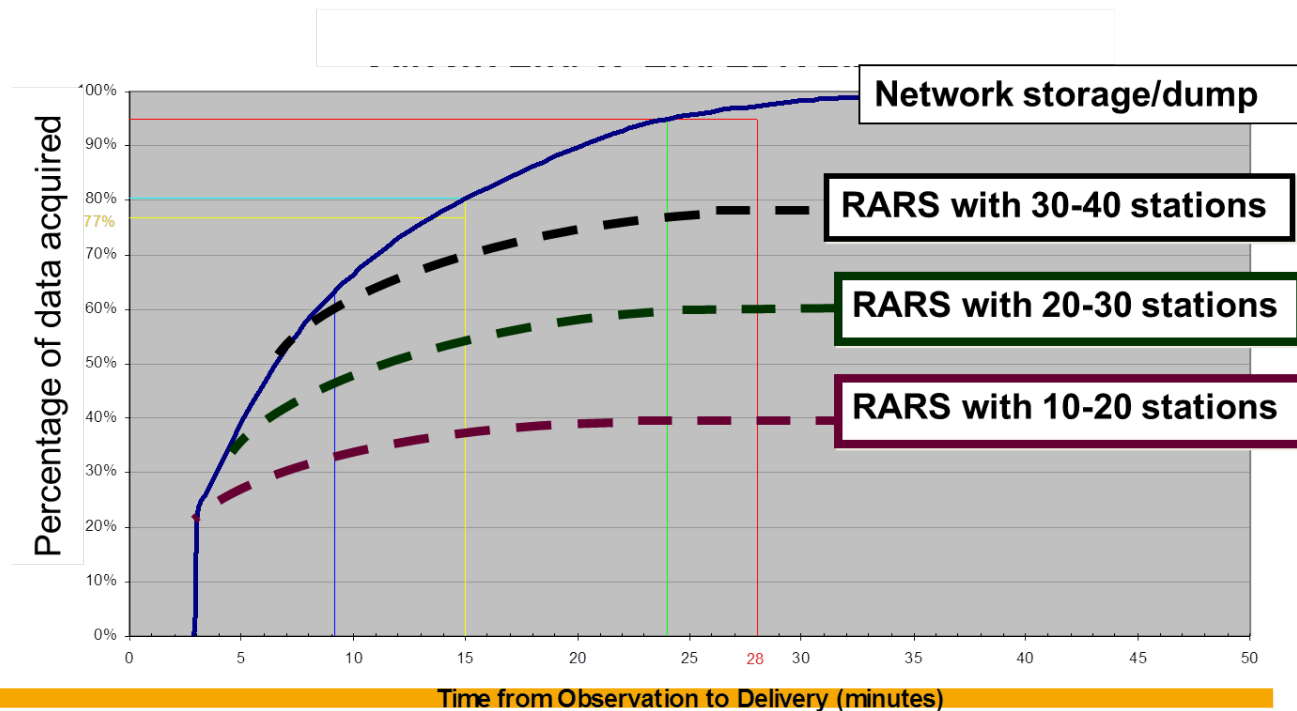
Each DBNet regional or sub-regional network contributes to one or several DBNet "Services". A DBNet Service is performing the Direct Readout Acquisition and Relay of a certain category of satellite data.

Categories of Services	Services/Instruments
IR/MW sounding	RARS(AMSU-A, MHS, HIRS), ATMS, VASS(MWTS, MWHS, IRAS)
IR/VIS imaging	VIIRS, AVHRR, MERIS
Hyperspectral IR sounding	CrIS, IASI, HIRAS
Scatterometry	ASCAT
MW imagery	MWRI



# High-level Service Specifications

- Products, Timeliness, Availability, Coverage
- Established with user bodies (ITWG, APSDEU-NAEDEX, IPET-SUP)
  - Timeliness: 15 min rather than 30 min
  - Coverage: it is a requirement at the network level , trade-off with cost

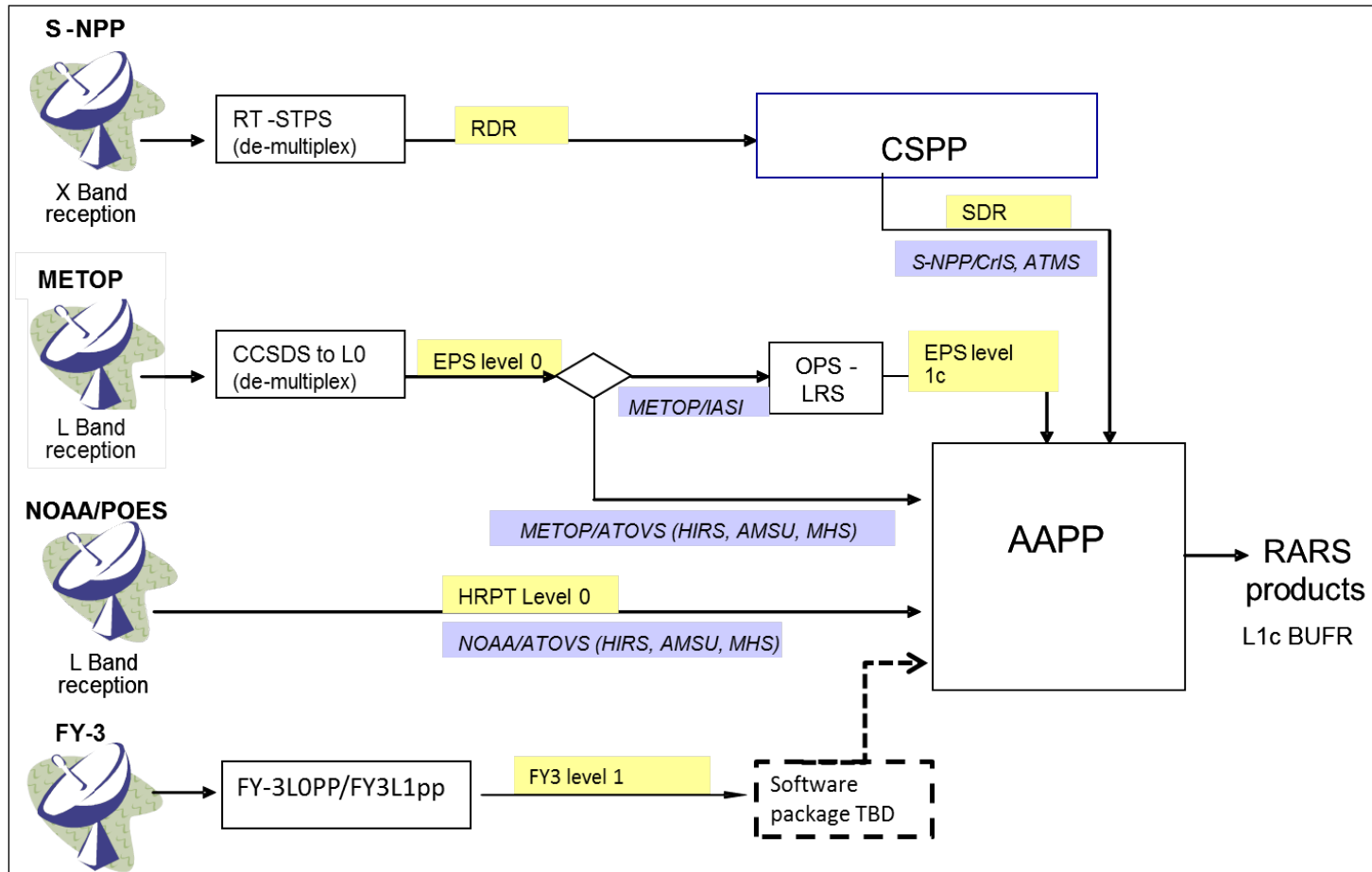


# DBNet Areas of harmonisation/standardisation

1. DBNet Network Management
  - Operational monitoring
  - Implementation planning
  - User information
2. Common DBNet Standards and Recommended Practices
  - Acquisition
  - Product Processing (AAPP, CSPP etc.)
  - Product Coding, Format and Distribution
  - DBNet Product Registration and Discovery
3. Specific Standards for Groups of DBNet Services
  - IR/MW sounding
  - IR/VIS imaging service
  - High Resolution Sounding
  - Scatterometry



# Common processing software and orbital elements for product consistency

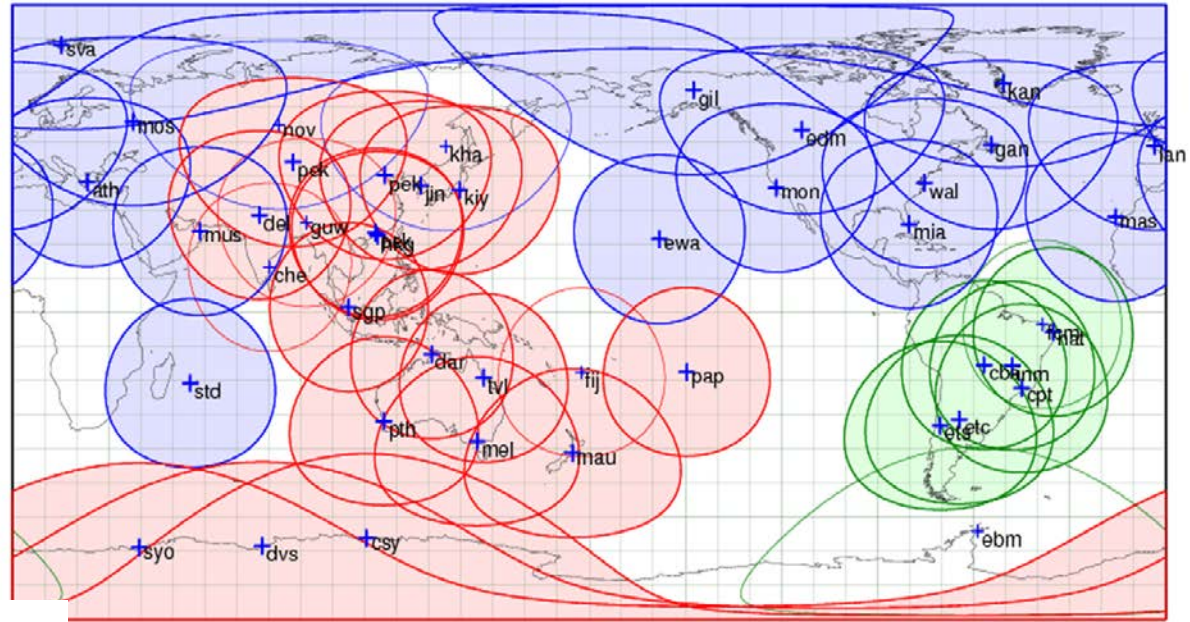


# DBNet (potential coverage)

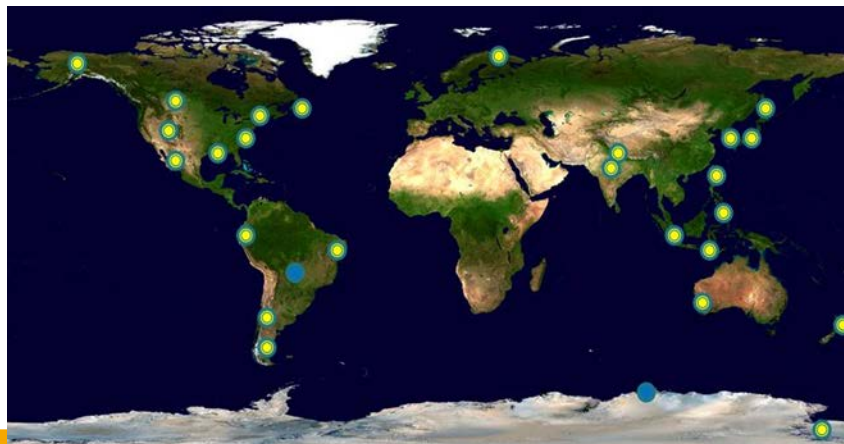
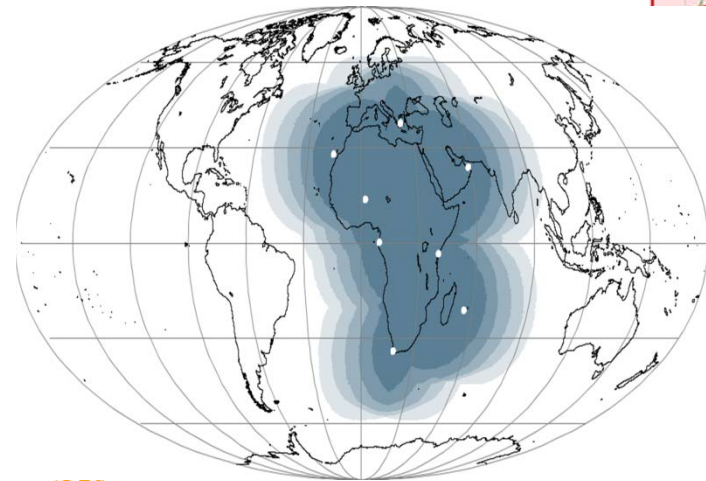
Current RARS network  
(ATOVS)

+ upgrade to X-band  
+ New US stations

Potential RARS Africa  
(ACMAD)



as of 2014/07/18



Potential collaborative sites  
(Seaspace NPP)



# Towards a Guide on DBNet

- Based on the outcome of the Coordination Group meeting in March, a Guide to DBNet is being developed to record the DBNet specifications, standard practices, and coordination mechanisms
- Progress will be reported to CGMS-43 (May 2015)
- Complete draft by June 2015
- To be presented to ITSC-20 and APSDEU-NAEDEX (Oct 2015)
- Final version submitted to WMO Commission for Basic Systems (2016)
- Draft will serve as reference for implementing the most mature DBNet services
- Sections on future services can be finalized later
- It should be a living document.



# DBNet Implementation

- NOAA and EUMETSAT will integrate the US DBRTN project as a component of DBNet
- DBNet Coordination Group should meet annually and hold virtual meetings as necessary.
  - Will address current RARS issues to improve product availability e.g. Higher priority to NOAA-18 than NOAA-15 in reception scheduling
  - Compatibility of RARS and DBRTN BUFR products for IASI and CrIS
  - CGMS Task Team on Metadata to define discovery metadata for DBNet
  - Operators to complete registration of DBNet products with WIS
  - Analyse with APSDEU-NAEDEX (Oct. 2015) the request for data exchange through WIS (originating centers, NWP users, data profile, volume and timeliness)
  - Liaise with RARS-Africa project, led by ACMAD and supported by EUM





# Conclusions

- RARS has been a highly successful initiative, now operationally receiving, processing and distributing ATOVS data covering 84% of the earth surface
- Based on the successful RARS partnership, DBNet provides the framework for providing services based on new sensors (IASI, CrIS, ATMS, VIIRS, MWTS, MWHS, IRAS, HIRAS,...) and fully integrating the US DB initiative
- The DBNet coordination group has been established to drive forward the DBNet implementation and further consolidate the existing ATOVS services
- CSPP is a core component of DBNet, and the efforts of the community in improving CSPP, in particular in terms of its performance, is crucial to the progress of DBNet



# Thank you for your attention!

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