Letter of Intent for SCOPE-CM Phase-2

1. Project title

Sustained production of the International Satellite Cloud Climatology Project (ISCCP) cloud products

2. Main applicant

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3. Composition of the project team

U.S. NOAA/ National Climatic Data Center	Ken Knapp
Japan Meteorological Agency (JMA)/ Meteorological Satellite Center(MSC)	Hiroaki Tsuchiyama h_tutiyama@met.kishou.go.jp
European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)	Harald Rothfuss harald.rothfuss@eumetsat.int
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4. Satellite Climate Data Records Capabilities

a. Geophysical parameters

The primary products of ISCCP are the cloud products derived from inter-calibrated satellite imager and sounder data. In addition to cloud frequency, numerous cloud property variables are also produced, such as cloud top temperature, pressure, and optical depth. Obtained in a homogeneous fashion for a 30+ year period, these products are an important Climate Data Record in understanding the impact of clouds on climate and climate feedbacks.

The project objective is the generation of a cloud product Climate Data Record (CDR) covering the Earth surface seen by geostationary and polar orbiting satellites for an initial period of 1983-2013 and expanding both backward (before 1983) and forward in time.

The project aims at a product that includes Level 2 (per satellite products) and Level 3 (gridded global products) cloud data records to be utilised in climate science and climate services.

b. Satellite sensor record

ISCCP was a prototype of the SCOPE-CM initiative when ISCCP began in the early 1980s. It was initially – and continues to be – a collaboration of operational agencies from numerous countries endeavouring to develop a consistent climate data record for clouds. The entire meteorological geostationary constellation serves as the base satellite sensor record (Fig. 1). This "geostationary quilt" shows how the ISCCP inter-calibration effort has turned this patchwork of various satellite sensors into a unique and homogeneous record. It should be noted that numerous other climate data records have benefitted from the ISCCP processing and archive of geostationary data.

Geostationary data for ISCCP was initially provided by satellite processing centers (SPCs) that included both public institutions (e.g., NOAA, JMA, EUMETSAT, ESA) as well as academic universities (CSU, U. Wisconsin). Over time as capabilities to process the full resolution geostationary data into the subsampled inputs became more readily available, the work was has transferred to the operational agencies (NOAA, EUMETSAT, JMA). Also, other agencies have joined the ISCCP effort in providing data from their respective satellites (CMA, INPE). Therefore, ISCCP is a clear example of the need to formalize such relationships in order to ensure the continuation of such an important climate data record.

Additionally, ISCCP incorporates operational polar meteorological satellites data to fill gaps in the geostationary coverage and where that coverage is lacking, that is, at the poles. The AVHRR data record is provided to ISCCP by NOAA for this purpose. Also, AVHRR serves as the calibration anchor for the geostationary constellation.

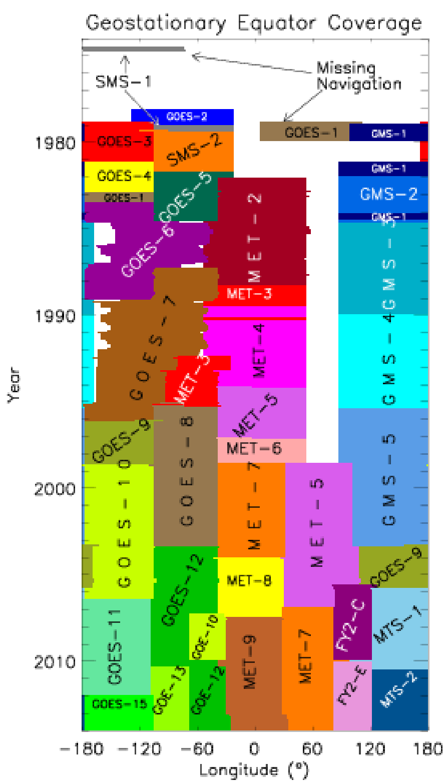

Figure 1: *Temporal and longitudinal coverage of the geostationary platforms planned to be used for generating ISCCP cloud products.*

Each sensor – geostationary and polar-orbiting – is inter-calibrated by the ISCCP project. Initially, this inter-calibration was performed at another institution in France, but this effort will be moved as part of the processing to the ISCCP Processing Center. The ISCCP cloud algorithm is processed at the ISCCP processing facility.

c. Processing chains

In short, SPCs provide subsampled geostationary and polar orbiting data to the ISCCP processing facility. The processing facility then runs the algorithm to produce the ISCCP cloud products. In this project, the primary requirement on the SPCs is that they reliably and routinely produce and deliver the subsampled data.

d. Algorithms

The ISCCP cloud product algorithms are described in various peer reviewed literature. The emphasis is on cloud detection tests that can be applied in a uniform manner across all geostationary satellites through time. This limits the tests to using the visible and infrared windows aboard the geostationary satellites.

5. Justification of the proposed project

a. Historical overview of related activities

The ISCCP project has operated routinely through informal and formal agreements for more than 30 years. However, during that time the operators have changed forcing the continued production to rely more on the operational satellite agencies.

A case in point is the recent switch of the GOES-East processing. Previously, the SPC for GOES-East was Canada (AES). However, a failure of a computer server and lack of funds to replace or recode the sampling code left a gap in the provision of GOES-East. Fortuitously, at that time, NOAA NCDC was working with CSU to assume the SPC role for GOES-West. So while developing the internal processing structure for GOES-West, GOES-East was also incorporated.

Clearly, as the production of this dataset now relies on operational agencies, a structured relationship between the agencies, developer and production facility is needed.

b. Assessment of the feasibility of the proposed project

This project is extremely feasible. It is currently operating and as a SCOPE-CM project, the project should run more smoothly.

6. Current and targeted Maturity Level

The maturity level is somewhat difficult to assess given the switch to the high resolution data. Therefore, the following analysis assigns the current maturity level based on the ISCCP D dataset. The Maturity level of ISCCP H will at least be the same as ISCCP D, data assuming that no significant issues arise between processing (current testing shows no issues). Furthermore, the low maturity of documentation for ISCCP D will be addressed by releasing the processing code to the public.

	Software Readiness	Meta Data	Documentation	Validation	Public Access	Utility
Current Maturity level	5	5	4	5	6	6
Targeted Maturity level	6	6	6	6	6	6

7. Expected results, challenges and potential contributions of the project

The ISCCP dataset has a proven track record of contributing to model development, climate science, cloud feedback studies and more. The contribution of this project is the further sustainment of ISCCP through support at the operational level.

Scientific challenges include calibration of the individual sensors and cloud detection. However, ISCCP has a proven track record of satellite inter-calibration that is continually being assessed. Furthermore, the ISCCP project has developed one of the most widely used and cited satellite cloud products. The technical challenges of this project prove a higher risk than the scientific ones.

Technical challenges include 1) routine production of input data, 2) monitoring the ingest of input data and dataset production and 3) modifying the processing to include new instruments as they become available.

1) The reliability of dataset production varies by agency. Some are prone to data gaps while others have provided low quality satellite data. The issue can be resolved in two ways. First, the NCDC will need to develop a quality monitoring system to identify gaps and/or quality as they occur. Second, communications and response by agencies need to respond to quality issues as they occur. Both aspects will be needed to maintain a reliable and sustained product.

2) The production facility will need to develop the capability to process and monitor the ISCCP calibration of each sensor as well as the cloud product production system as a whole. In addition to the satellite inputs, the task will rely on routine ingest and monitoring of ancillary data (atmospheric temperature and water vapor profiles, ozone amount, snow cover, sea ice, etc.). Some of the aspects of these first two items are already handled in to some extent. However, this SCOPE-CM project will help make processing more routine and reliable.

3) The ISCCP project scientist and others will need to develop pathways to incorporate new polar and geostationary satellite datasets into cloud products. Routine and sustained production means contingencies when satellites (or other inputs) fail. Furthermore, it will

require modification as sensors advance (e.g., how to incorporate COMS-1 from Korea or VIIRS from S-NPP).

Near real time cloud product generation – The capability to produce ISCCP in near real time would benefit climate and weather applications. NOAA NCDC is investigating the capability to produce these Interim-CDRs on a regular basis to support various societal benefit areas. However, this would require stable data provision from the source agencies as well as a robust processing system at NCDC to provide reliable cloud products. SCOPE-CM could make this concept a reality by supporting the ISCCP product generation.

8. Duration of the project and tentative schedule

The original ISCCP project was initially slated as a 5-year project, so it might be presumptuous to estimate any limited duration. The current 30+ year potential of cloud products only emphasizes the importance of climate data records. As each year is added, the product becomes more unique in length, coverage and product breadth.

Planned length of project: not applicable

Proposed starting date: not applicable (the project started July 1, 1983)

Proposed continuing date: As soon as accepted by the SCOPE-CM panel.

Tasks	Year	Actors
− Sustained production of subsampled satellite input data − Sustained production & monitoring of ISCCP cloud products − Investigate near-real-time data provision and cloud product generation.	2014	All agencies NOAA All agencies
− Sustained production of subsampled satellite input data − Sustained production & monitoring of ISCCP cloud products	2015-	All agencies NOAA

9. Funding situation

Currently, funding is provided by the participating institutions from their basic funding. Furthermore, the NOAA Climate Data Record program is supporting a portion of the ISCCP project scientist's development costs to transition the processing of ISCCP to NCDC.

10. Required and available processing capacities

- Agencies providing satellite data should continue to provide satellite data to the project.
- Agencies providing satellite data should incorporate ISCCP observation coverage (full disk every 3 hours) into satellite scan schedules and provide at a reliable latency (within a day).
- The ISCCP processing facility will need to develop and maintain the capability to process and reprocess ISCCP on a routine (near real-time) basis.
- The ISCCP cloud product should aim to make use of other SCOPE-CM FCDR projects.

Currently available and planned processing environments are/will be capable of fulfilling these needs.

11. Curriculum vitae of the key investigators

CCNY:

Dr. William Rossow is the original developer of the ISCCP processing system including the radiance calibration system, the cloud detection algorithm and the radiative-transfer-model-based retrieval method, as well as the designer of the multi-level data products. He has published over 200 papers and reports on clouds, radiation and other aspects of climate and is currently a Distinguished Professor of Remote Sensing (Electrical Engineering) at the City College of New York.

NOAA:

Dr. Ken Knapp holds a PhD from Colorado State University (2000) in Atmospheric Science. He has published numerous papers on scientific applications of geostationary data and is presently chief of the Products Branch in the Remote Sensing and Applications Division of NOAA's National Climatic Data Center.

EUMETSAT:

Dr Harald Rothfuss obtained a PhD from the Ludwig-Maximilians-University of Munich, Faculty of Geosciences (1994), on an environmental application of Airborne Imaging Spectroscopy data, while working for the German Aerospace Center (DLR). Following ten years of working in managerial roles for a large IT Service provider, he joined EUMETSAT in 2008 where he heads the Data Centre Operations team. The team manages the archiving and user access to historic EUMETSAT satellite data and is involved in the routine processing of Climate Data Record generation.

JMA:

Mr Hiroaki Tsuchiyama is a scientific officer of the System Engineering Division at MSC/JMA. He is now in charge of the operation of the MTSAT data provision to the ISCCP project. He is also developing calibration software for Himawari-8 and Himawari-9, which are the next generation Japanese geostationary meteorological satellites following the currently operational MTSAT-2 satellite (Himawari-7).