Restoration of NPOESS Climate Capabilities: Climate Data Records*

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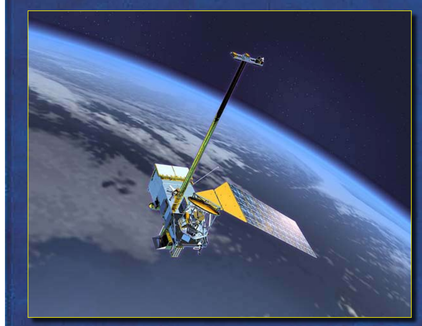
Abstract

NPOESS was designed primarily to serve operational users who typically need near real time observations and products. Consequently, NPOESS does not provide reprocessing, data record gap filling, or assurance that its products are consistent with those of heritage missions. However, these characteristics are critical for climate studies since climate signatures are generally small compared to normal observation variability. Thus, NOAA, NASA and USGS are developing a joint-agency program to create Climate Data Records* (CDRs) and Climate Information Records* (CIRs). The proposed 4-phase program is systematic and designed for sustained implementation. It progressively evolves a candidate algorithm through a 6-level research and operational path to maturity. It also includes ongoing algorithm maintenance and basic research for later technology insertion. The proposed program is jointly managed by the responsible agencies, but its execution relies extensively on community activities. The result will be a comprehensive set of CDRs and CIRs useful for spatio-temporal detection, analysis and prediction of environmental change, and for development of a coherent environment for climate model execution.



1. Input

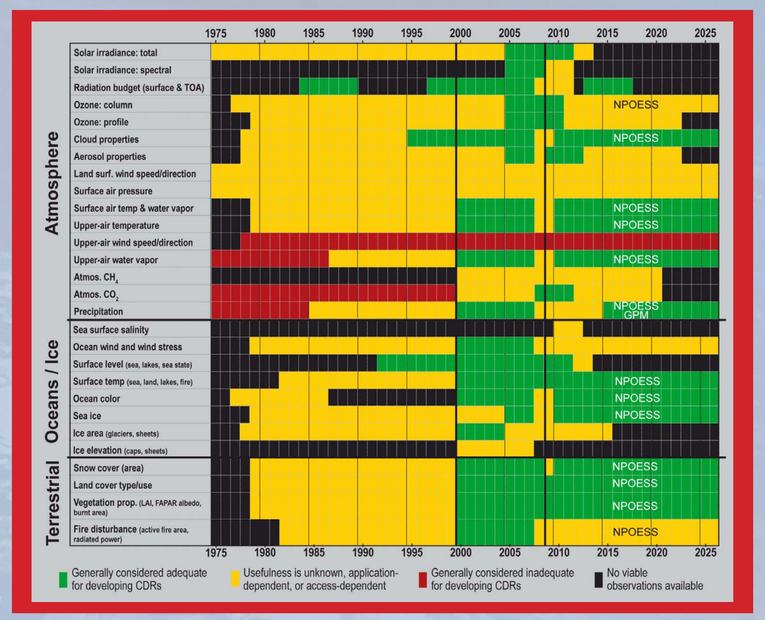
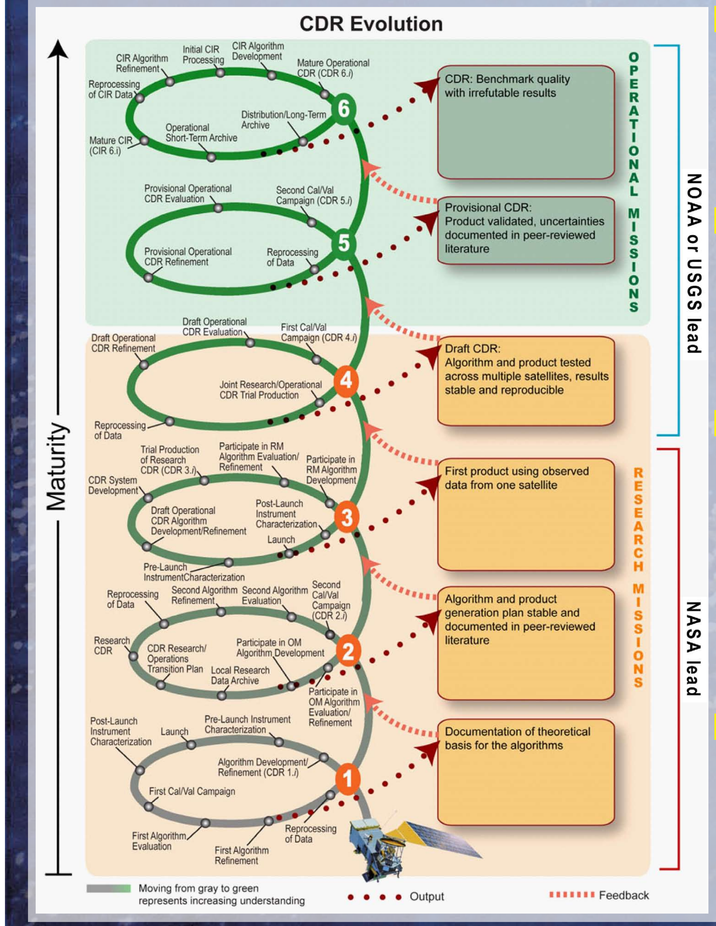


Figure 1. Satellite observation quality for key geophysical variables varies with time and variable. Resulting Climate Data Records (CDRs) should be consistent and seamless.

2. Process *(Proceeds from bottom to top of figure)*

Figure 2.



Phase 4). Technology Incubation and Insertion. Occurs in parallel with other phases. Ensures CDRs remain state-of-the-art through the support of advanced algorithm development; e.g., would facilitate use of decadal survey mission data (NRC, 2007). Responsibility: Research agency (e.g., NASA).

Phase 3). Operations and Maintenance. Post-release phase provides funding to competitively selected algorithm experts to maintain algorithm through the unavoidable and continuous degradation of on-orbit sensors. Responsibility: Operational agency (e.g., NOAA, USGS).

Phase 2). Transition and Refinement. Maturity Levels 4- to 6. Begins with research and operational agencies independently generating product to demonstrate transition readiness. Algorithm adapted for all relevant heritage data. Includes repeated validation, algorithm refinement, and reprocessing, and culminates in the release, distribution, and archiving of an irrefutable CDR. Responsibility: Operational agency (e.g., NOAA, USGS).

Phase 1). Early Development. Maturity Levels 1- to 3. Includes initial algorithm development, pre- and post-launch sensor characterization, and multiple iterations of product generation, evaluation, and improvement. Responsibility: Research agency (e.g., NASA).

3. Output

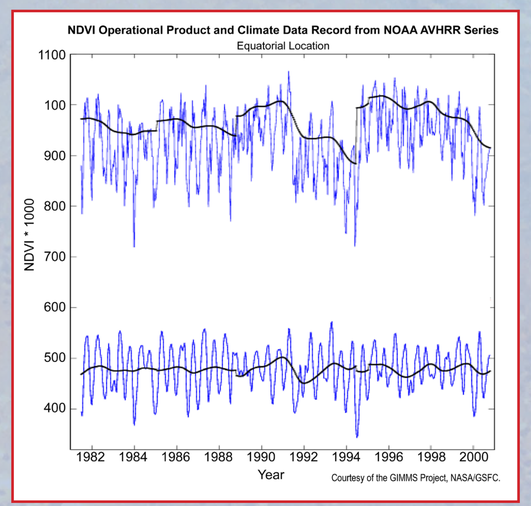
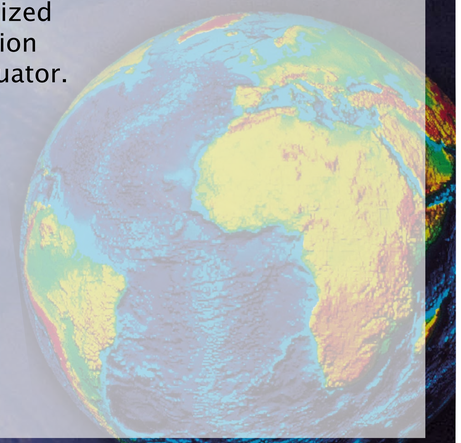


Figure 3. Operational product (top lines) and Climate Data Record (bottom lines) for the AVHRR Normalized Difference Vegetation Index (NDVI) at equator. The operational product shows erratic trends due to observatory changes (orbital and calibration drift). The CDR algorithm corrects these artifacts.



* Working Definitions of Climate Products

A Climate Data Record (CDR) is a time series of measurements of su cient length, consistency, and continuity to determine climate variability and change [NRC, 2005]. CDRs typically use data from di erent satellites and sensors extending from present back to the beginning of the relevant satellite observation period.

A Climate Information Record (CIR) is a time series derived from CDRs and related long-term measurements to provide specific information about an environmental phenomena of particular importance to science and society. CIRs are often designed to convey key aspects of complex environmental phenomena in a manner useful to a variety of applications of particular interest to certain stakeholder communities. Examples include El Nino Occurrence/Persistence/Magnitude, Antarctic Ozone Hole Area and Magnitude, Hurricane Intensity and Tracks and Drought Indices.