COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

- CGMS –

presented by Jörg Schulz
EUMETSAT

Coordination Group for Meteorological Satellites

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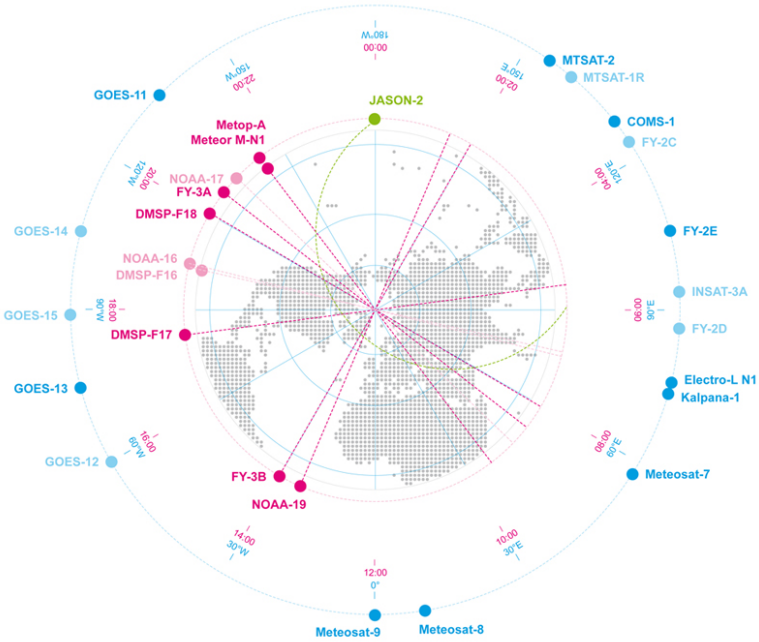
Coordination Group for Meteorological Satellites - CGMS

CGMS:

The Coordination on Geostationary Meteorological Satellites was initially created in 1972 to consider common interests relating to the design, operation and use of planned meteorological satellites.

The name was later changed to the Coordination Group for Meteorological Satellites to include low-Earth orbit satellites and the activities are governed by a Charter.

The CGMS meets in plenary session on an annual basis following meetings of four Working Groups on telecommunication, satellite data and products, operational continuity and contingency planning, and global data dissemination respectively.



Members:

Members are those organisations and space agencies that are current and prospective developers and operators of meteorological satellites ; Space agencies operating R&D satellites contributing to WMO programmes; WMO, because of its unique role as representative of the world meteorological data user community.

<u>Current members:</u>
CMA, CNES, CNSA, ESA, EUMETSAT (CGMS Secretariat since 1987), IMD, IOC/UNESCO, JAXA, JMA, KMA, NASA, NOAA, ROSCOSMOS, ROSHYDROMET, and WMO

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The objectives of CGMS are formalised within its Charter:

- To provide an international forum for the exchange of technical information on geostationary and polar-orbiting meteorological satellite systems and research & development missions, such as reporting on current meteorological satellite status and future plans, telecommunications matters, operations, intercalibration of sensors, processing algorithms, products and their validation, data transmission formats and future data transmission standards.

- To harmonise meteorological satellite mission parameters (such as orbits, sensors, data formats and downlink frequencies) to the greatest extent possible.

- To encourage complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning, compatible meteorological data products and services and the coordination of space and data-related activities, thus complementing the work of other international satellite coordinating mechanisms.

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Examples of CGMS achievements:

- Establishment of a global back-up framework (contingency planning) - the concept of **"helping thy neighbour"** e.g. manoeuvring an available satellite to a different location to support satellite observations. In the 1980s NOAA's GOES-4 satellite successfully supported the Meteosat DCS that had run into difficulties. Later in the early 1990s, Meteosat-3 was moved to a position over the Western Atlantic to support NOAA to perform an operational imaging mission vital for hurricane observations. This established partnership continued in 2003 when NOAA supported JMA with GOES-9 to perform operational imaging after retiring GMS-5 and before the availability of MTSAT-1;

- The close cooperation of CGMS leads to an optimisation and coordinated enhancement of the WMO Global Observing System (WIGOS). CGMS operators inter alia adopted the WMO vision for the GOS to 2025;

- Standardisation of data dissemination formats and coordinated planning for the analogue to digital transition;

- Development of a common standard for the International Data Collection System (IDCS);

- Development of an integrated strategy for data dissemination and data exchange (GTS, Internet, ADM, GEONETCast...);

- Coordinated activities toward protection of radio frequencies;

- Development of a coordinated approach to calibration and intercalibration (Global Space-based Inter-calibration System – GSICS);

- Promotion and development of a coordinated framework for generating climate data records from space observations (SCOPE-CM);

- Overarching framework for science development and the improvement and utilisation of satellite products through International Science Working Groups that interact with CGMS (the International TOVS Working Group - addressing satellite radiance measurements and retrievals in a broad sense; the International Winds Working Group addressing Atmospheric Motion Vectors (AMVs) and winds from satellites in general; the International Precipitation Working Group and the International Radio-occultation Working Group);

- Promotion of a common approach to archiving of data and products; and

- Promotion of training and the development of the Virtual Training Laboratory (VLab).

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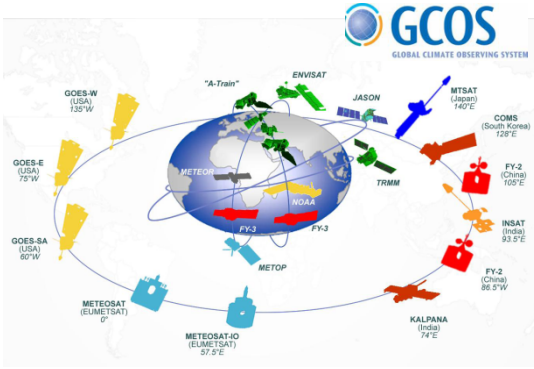
Future plans of CGMS:

- A 3-5 year high level priority plan is under preparation for endorsement by the 40th CGMS plenary meeting in November 2012.
  - One of the priorities expected to be included in the plan is a common CGMS approach in view of the space-based climate architecture contributing to the Global Framework for Climate Services in the context of WMO



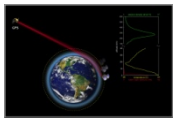
- Enhancing CGMS as a forum offering the scope for detailed technical discussions required to coordinate meteorological satellite observing systems and maximise the overall benefits for the user community.

- Enhancing the collaboration between CGMS and the international science working groups (ITWG, IPWG, IWWG, IROWG).

INTERNATIONAL ATOVS WORKING GROUP

CGMS IPWG International Precipitation Working Group

IWWG



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Further information on CGMS:

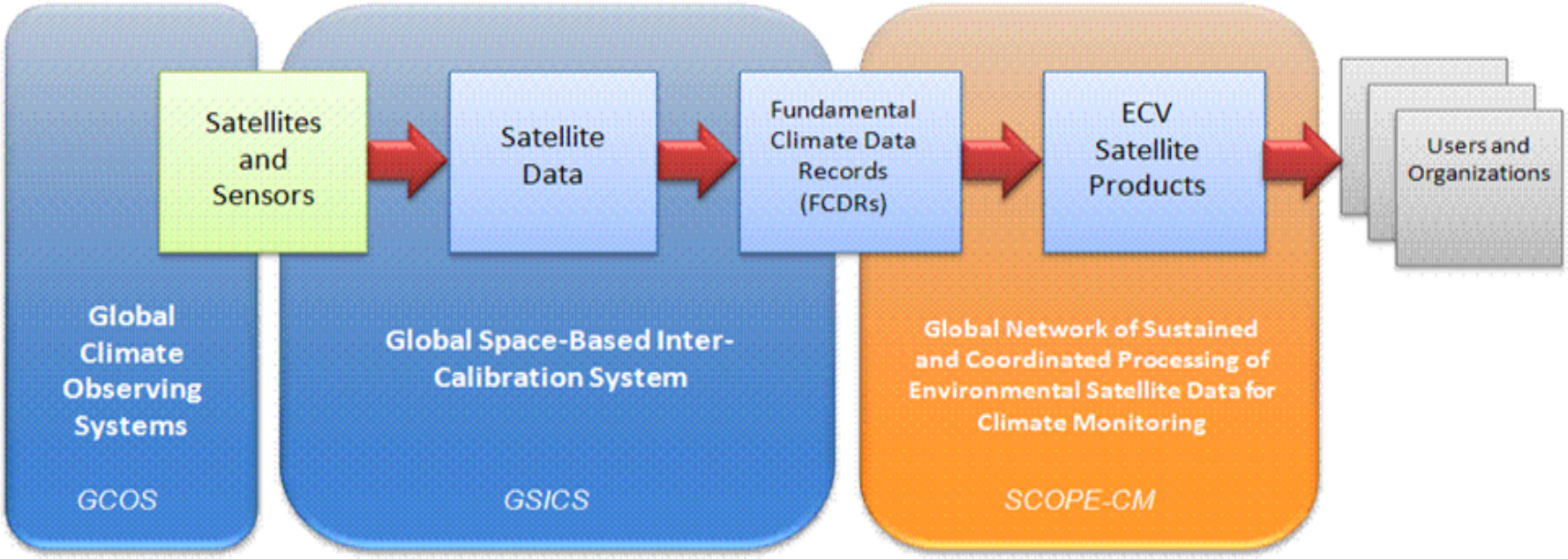
Web: www.cgms-info.org

E-mail: cgmssec@eumetsat.int

CGMS-40:
The next and 40th plenary meeting, CGMS-40, will be held in Lugano, Switzerland on 7-8 November 2012 (preceded by the four Working Groups on 5-6 November).

The meeting is hosted by WMO, the Federal Department of Foreign Affairs (FDFA) of Switzerland and the Federal Office of Meteorology and Climatology, MeteoSwiss.

Conceptual View of End-to-End Provision of ECV



The architecture for space-based for climate monitoring contributing to the Global Framework for Climate Services in the context of WMO considers the whole chain from observations to decision making.

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GSICS Global Space-based Inter-Calibration System

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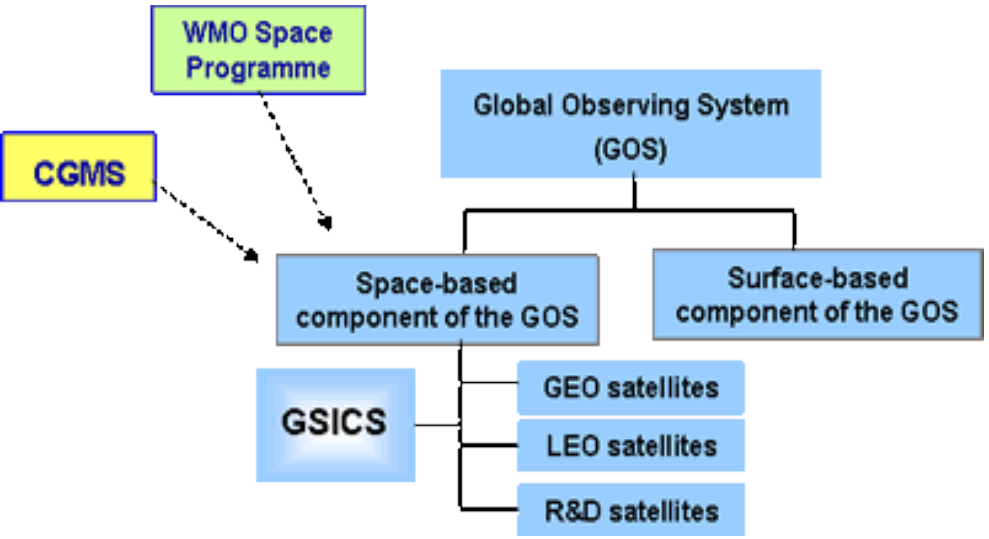
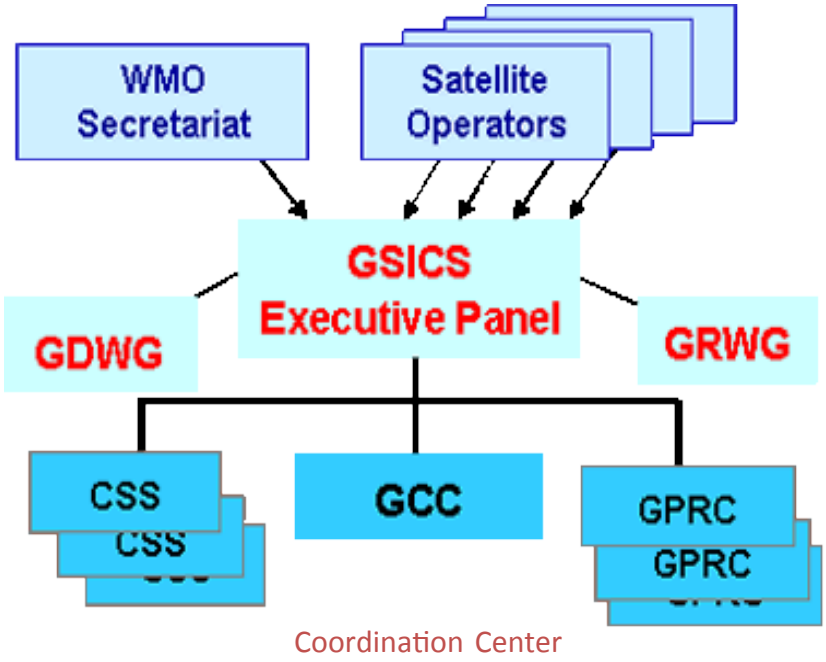
Global Space-based Inter-Calibration System

- What is GSICS? (http://gsics.wmo.int/index_en.html)
  - **G**lobal **S**pace-based **I**nter-**C**alibration **S**ystem
  - Initiative of CGMS and WMO
  - Members: CMA, CNES, EUMETSAT, ISRO, IMD, JAXA, JMA, KMA, NASA, NIST, NOAA, ROSHYDROMET, USGS, WMO; Associates: GPM X-Cal, Observers: ESA and CEOS WGCV
  - An effort to produce consistent, well-calibrated data from the international constellation of operational meteorological satellites
- What are the basic strategies of GSICS?
  - Best practices/requirements for prelaunch characterisation (with CEOS WGCV)
  - Improve on-orbit calibration by developing an integrated inter-calibration system
    - Initially by LEO-GEO and LEO-LEO inter-satellite/inter-sensor calibration
    - Double Differencing with NWP model

GSICS organization



GSICS as an element of the space-based component of the Global Observing System



Organizations contributing to GSICS: CMA, CNES, EUMETSAT, ISRO, IMD, JAXA, JMA, KMA, NASA, NIST, NOAA, ROSHYDROMET, USGS, WMO, ESA

- Overseen by GSICS Executive Panel
- Assisted by Research Working Group and Data management Working Group

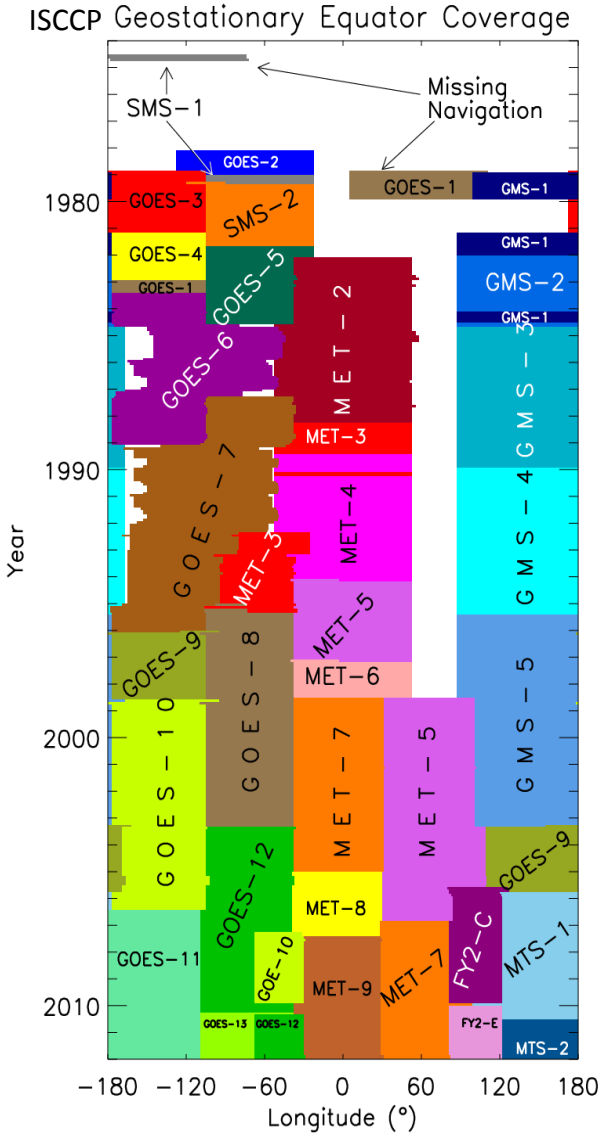
GSICS activities rely on:

- GSICS Coordination Centre (GCC)
  - operated by NOAA/NESDIS
- Processing & Research Centres (GPRC)
  - operated by each satellite operator
- Calibration Support Segments (CSS)
  - including field sites and laboratories

GSICS Outcome

- Coordinated international inter-satellite calibration program
- Exchange of critical datasets for cal/val
- Best practices/requirements for monitoring observing system performance
- Best practices/requirements for prelaunch characterisation (with CEOS WGCV)
- Establish requirements for cal/val (with CEOS WGCV)
- Advocate for benchmark systems
- Quarterly reports of observing system performance and recommended solutions
- Improved sensor characterisation
- High quality radiances for NWP & Climate

FCDR Creation - Scale of the Challenge



- International community has embarked on the creation of FCDRs for archived data (EUMETSAT, NOAA-CDR program and similar programs);
- It is essential for fulfilling GCOS ECV requirements;
- Inter-calibration of the sensors to allow seamless products is a weakness in existing data records, e.g., GEWEX data projects;
- The creation of FCDRs has a large science component calling for collaborations of space agencies and scientists **<- WCRP involvement**;
- **GSICS and SCOPE-CM are the right frameworks to make progress and achieve GCOS goals.**

Figure: Courtesy of Ken Knapp, NOAA-NCDC

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WMO's SCOPE-CM Initiative

- Coordinated international network to produce CDRs from multi-agency mission data addressing GCOS requirements;
- Current Participants of the SCOPE-CM Network;
- Operational Satellite operators:
  - NOAA, JMA, (CMA), EUMETSAT
- Stakeholder:
  - WMO Space Programme, GCOS, CEOS, CGMS/GSICS, WCRP/GEWEX, ESA (observer)
- Established structure:
  - Executive Panel and 5 pilot projects

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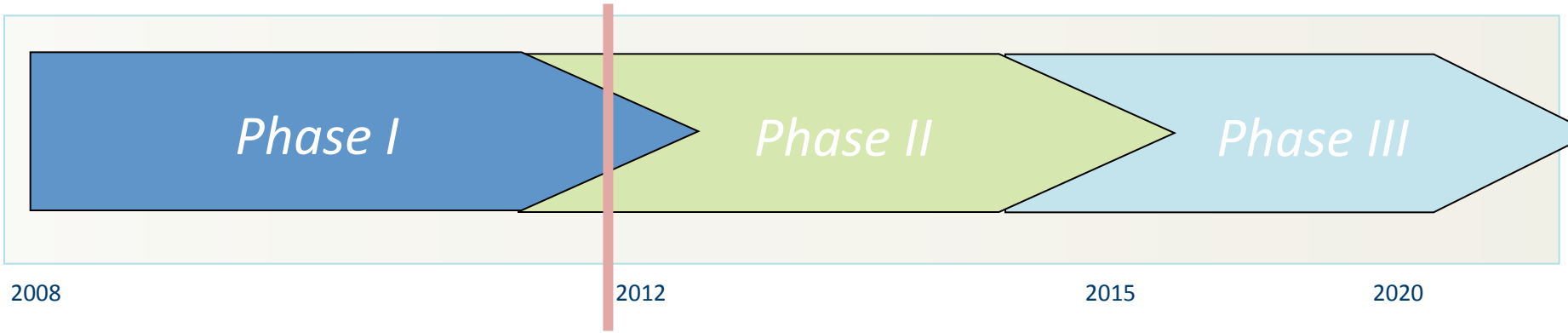
SCOPE-CM Phase-1 Pilot projects

	Sensors	*Parameters and topics*	*Lead*	*Contributors*
1	AVHRR	Clouds and Aerosols	NOAA	CM SAF
2	SSM/I	Water vapour, clouds, precipitation	CM SAF	NOAA
3	GEO	Surface albedo, clouds and aerosols	EUMETSAT	EUMETSAT, NOAA
4	GEO	Winds and clear sky radiances	EUMETSAT	EUMETSAT
5	GEO	Upper tropospheric humidity	NOAA	EUMETSAT, CM SAF

Groups at different level of integration and nature of cooperation; some pilot projects grouped by sensors, some by targeted ECV CDR.

SCOPE-CM Phasing (Phase-2 Implementation Plan)



- Establish initial network and structure;
- Agreement on principles and standards;
- First pilot projects on selected subjects;
- Assessment of the current capabilities.

- Establishment of cooperative framework for sustainable generation of high maturity FCDRs and TCDRs;
- Increased coverage of products in terms of ECVs, time and spatial dimension;
- Production of moderate and high maturity CDRs;
- Fostering extension of the network.

- Release of high maturity class CDRs;
- Review and assessment;
- Continuous improvement of processes and products.

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SCOPE-CM transition towards Phase 2: Questions and Issues

- Increasing interest from other organisations to provide science: Universities, GEWEX, ESA, ...
- Research groups to join SCOPE-CM? How?
- What are the conditions to become a member?
- What shall be the difference between a SCOPE-CM activity and any other type of research project?
- What shall be the difference and the relation to other initiatives, projects e.g. WMO GFCS, CEOS Working Group Climate, ESA CCI, GMES Climate Service, ...

Basic Elements of SCOPE-CM Phase-2

- All SCOPE-CM Projects have the high level goal to increase the maturity of a specific CDR.
- Any organization/institute can be part of a consortium (research institute, space agencies, user organization), it shall not be limited to SCOPE-CM participating organizations;
- The Maturity Model defines the conditions to be met. SCOPE-CM shall use an agreed existing terminology;
- The Maturity Model indicates the "quality" of deliverables, e.g. "peer-reviewed", "public", which implies processes which SCOPE-CM can rely on;
- Any new projects shall identify, which Maturity Level is targeted at the end of the project. This defines the required activities and deliverables.
- At SCOPE-CM level, a review called "Maturity Assessment Review“ will be organised. This review will assign a maturity level to the CDR being subject of a specific project and provides recommendation on follow-on SCOPE-CM Projects, targeting at higher maturity.

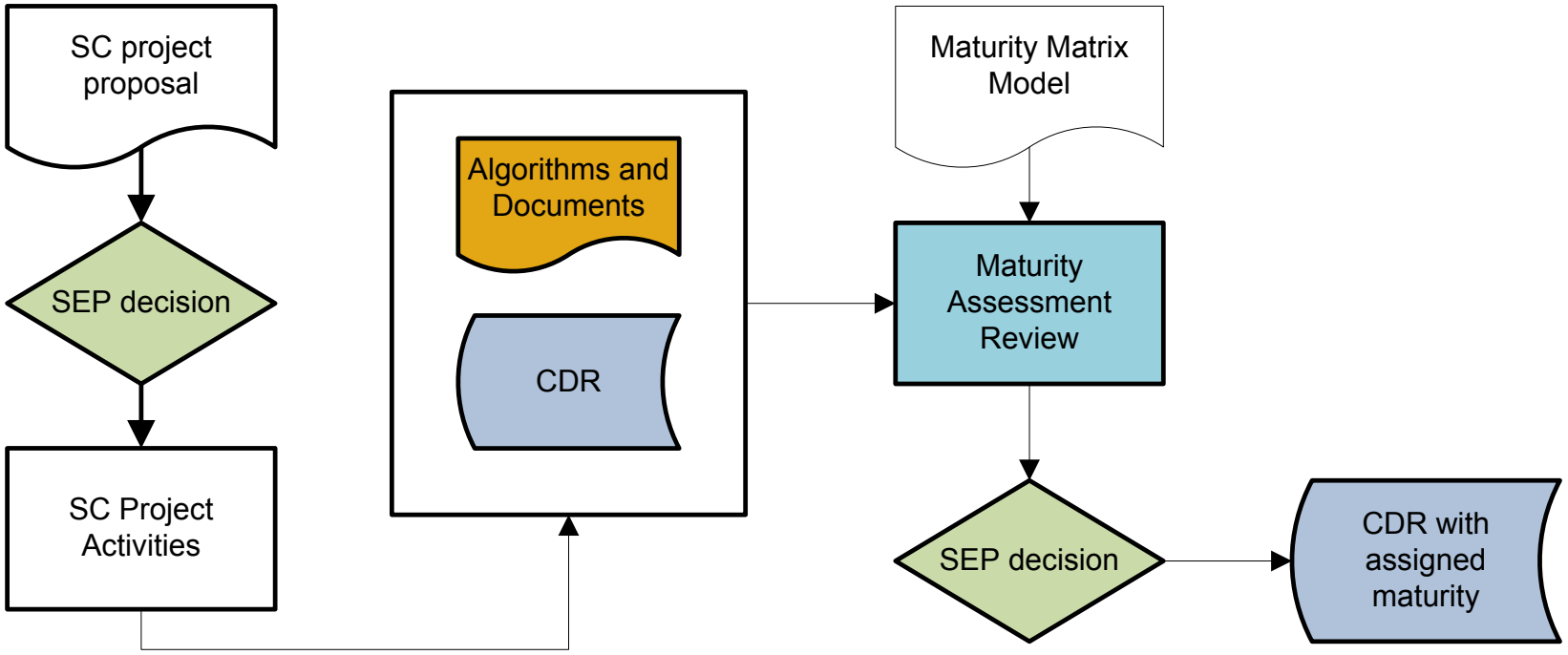
Climate Data Record Maturity Matrix Model (V4.0 from NOAA/NCDC)

Maturity	Software Readiness	Metadata	Documentation	Product Validation	Public Access	Utility
1	Conceptual development	Little or none	Draft Climate Algorithm Theoretical Basis Document (C-ATBD); paper on algorithm submitted	Little or None	Restricted to a select few	Little or none
2	Significant code changes expected	Research grade	C-ATBD Version 1+ ; paper on algorithm reviewed	Minimal	Limited data availability to develop familiarity	Limited or ongoing
3	Moderate code changes expected	Research grade; Meets int'l standards: ISO or FGDC for collection; netCDF for file	Public C-ATBD; Peer-reviewed publication on algorithm	Uncertainty estimated for select locations/times	Data and source code archived and available; caveats required for use.	Assessments have demonstrated positive value.
4	Some code changes expected	Exists at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets international standards for dataset	Public C-ATBD; Draft Operational Algorithm Description (OAD); Peer-reviewed publication on algorithm; paper on product submitted	Uncertainty estimated over widely distributed times/location by multiple investigators; Differences understood.	Data and source code archived and publicly available; uncertainty estimates provided; Known issues public	May be used in applications; assessments demonstrating positive value.
5	Minimal code changes expected; Stable, portable and reproducible	Complete at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets international standards for dataset	Public C-ATBD, Review version of OAD, Peer-reviewed publications on algorithm and product	Consistent uncertainties estimated over most environmental conditions by multiple investigators	Record is archived and publicly available with associated uncertainty estimate; Known issues public. Periodically updated	May be used in applications by other investigators; assessments demonstrating positive value
6	No code changes expected; Stable and reproducible; portable and operationally efficient	Updated and complete at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets current international standards for dataset	Public C-ATBD and OAD; Multiple peer-reviewed publications on algortihm and product	Observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation; quantified errors	Record is publicly available from Long-Term archive; Regularly updated	Used in published applications; may be used by industry; assessments demonstrating positive value

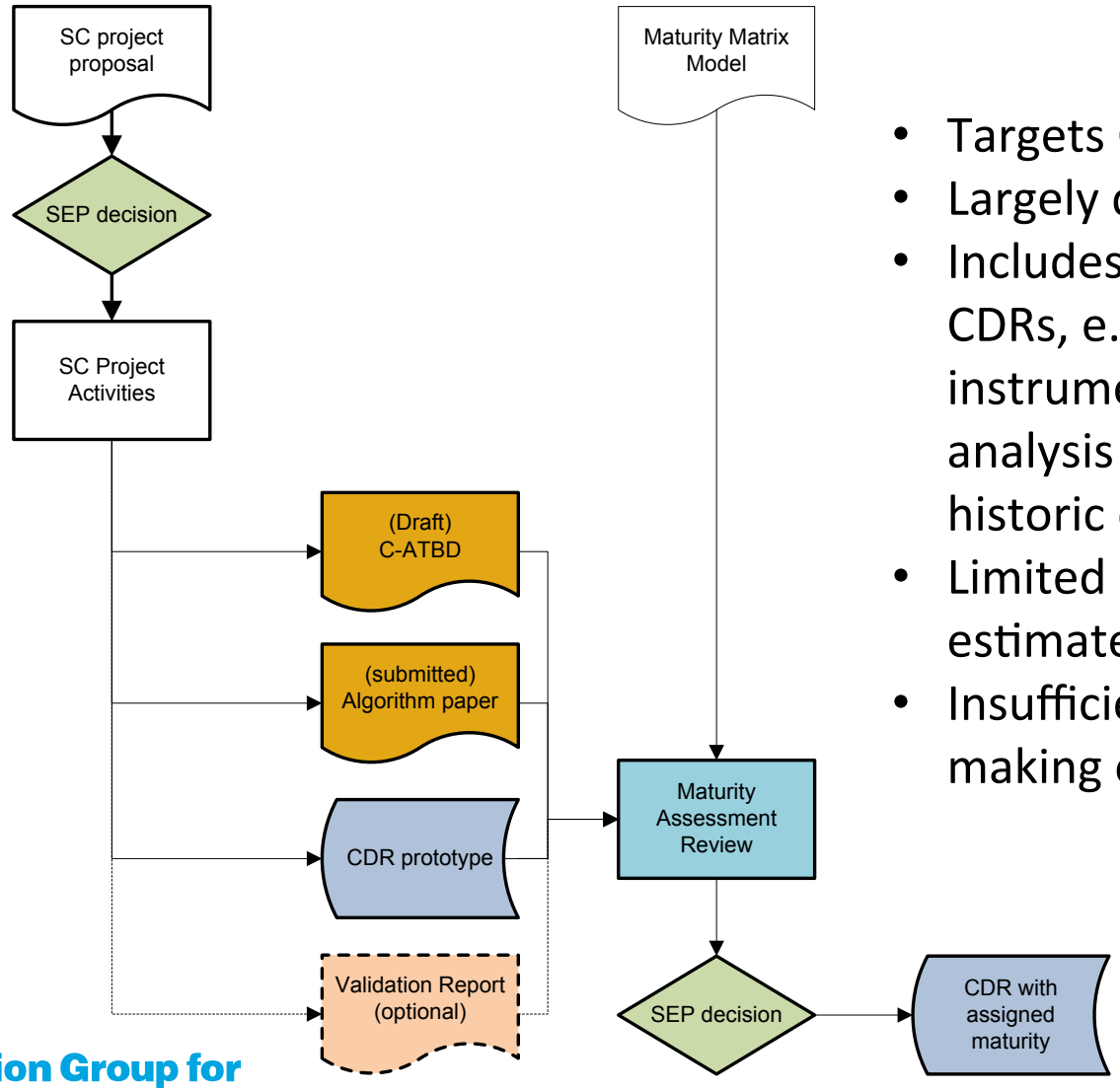
1 & 2	Research
3 & 4	IOC
5 & 6	FOC

CDRP-MTX-0008 V4.0 (12/20/2011)

Generic Process for SCOPE-CM Projects



SCOPE-CM Research Project



- Targets CDR at maturity 1-2;
- Largely driven by research;
- Includes first realisation of CDRs, e.g., from new instruments or due to new analysis techniques for historic data;
- Limited uncertainty estimates;
- Insufficient for Decision making or use in GFCS.

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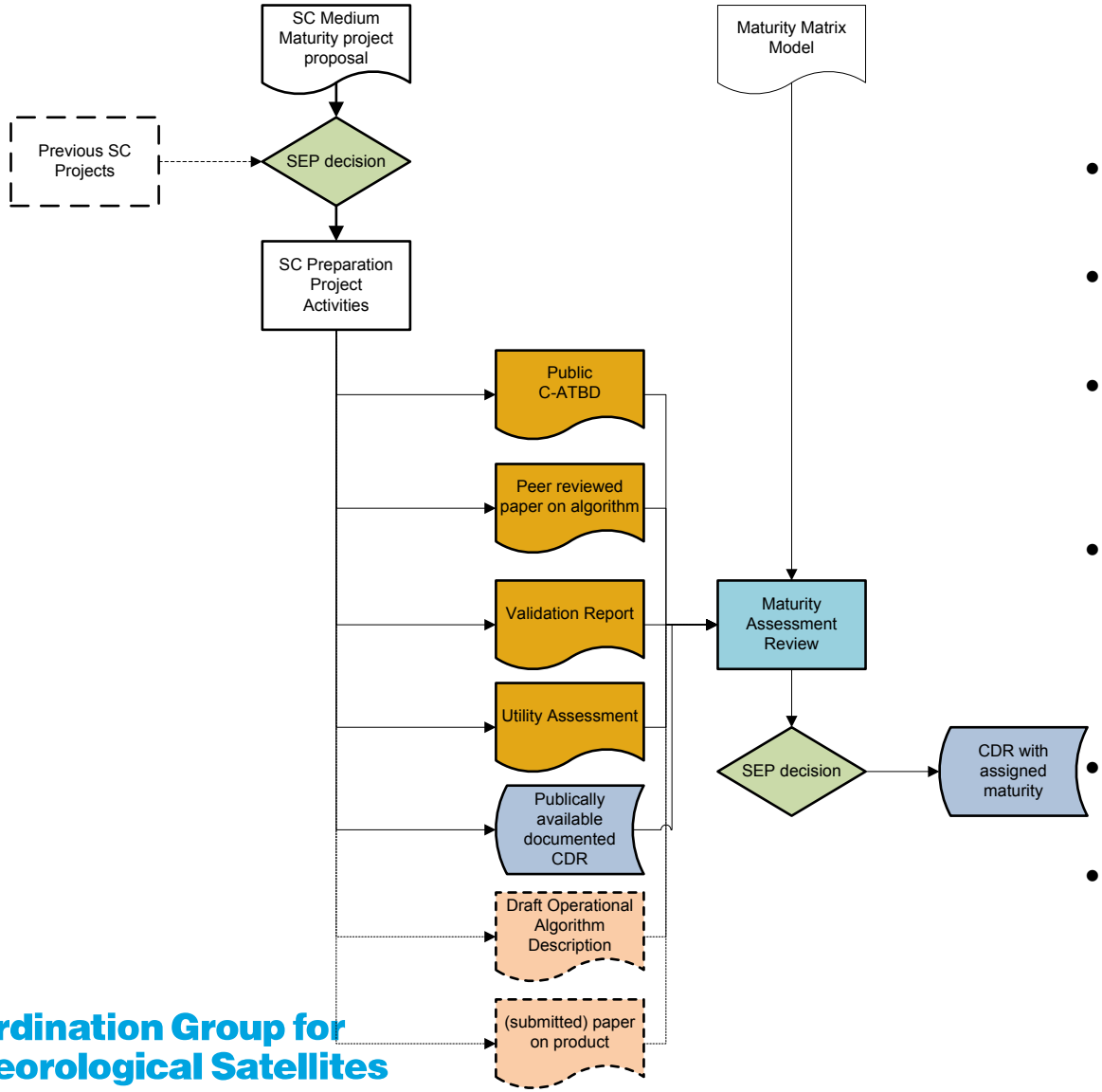
SCOPE-CM Moderate Maturity Projects



- Targets at moderate maturity CDRs;
- Provides Initial Operations Capability;
- Assures compliance/ coherence of standards and procedures;
- Typically includes transition projects, e.g., ISCCP to NOAA/ NCDC or HOAPS to EUMETSAT CM-SAF;
- Assessments demonstrate positive value;
- Tentative use for decision making or climate services.

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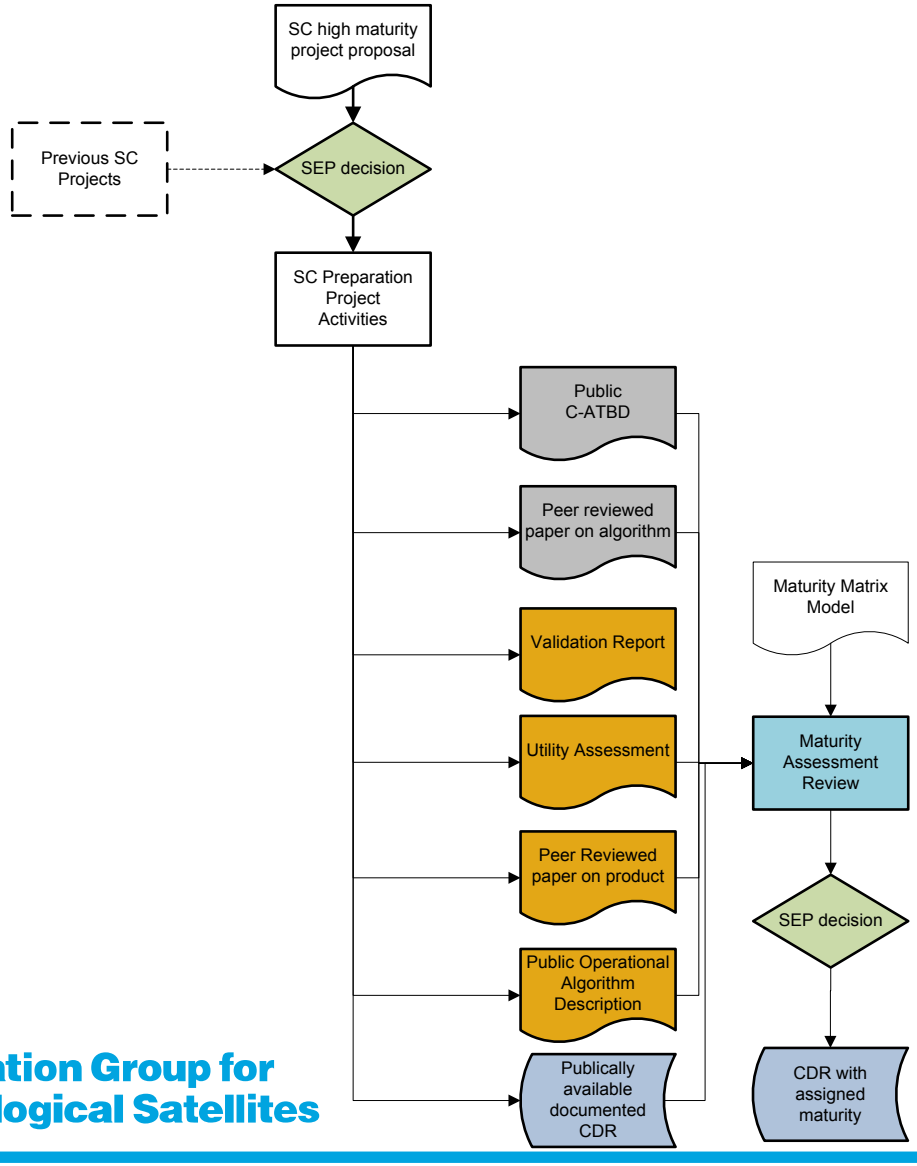
SCOPE-CM High Maturity Projects



- Targets at high maturity CDR generation;
- Provides Full Operations Capability – all aspects of maturity complete;
- Production embedded in framework that ensures reproducibility and update of data sets;
- Full provenance tracking established;
- Used in published applications;
- Full use in decision making and climate services.

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Summary and Prospects

- SCOPE-CM targets ECV CDRs where international coordination for its production is needed;
- SCOPE-CM does not provide funding but it facilitates direct collaboration with and among satellite agencies including access to data, information on data, operational infrastructure, long-term sustainability of activities;
- The new structure of SCOPE-CM shall be open for the participation of research groups to provide science for innovation and operational groups (multi-agency structure) to provide sustainment of scientific investments in a coordinated manner;
- Assessment of SCOPE-CM CDRs could be let by WCRP (expect to strengthen collaboration with GEWEX and others);
- The proposed SCOPE-CM CDR life cycle follows best practises from the scientific community (many coming from the experience in WCRP), the archive community for data preservation and description and the engineering community for software.