World Meteorological Organization

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GRUAN-GSICS-GNSSRO “3G” WIGOS Workshop and Follow-Up

Stephan Bojinski, Greg Bodeker, Peter Thorne

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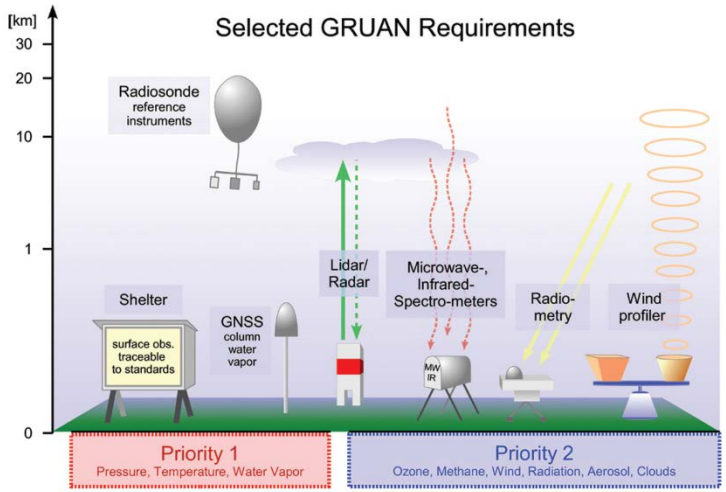
Background

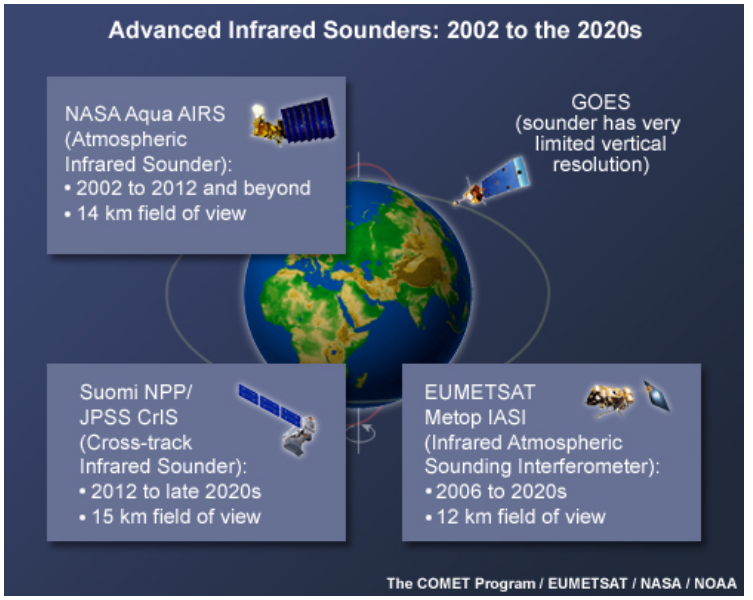
- "GRUAN-GSICS-GNSSRO WIGOS Workshop on Upper-Air Observing System Integration and Application"
- 6-8 May 2014, WMO HQ, Geneva, Switzerland
- Experts, by invitation only

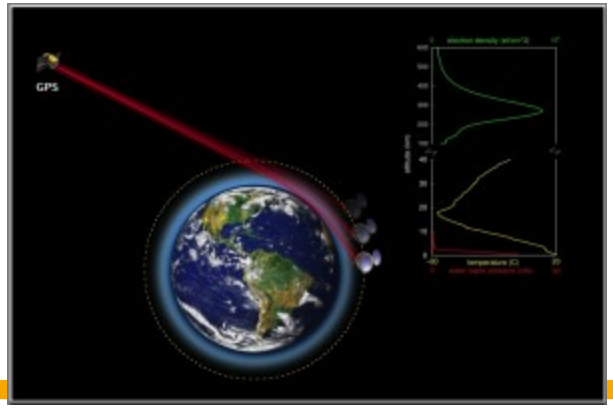
- Objectives
  - Identify measures to better connect GRUAN with the satellite community
  - Compare methods of measurement uncertainty estimation
  - Provide guidance for how the various observing systems and datasets can better serve meteorological and climate applications
  - Develop recommendations for future observing system design

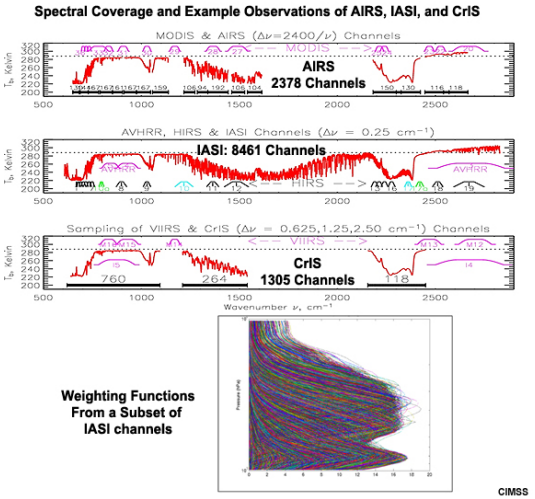
- Addressing key areas for WIGOS Implementation (Ref: WIP v2.0):
  "Inform the development of guidance for sharing operational experiences, expertise, and joint exploitation of resources"

- Workshop framed as a WIGOS "case study" in this regard; benefited from WIGOS Project Office funding


Selected GRUAN Requirements
[km]
30
20
10
1
0
Radiosonde
reference
instruments
Shelter
surface obs.
traceable
to standards
GNSS
column
water
vapor
Lidar/
Radar
Microwave-,
Infrared-
Spectro-meters
MW
IR
Radio-
metry
Wind
profiler
Priority 1
Pressure, Temperature, Water Vapor
Priority 2
Ozone, Methane, Wind, Radiation, Aerosol, Clouds


Advanced Infrared Sounders: 2002 to the 2020s
NASA Aqua AIRS
(Atmospheric
Infrared Sounder):
• 2002 to 2012 and beyond
• 14 km field of view
GOES
(sounder has very
limited vertical
resolution)
Suomi NPP/
JPSS CrIS
(Cross-track
Infrared Sounder):
• 2012 to late 2020s
• 15 km field of view
EUMETSAT
Metop IASI
(Infrared Atmospheric
Sounding Interferometer):
• 2006 to 2020s
• 12 km field of view
The COMET Program / EUMETSAT / NASA / NOAA


GPS


Spectral Coverage and Example Observations of AIRS, IASI, and CrIS
MODIS & AIRS (Δν=2400/ν) Channels
AIRS
2378 Channels
AVHRR, HIRS & IASI Channels (Δν = 0.25 cm⁻¹)
IASI: 8461 Channels
Sampling of VIIRS & CrIS (Δν = 0.625,1.25,2.50 cm⁻¹) Channels
CrIS
1305 Channels
Wavenumber ν, cm⁻¹
Weighting Functions
From a Subset of
IASI channels
CIMSS

Participants (22)

Greg Bodeker (Bodeker Scientific)
Bojan Bojkov (ESA)
Xavier Calbet (EUMETSAT)
Alaor Moacyr Dall'Antonia (INMET, Brazil)
Martine de Mazière (BIRA-IASB, Belgium)
John Dykema (Harvard U, USA)
John Eyre (UK MetOffice)
Sean Healy (ECMWF)
Tim Hewison (EUMETSAT)
Gottfried Kirchengast (U Graz, Austria)
Anthony Mannucci (NASA JPL, USA)
Tony Reale (NOAA NESDIS, USA)
Adrian Simmons (ECMWF)
Peter Thorne (NERSC, Norway)
Holger Vömel (DWD, Germany)
Axel von Engeln (EUMETSAT)
Mario Matricardi (ECMWF, by phone)
Larrabee Strow (U Maryland, USA, by phone)

Stephan Bojinski (WMO)
Jérôme Lafeuille (WMO)
Anna Mikalsen (WMO/GCOS)
Lars Peter Riishojgaard (WMO)

Agenda

1. Introductory position statements
2. WMO observing system planning
3. Applications of upper-air observations
   - Climate monitoring
   - Climate process studies
   - NWP
   - Reanalysis
4. Observing systems: principles, practices, uncertainties
   - GRUAN, Hyperspectral sounding/GSICS, GNSSRO
5. Focussed discussion on:
   - Application requirements for datasets
   - Measurement uncertainty estimation and terminology
   - Observing system coordination and collocation
   - Participation and outreach

Output

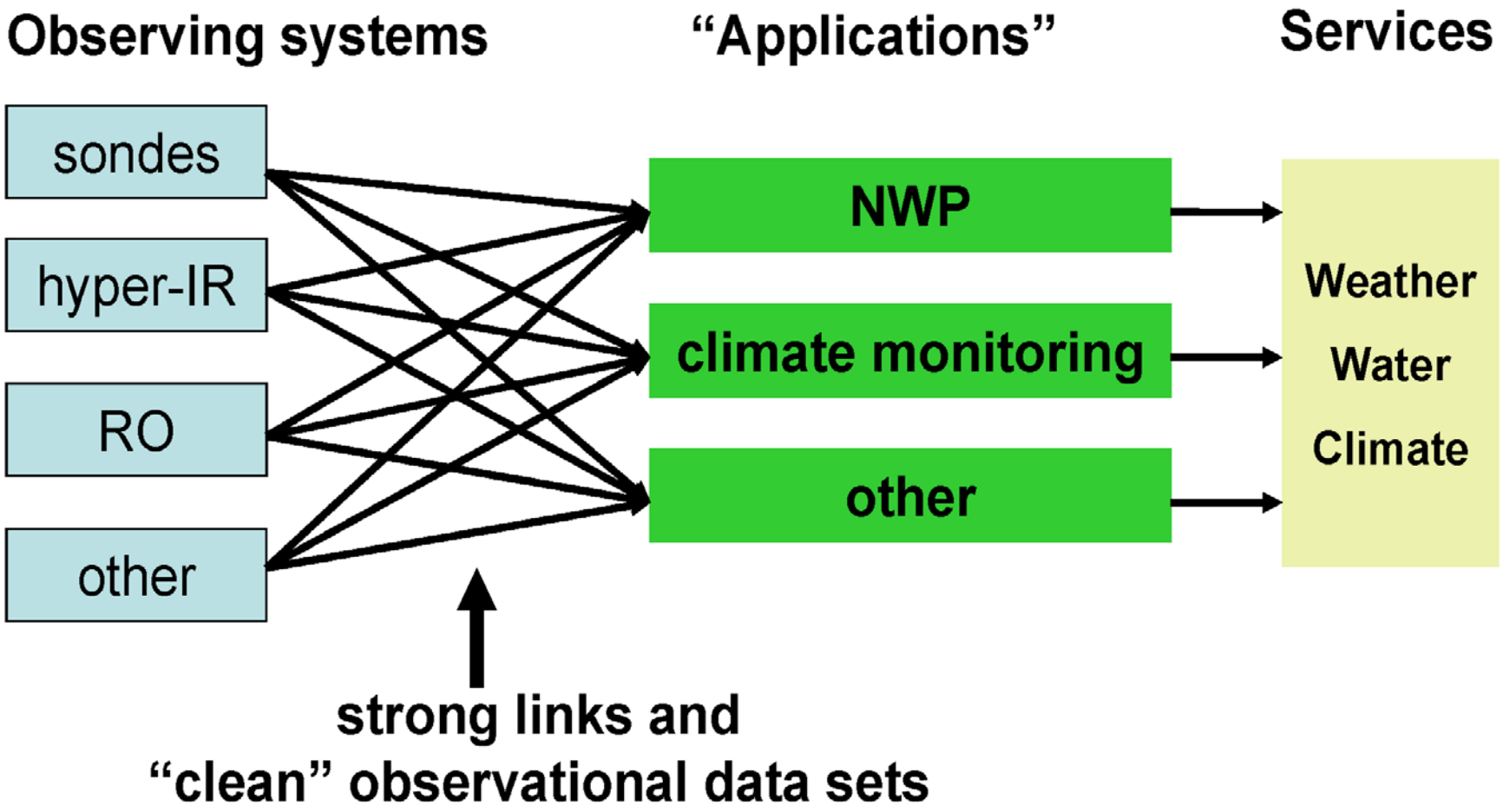
- 20 Recommendations, at technical and strategic level
- Workshop report http://www.wmo.int/pages/prog/www/WIGOS-WIS/reports/3G-WIGOS-WS2014.pdf
- Workshop summary http://docs.lib.noaa.gov/noaa_documents/NESDIS/GSICS_quarterly/v8_no2_2014.pdf
- Follow-Up Action (checkpoint: 26 Nov 2014)

Discussion highlights

- Goal: resilient and cost-effective overall observing system, best serving applications: “3G” contributes to this end
- GRUAN to demonstrate its value to applications now (and not in 30 years..)
- Importance of independent reference (“anchor”) datasets recognized in climate and NWP applications
- These can help improve utility and quality of other observations such as GUAN (demonstration needed)
- What is the benefit for my country in hosting a GRUAN station? (Brazil)
- Consistent uncertainty estimation and terminology recommended across the 3G: comparability is important, and uncertainty information has many users

Discussion highlights

- 3G should in principle be maintained and QC'd independent from each other
- GRUAN data may be useful to calibrate satellite MW sensors since there is no obvious on-orbit reference (in GSICS)
- NWP want single-source datasets with uncertainties, not combined 2G/3G observation datasets
- Uncertainty in spectroscopic libraries used in RT can affect observation uncertainty estimates (error covariance matrix); although significant effect in some bands (WV), who owns the problem?
- Representativeness, collocation, point2area…



"Integration" in the sense of the WMO Vision for 2015
means strong links between observing systems and application communities

Action highlights (all ongoing)

- GRUAN best practices in using uncertainty terminology have been circulated with other communities (3G-5)
- Prediction tool for availability of RO profiles in space/time useful for dedicated observations/launches (3G-7; see separate talk by Axel von Engeln)
- Intercomparison of methods to estimate collocation uncertainties based on data from “3G”, NWP fields, SASBEs over 4 GRUAN sites (3G-9)
- Study has been commissioned on characterizing radiosonde temperature biases and errors using RO measurements and NWP background fields (EUMETSAT ROM SAF Visiting Scientist, TBD) (3G-11)
- …

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Thank you for your attention

sbojinski@wmo.int

www.wmo.int/sat

Workshop Organizing Committee

- Greg Bodeker
- Stephan Bojinski
- Bojan Bojkov
- Xavier Calbet
- John Dykema
- John Eyre
- Tony Mannucci
- Peter Thorne
- Holger Vömel