

SUSTAINED COORDINATED PROCESSING OF ENVIRONMENTAL SATELLITE DATA FOR NOWCASTING (SCOPE-Nowcasting)

CONCEPT

(v1.2 January 2017)

Review History:

Date	Reviewer	Comment
30-11-2011	A. Rea, P. Zhang	Concept of Operations Outline: to ET-SUP-6
30-05-2012	L. Machado, S. Bojinski	PP Structure added; Consolidation of PP Outlines; Addition of Precip/SWRiskReduction Pilot
01-06-2012	P. Chen (SWFDP)	Comments on Concept; Feedback on PPs
04-06-2012	CMA, IMD, EUM, JMA	Input and Comments on PPs
11-06-2012	A.Rea (BoM)	Input and Comments on PP
22-06-2012	L. Machado, S. Bojinski	Consolidation of Input
30-07-2012	Paul Joe (WWRP Nowcasting Research WG)	Seeking comments
03-09-2013	A. Rea	Update post ET-SUP-7 and CGMS-41
21-10-2013	S. Bojinski	Minor update: consistency with ET-SUP-7 conclusions
Jan 2017	S. Bojinski, M. König	Revision

Introduction

1. The aim of the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Nowcasting (SCOPE-Nowcasting) initiative is to demonstrate continuous and sustained provision of consistent, well-characterized satellite products for nowcasting and severe weather risk reduction. This is to be achieved through a number of pilot projects, and through establishing a collaborative network among experts, user institutions and satellite operators, that can help sustain product dissemination and facilitated user uptake. The initiative will be supported by WMO.

Background

2. The concept for SCOPE-Nowcasting arose from discussions in 2010 (in the WMO Expert Team on Satellite Utilization and Products – ET-SUP) after consideration of the benefits of the SCOPE for Climate Monitoring (SCOPE-CM) initiative, where the value of different models of cooperation among satellite operators in generating satellite datasets for climate has been demonstrated through theme-driven pilot projects. It was felt by ET-SUP-5 that the concept could be usefully applied to the nowcasting domain, given that:
 - The related science is reasonably mature;
 - An organized user community is available;
 - An established description of the needs of this community exists;
 - There are opportunities and synergy with other initiatives.
3. A draft discussion paper was prepared for ET-SUP-6 and further refined at ET-SUP-7. The concept was presented at the 3rd Asia Oceania Meteorological Satellite Users Conference in October 2012, and at the 41st Meeting of the Coordination Group for Meteorological Satellites in July 2013. The concept has gathered the support of satellite operators. Under the initiative, four pilot projects were initiated, and a review was undertaken in early 2017. A summary of the four pilot projects and their status as of January 2017 can be found in on the SCOPE-Nowcasting webpage¹.
4. SCOPE-Nowcasting is aligned with a number of WMO initiatives, in particular SCOPE-CM (Climate Monitoring) and the Severe Weather Forecasting Demonstration Project (SWFDP). SWFDP is focused primarily on numerical weather prediction output; the observational focus of SCOPE-Nowcasting has the high potential to complement and enhance SWFDP final output and thus lead to improved warning

¹ http://www.wmo.int/pages/prog/sat/scope-nowcasting_en.php

services. Linkages with other relevant programmes, initiatives and groups will be sought, as appropriate (see below).

5. Should it move after proof-of-concept and pilot phase to an implementation phase, SCOPE-Nowcasting will need to operate as far as possible within the WMO Information System (WIS) framework, in particular regarding delivery mechanisms for products. Better data integration, standardization and quality control as foreseen within SCOPE-Nowcasting are all key objectives in the WMO Integrated Global Observing System (WIGOS).

Objectives

6. The key objective of SCOPE-Nowcasting is to provide a mechanism through which satellite data can be made available simply and quickly, primarily for users in the NMHSs of smaller or developing nations, where expertise and facilities for processing and utilizing satellite data may be limited or non-existent, but also for more advanced nations where there may be efficiencies possible through combining resources, expertise, and efforts.
7. To achieve this goal, SCOPE-Nowcasting must facilitate the provision of sustained (or at least sustainable) products. That is, the satellite products must:
 - a) have a long-term stable status, beyond individual satellite missions;
 - b) be generated operationally in a routine and repeatable manner; and
 - c) include provisions for smooth transition between different satellite sources, in order to minimize the impact on users' processing and forecasting systems, and reduce training needs.
8. The products must also be coordinated. That is:
 - a) products need to be consistent across platforms using equivalent algorithms; and
 - b) products should be generated in consistent, standard formats [be interoperable].

Concept and Scope of Operations

9. The concept for SCOPE-Nowcasting builds on the WIS framework concerning the metadata definition, data discovery and operational data flow. In addition, it shall include user interaction for consultation on needs, gathering feedback and ensuring outreach, and an expert component for defining standard products and formats, for validation of the products and their documentation, and for scientific feedback. A governing body will define a finite number of areas of interest, and agree upon a finite number of standard products to be pursued.
10. The scope of SCOPE-Nowcasting is limited to satellite-based nowcasting products, that is, products that are useful in the forecasting range zero to six hours where, in the case of NWP, current model forecasting capability is limited. On land, the value of nowcasting products is particularly apparent in regions without weather radar coverage. The products to be considered by SCOPE-Nowcasting fall into four broad categories:
 - a) Basic (Atmospheric) Nowcasting Products: these are primarily products used qualitatively, such as visible and infrared imagery, RGB composites and enhancements, fog detection and cloud products;
 - b) Advanced (Atmospheric) Nowcasting Products: these include quantitative products requiring the application of algorithms for their generation; products such as precipitation, atmospheric motion vectors, stability indices, total precipitable water, convective initiation and sounding products, and other products to support aviation such as turbulence or aircraft icing potential;
 - c) Realtime Ocean Products: these include scatterometer data for sea surface winds and sea state data from altimetry; and
 - d) Realtime Atmospheric Composition Products: these include fire detection, smoke, sand and dust, aerosols and volcanic ash.
11. Products may be generated from geostationary or low-Earth orbit data and, where possible, the higher resolution afforded by low-Earth orbiters should be used to improve interpretation of geostationary data. For example, the interpretation of a lower resolution geostationary fog detection product may be aided if used in conjunction with an interoperable product derived from a polar orbiting satellite.

12. Products will be generated in real time over the defined areas of interest by the Data Providers and sent to the Host Agencies. Alternatively, Data Providers may distribute processing software which the Host Agencies can use to themselves generate products, using raw satellite data distributed by the Providers. There may be multiple Data Providers for any one area of interest. The host agencies will act as a repository for the products and provide online access, and will push products to specific Client Agencies as required. The concept of operations is depicted in Figure 1.

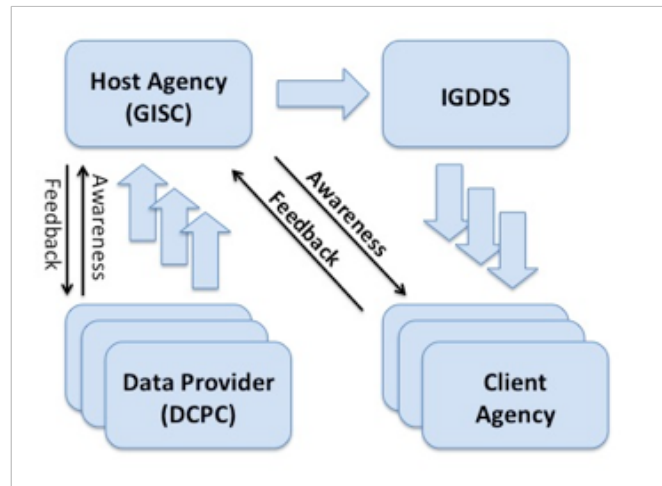


Figure 1: SCOPE –Nowcasting – Concept of Operations

Roles

13. The SCOPE-Nowcasting concept requires a number of different roles to be filled, these are:
- a) Client agency;
 - b) Host agency;
 - c) Data provider;
 - d) Executive panel.

Each of these roles is described in detail below.

Client Agency

14. The *Client Agency* is the primary user of the products provided through SCOPE-Nowcasting. The primary roles of the Client Agency are:
- a) to define their requirements and make a formal request for products to be generated over their area of interest;
 - b) to make appropriate use of the products to serve their end-users and to provide feedback to the Host Agency on issues or errors;
 - c) to regularly liaise with Host Agency and Data Providers to remain aware of novel product developments, through training events or user conferences.

Host Agency

15. The *Host Agency* operates the repository for products to be delivered to Client Agencies. In this sense, the Host Agency functions as a Global Information System Centre (GISC) under the WIS framework. The primary roles of the Host agency within SCOPE-Nowcasting are:
- a) to gather data from the various Data Providers;
 - b) to make data available to Client Agencies in a timely and effective manner;
 - c) to provide a contact point for Client Agencies to raise issues or report problems;
 - d) to compile feedback to Data Providers based on reports by Client Agencies;
 - e) to inform Client Agencies of novel developments in data and product availability.

Data Provider

16. The *Data Provider* is responsible for generating SCOPE-Nowcasting products and providing these to the Host Agency. In this sense, the Data provider functions as a Data Collection or Production Centre (DCPC) within the WIS. A data provider can be a satellite operator, or another organization with real-time access to satellite data. The primary roles of the Data Provider within SCOPE-Nowcasting are:
- a) to generate products covering areas of interest;
 - b) to provide products to the Host Agency in a timely and reliable manner;
 - c) to provide a point of contact for data problems, issues, and feedback;
 - d) to inform Host and Client Agencies of novel developments in data and product generation and availability.

Executive Panel

17. The SCOPE-Nowcasting *Executive Panel* is responsible for overseeing all SCOPE-Nowcasting activities and ensuring that activities are coordinated appropriately. The Executive Panel will fulfil the following roles:
- a) to agree on standard products, formats and areas of interest;
 - b) to respond to requests for new products from Client Agencies;
 - c) to designate Data Providers and Host Agencies and identify what products will be generated and disseminated by each;
 - d) to provide a central coordination point for SCOPE-Nowcasting activities and point of contact for all external enquiries; and
 - e) to liaise with the user community, data providers and other WMO groups and initiatives as required to ensure efficient and effective operation with no duplication of effort.

Links to Underlying Science and Related Initiatives

18. SCOPE-Nowcasting will need to build on product development in the scientific community, where such products are mature and have demonstrated benefits. For specific product areas, there will be links to both related scientific communities and governance arrangements within WMO, such as with the World Weather Research Project (WWRP) and the Severe Weather Forecasting Demonstration Project (SWFDP). For example, for precipitation products there would be a clear link to the International Precipitation Working Group.

Benefits

Benefits of this approach will be:

- a) Improved access to satellite data by member states;
- b) Improved confidence in products generated through SCOPE-Nowcasting;
- c) Reduced operating costs associated with technological change and software upgrades;
- d) Reduced training overheads;
- e) Improved cooperation between NMHSs through access to shared products.

Implementation through Pilot Projects

19. The concept is implemented through pilot projects. These projects should be demonstrated on a limited basis and tested for user acceptance and added value. These pilot projects should fit into the four application areas identified. For all areas, a global need has been recognized which will initially be demonstrated and tested with the user community on a regional basis. For each pilot project, the Executive Panel appoints a working group to realize the project, gather user feedback, and to report back to the Executive Panel on a regular basis. Depending on user acceptance, scaling up to the global level and transition to a full SCOPE Nowcasting product shall be pursued at a later stage and where appropriate.

20. The following criteria are applied to pilot projects. They should:

- a) use multi-source satellite data;
- b) generate dataset formats that can be read by standard tools;
- c) provide concise (<2 pages) product documentation including a description on: general product characteristics, data format, data fields, originating satellite datasets, algorithm, validation and uncertainty estimates, and limitations;
- d) provide open access;
- e) be available in near-real time (<6h);
- f) provide adequate training information; and
- g) be led by one or more agencies that form a project working group which reports back to the Executive Panel;
- h) have an official commitment from all agencies involved in the project