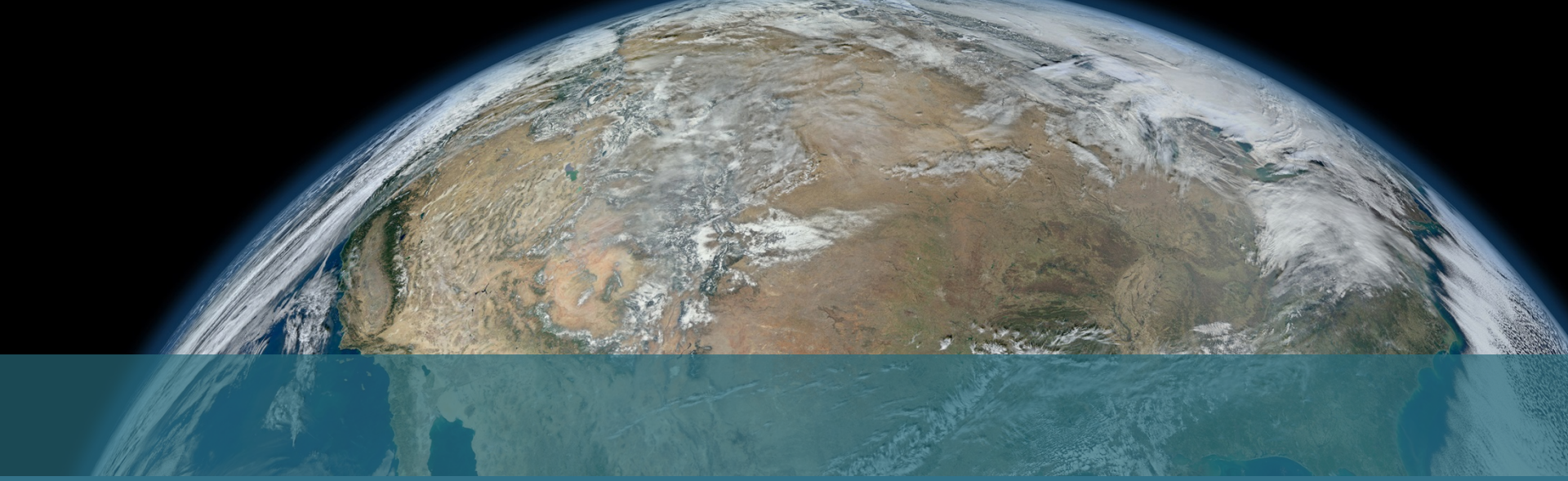


Perspective from SCOPE-CM

Ed Kearns
Chief, Weather Science Division, Center for Weather and Climate
NOAA's National Centers for Environmental Information

August 4, 2015

National Centers for Environmental Information | Center for Weather and Climate

What is SCOPE-CM?

- The aim of WMO's Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) is to enable a network of facilities ensuring continuous and sustained provision of high-quality dataset for climate monitoring.

- The foundation of SCOPE-CM is the network of relevant space agencies and other organizations (including GSICS) with the aim to develop, extend and preserve the capabilities and skills of generating and re-generating Climate Data Records (CDR).

- International, cooperative, satellite-centric analog to NOAA's CDR Program.

WMO's SCOPE-CM initiative

- Coordinated international network to produce CDRs from multi-agency mission data in operational environment addressing GCOS requirements

- Current Participants of the SCOPE-CM Network
  Operational Satellite operators:
  - NOAA, JMA, CMA, EUMETSAT

  Stakeholders:
  - WMO Space Programme, GCOS, CEOS, GEO, CGMS/GSICS, WCRP/GEWEX, ESA (observer)

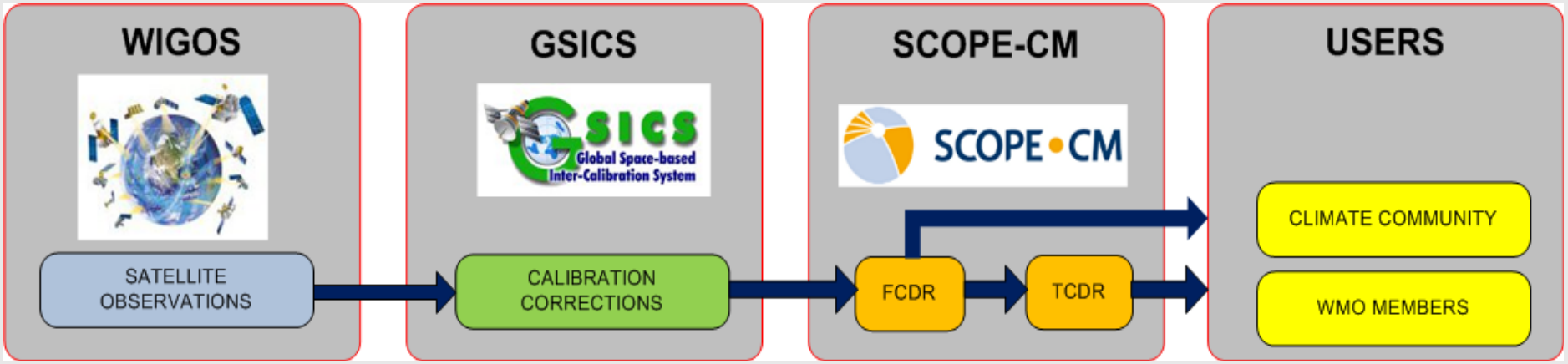
SCOPE-CM Executive Panel Members

Chair:	John Bates → Ed Kearns (NOAA NCEI) - 07/2014
CEOS:	Kerry Sawyer (NOAA) → Jono Ross (Geosc. Australia) - 12/2014
CGMS/GSICS:	Mitch Goldberg (NOAA NESDIS)
CMA:	Naimeng Lu
ESA observer:	Pascal Lecomte
EUMETSAT/SAF:	Lothar Schueller (EUMETSAT)
GCOS:	Robert Husband (WMO)
GEO observer:	Espen Volden → Andre Obregon - 11/2014
JMA:	Toshiyuki Kurino -> Arata Okuyama - 03/2015
NOAA:	John Bates → Ed Kearns (NOAA NCEI) - 07/2014
WCPR/GEWEX:	Joerg Schulz
WMO:	Stephan Bojinski

SCOPE•CM

Conceptual view of the end-to-end system for the exploitation of satellite observations for climate monitoring

SCOPE-CM is one component of an end-to-end system with the **final objective of climate monitoring** having the satellite observations represented by the WMO Integrated Global Observing System at one end and the CDR user community at the other end.



CDR is defined as a time series of measurements of sufficient length, consistency, and continuity to determine climate variability and change.

SCOPE•CM

SCOPE-CM is now a two-phased project

- **Phase 1** – Establishing international collaborations
  → successfully completed

- **Phase 2** – Sustained production of Climate Data Records
  → in progress…group is working and evaluating

SCOPE•CM

Phase 2: Sustained production of CDRs

Objectives:

- Establish a systematic approach to increase the sustainability (maturity) of CDR generation capabilities;
- Establish structures for sustainable generation of Fundamental CDRs and Thematic CDRs.

Mechanisms:

- Initiate Phase-2 projects and generate SCOPE-CM CDR products;
- Increase coverage of products in terms of ECVs, time and spatial dimension;
- Foster extension of the network to additional partners.

Benefits for space agencies (and associated institutes):

- Ensures their role in the field of climate data stewardship;
- Improves their capacity to deliver data services for Global Climate Services;
- Improves their capacity to serve the scientific community.
- Serves their nation's and international user requirements

SCOPE•CM

Phase 2, continued – Sustained production of CDRs

- Advance the maturity of projects' CDRs
- Call for new collaborative projects, from new partners
  - include land, ocean, cryosphere
  - E.g. a LST collaboration?
- Consider feasibility of ICDRs to meet emerging requirements – latency, quality – as a <u>secondary</u> concern
- Seek efficiencies in CDR production through collaborations

SCOPE•CM

SCOPE-CM projects running in phase 2

- 10 projects are part of phase 2.
- 9 projects are actively proceeding.

→ 3 generating FCDRs

→ 8 generating atmospheric TCDRs

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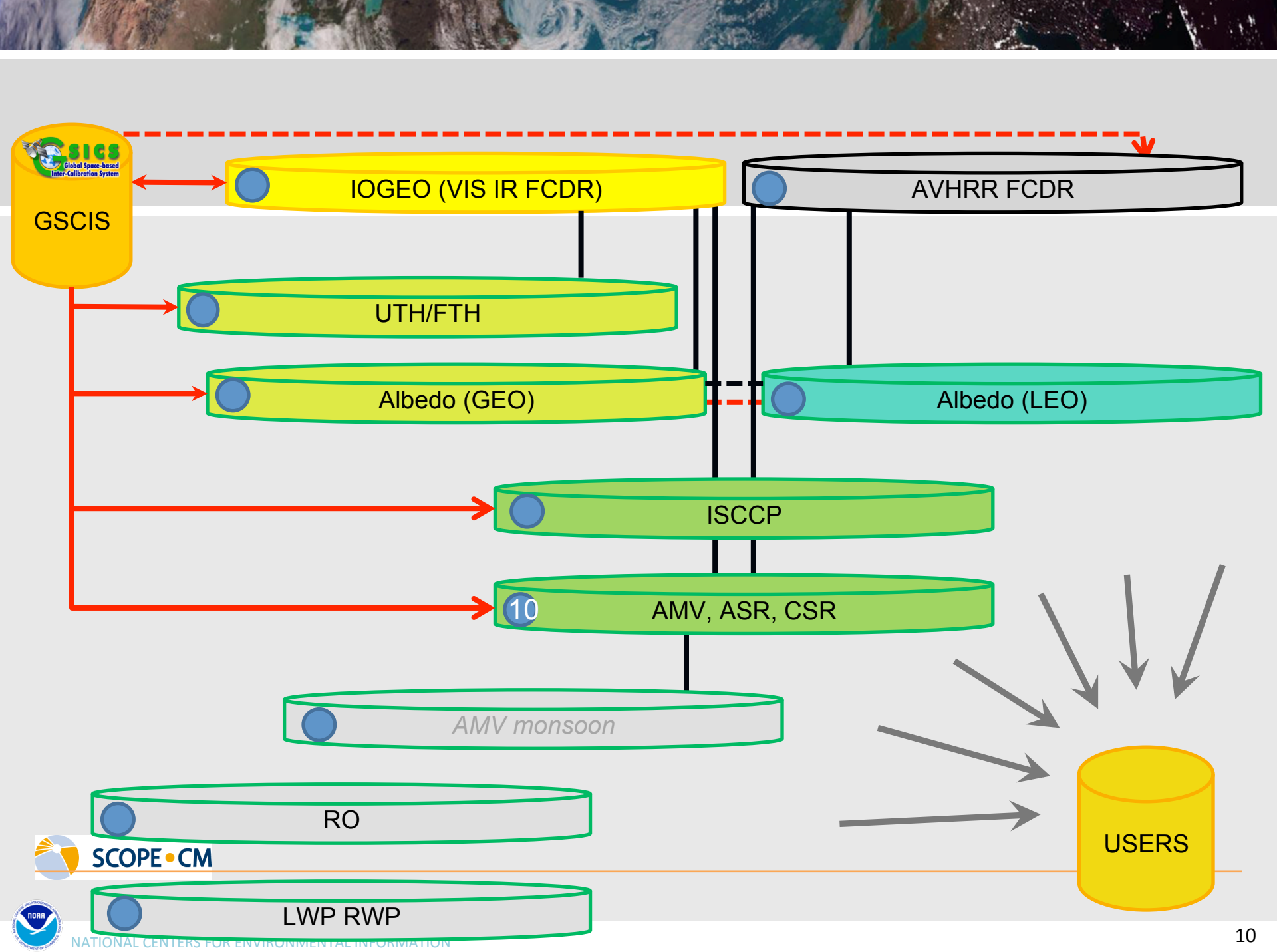

GSCIS
IOGEO (VIS IR FCDR)
AVHRR FCDR
UTH/FTH
Albedo (GEO)
Albedo (LEO)
ISCCP
10
AMV, ASR, CSR
AMV monsoon
RO
LWP RWP
USERS
SCOPE•CM
NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION

FCDRs addressed in Phase 2 projects

(5+ year project)

AVHRR GAC
MODIS
HIRS

EUMETSAT CM-SAF
(SMHI, KNMI)
NOAA/NESDIS
ESA-CLOUD-CCI
ESA-SST-CCI

5

Improved
AVHRR FCDR

(5 year project)

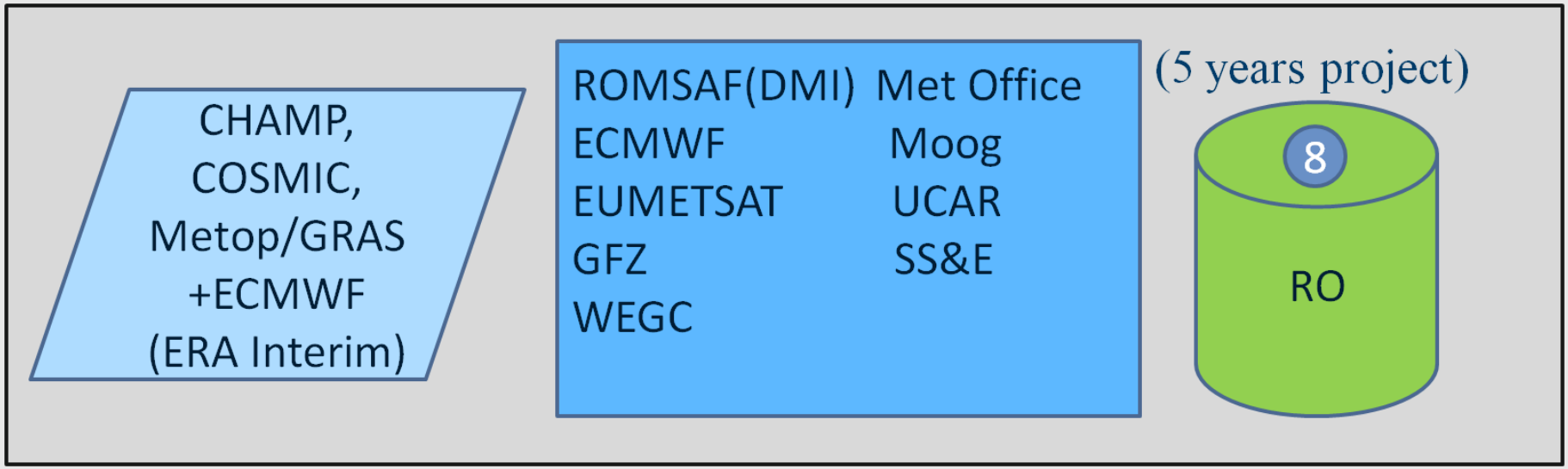
HIRS,AIRS,IA
SIMETEOSAT
GOES
MTSAT
FY-2

EUMETSAT
CM-SAF (DWD)
NOAA NCDC
JMA
CMA
(*IMD, NASA*)

6

GEO FCDR
(VIS, IR, WV)

FCDRs addressed in phase 2 projects…continued



SCOPE-CM is now considering….

- What strategic direction to adopt for the next phases of SCOPE-CM
- Evaluate its tactical progress through the maturity assessment of CDR generation projects
- How might SCOPE-CM encompass more aspects of operational climate monitoring
  - –Input from Deke Arndt (NOAA) and Rainer Hollman (CM SAF)
  - –Monitoring needs – data latency, consistency
    - “interim CDRs” within future sustainment activities?
  - –In situ versus satellite data for monitoring
  - –Demand for uncertainties; climatologies

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Questions

NOAA's National Centers for Environmental Information

www.ncei.noaa.gov
www.climate.gov

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NCEI Ocean & Geophysics Facebook: http://www.facebook.com/NOAANCEIoceangeo
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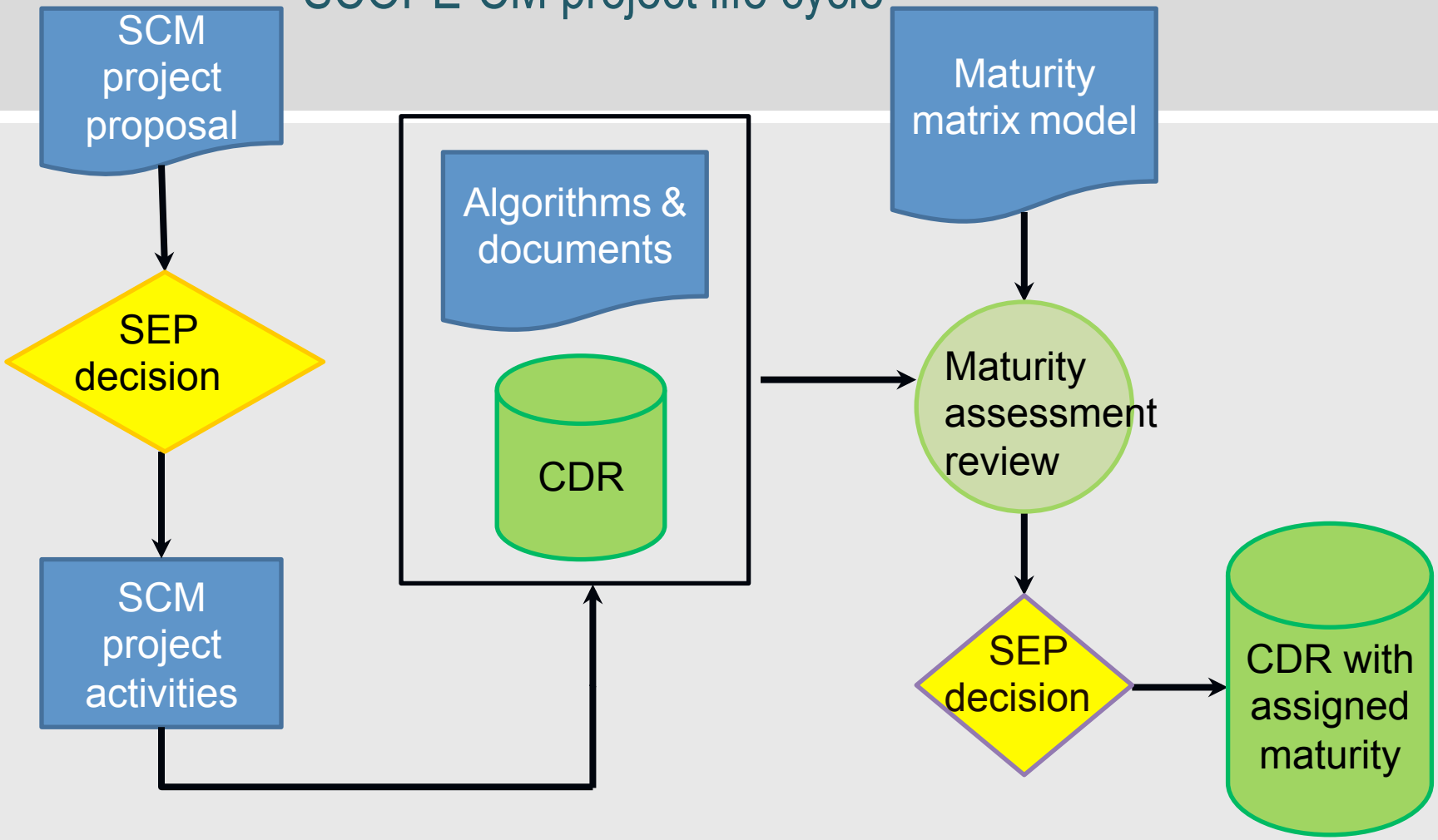
NCEI Ocean & Geophysics Twitter (@NOAANCEIocngeo): http://www.twitter.com/NOAANCEIocngeo

SCOPE-CM project life cycle



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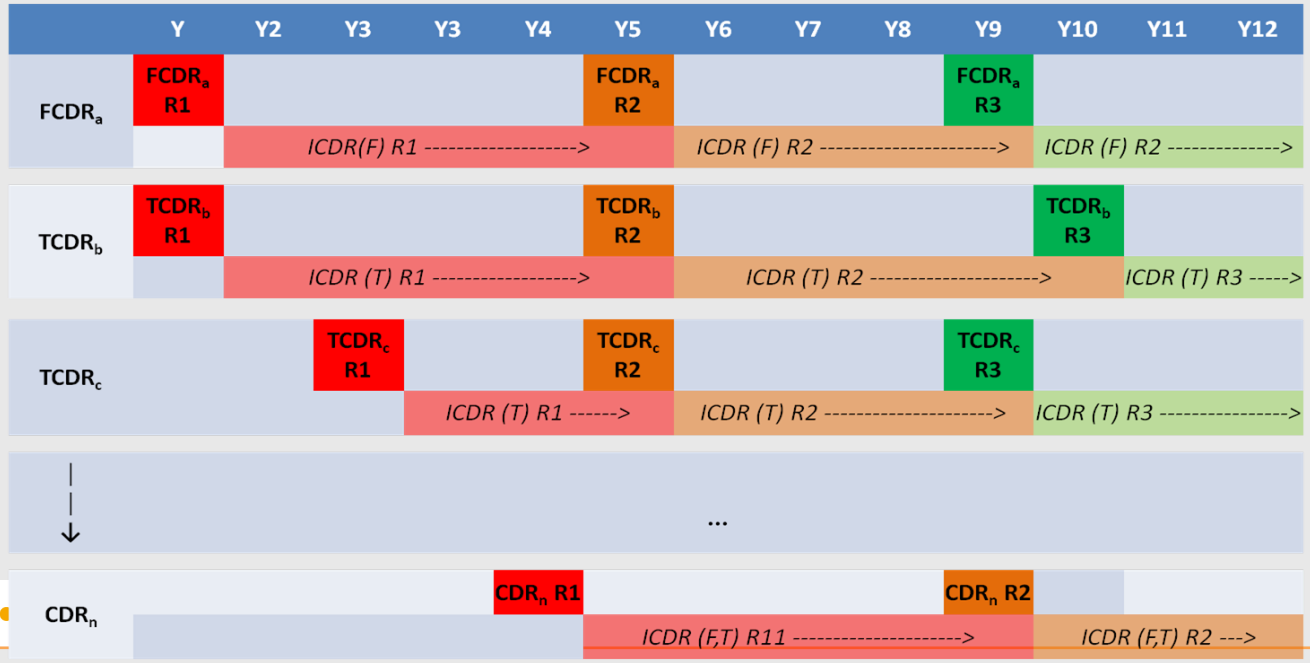
How to meet requirements for climate monitoring?

- Input from Deke Arndt (NOAA) and Rainer Hollman (CM SAF)
- Monitoring needs – data latency, consistency
- In situ versus satellite data for monitoring
- Demand for uncertainties; climatologies



FCDR INVENTORY

CGMS-WG Climate noted that it is carrying an action for the CGMS Plenary in May regarding the pilot FCDR inventory:

- **Conduct an initial analysis of available FCDRs past and current available for or planned for use in the current set of SCOPE-CM projects using CEOS, CGMS, and WMO satellite data bases;**
- **Identify SCOPE-CM ECV projects that are or may be able to use the above FCDRs;**
- **Assess availability of the above FCDRs for the future;**
- **Following the first ECV gap analysis, consider FCDRs that may be useful in assessing ECV opportunities in the future ECV gap analysis**.

The SCOPE-CM Projects are developing 3 FCDRs that will both have a useful past record and are sustainable given the anticipated observing system of the future:

1. GEO-Ring IR and Visible FCDR (30+ years)
2. AVHRR IR and Visible FCDR (30+ years)
3. RO Bending Angles (13 years)

There are also a number of other FCDRs from SCOPE-CM collaborators that are available but not as SCOPE-CM collaborative products (e.g. HIRS Ch 12 BT, SSMI-SSMI/S).

The SCOPE-CM ECVs/TCDRs that depend on these include many from ISSCP, albedo, UTH, etc. but there are many more candidates (LST, SST, sea ice, snow cover). We can help call these out in the WG Climate analysis.

SCOPE-CM will make a request to CGMS for continued support for operational production, access to additional data (e.g. Indian Ocean GEO data) to close gaps in coverage, and…? Will consult team.

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Is the software robust and maintainable?

Are the data and methods well documented?

Has the uncertainty of the data been systematically assessed?

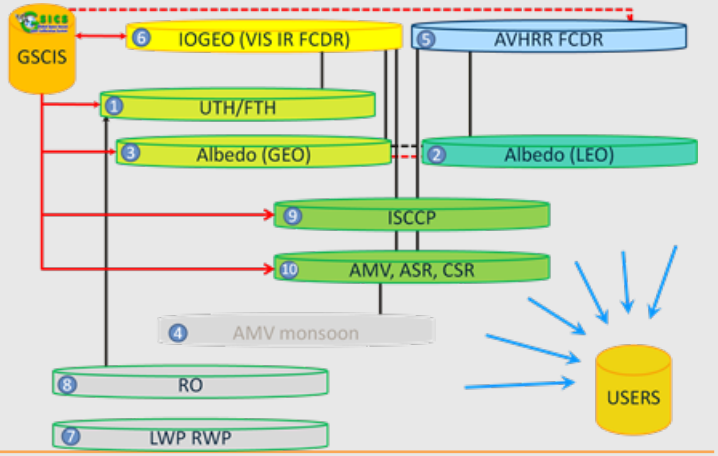
Are data well used and user feedbacks taken care of?

Software readiness	Metadata	User documentation	Uncertainty Characterisation	Public Access, Feedback and Update	Usage
Are the codes compliant with standards, stable, portable and reproducible?	Do the metadata meet international standards, and allow provenance tracking?	Are the formal documents and peer-reviewed papers up-to-date and public?	Are the uncertainties assessed systematically in a standard manner?	Are the data, source code, and documents publicly available and regularly updated?	Are the data widely used in the scientific, and decision and policy making communities?

The MM does not describe the CDR quality per se, **but the quality of the CDR generation capabilities with respect to its sustainability**. The quality of the CDR depends on the intended application.

SCOPE•CM

- **SCOPE-CM Meeting March 23-24, 2015 at WMO headquarters in Geneva, Switzerland.**
- The Executive Panel of the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) group held its annual meeting on March 23-24, 2015 at the World Meteorological Organization's (WMO) headquarters in Geneva, Switzerland. The SCOPE-CM effort (http://www.scope-cm.org/) incorporates international experts and facilities to promote the continuous and sustained provision of high-quality datasets from satellites for climate monitoring. The SCOPE-CM Executive Panel met with the objective to continue to facilitate development of a network of national space agencies, in coordination with other organizations including the WMO, the Coordination Group for Meteorological Satellites (CGMS), and the Global Space-based Inter-Calibration System (GSICS), in order to develop, extend and preserve the operational generation of Climate Data Records (CDRs). The SCOPE-CM group has been active since 2008 and is now in its second phase, the objectives of which are to establish a systematic approach to increase the sustainability and maturity of CDR generation capabilities and to promote structures for the sustainable generation of Fundamental and Thematic CDRs (FCDRs and TCDRs, see Figure 1). The meeting agenda included presentation of initial results and progress updates from the nine active, coordinated projects in this phase, which are focused on the ability to sustain the generation of FCDRs from polar orbiters and geostationary satellites, as well as the generation of TCDRs including atmospheric wind vectors, upper tropospheric humidity, surface albedo, water vapor, liquid water path, and radio occultation products. The Panel recognized the significant investments of in-kind resources for this effort are being contributed by the SCOPE-CM partners, including the CMA, EUMETSAT, JMA, and NOAA.
- The agenda also included a strategic discussion of future directions, for SCOPE-CM's third phase and beyond. The current SCOPE-CM is not yet an operational entity, but is building towards one under the Panel's guidance. The Executive Panel agreed that SCOPE-CM will continue to generate and elevate the maturity of key CDRs and welcome new international partners; the Chair will extend invitations for new SCOPE-CM partners prior to the next meeting. The Panel also agreed that both the active engagement of international CDR experts and access to as many existing operational satellite data sets as possible are essential to the ultimate success of the effort. While much of the meeting's discussion was focused on the techniques, processes, data, and associated best practices required for sustained production of high quality CDRs, the Panel and its WMO hosts also found that near-realtime "interim CDRs" (iCDRs) are likely to emerge in the future as one of the key observation components needed for the timely provision of climate services. The Panel considered the impacts of such reduced latency requirements for many operational climate information products, and concluded these should be considered as future, emerging challenges by each individual project.
- ***Figure 1:*** *Conceptual view on SCOPE-CM project interactions for geostationary (GEO) visible and infrared imagery and polar low-earth orbit (LEO) satellite data sets. The relations among SCOPE-CM's nine active projects are depicted, including those for Upper Tropospheric Humidity (UTH), the International Satellite Cloud Climatology Project (ISCCP), and Atmospheric Motion Vectors (AMV), as well as Radio Occultation (RO) and Liquid Water Path (LWP) projects.*
- Dr. Edward J. Kearns NOAA/NESDIS and Dr. Marie Doutriaux-Boucher EUMETSAT http://www.scope-cm.org/



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