

NOAA/NESDIS



NESDIS-REQ-1001.1 NESDIS LEVEL REQUIREMENTS

September 30, 2020



Prepared by:

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National Oceanic and Atmospheric Administration (NOAA)

National Environmental Satellite, Data, and Information Service (NESDIS)



**NESDIS
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1. Introduction

This document defines the overarching National Environmental Satellite, Data, and Information Service (NESDIS) Level Requirements (NLR) to implement NOAA's mission of Science, Service, and Stewardship. Requirements development is an initial step mandated by the NOAA program management process and follows NOAA Administrative Order (NAO) 216-108, Requirements Management. The NLR document establishes top-level observing systems requirements to codify and validate user needs and expectations. This document will provide a basis for generating and prioritizing lower level requirements documents such as program/office level, and project level requirements documents.

2. Scope

The scope of the NLR includes all validated requirements that NESDIS must meet to support NOAA's mission: 1) to understand and predict changes in climate, weather, oceans, coasts, and space weather; 2) to share that knowledge and information with others; and 3) to conserve and manage coastal and marine ecosystems and resources. These requirements are consistent with NESDIS performance metrics (Government Performance and Results Act) contributing toward meeting Strategic Objectives within the Department of Commerce Strategic Plan and the NOAA Annual Performance Plan and Report.

Requirements are identified by the symbol "[REQ]" to unambiguously define them. In order to provide implementation flexibility, the term "will" is not used to specify mandatory actions because it can be interpreted as legally-binding terminology, which removes all agency discretion. NESDIS validates these requirements by communication and agreement through a rigorous process with stakeholders (e.g., NOAA line offices, OSC, NOSC). The document is designed to enable NESDIS discretion in implementing specific programs, projects, and missions, while ensuring that new missions are acquired, developed and implemented in a manner consistent with NESDIS' long-term vision and strategy.

3. NESDIS Mission

NESDIS supports NOAA's mission of Science, Service and Stewardship through our satellite missions, data centers, data and information products and services as well as use-inspired science. It is an end-to-end responsibility that underpins NOAA's value to the Nation. NESDIS' responsibility is to provide secure and timely access to global environmental data and information from satellites and other sources to promote and protect the nation's security, environment, economy, and quality of life. The 24/7 global coverage provided by NESDIS generates an uninterrupted stream of information and products. These products and information enable services used across the country in preparation for events that impact our climate, weather, oceans, daily lives and national safety and provide essential information for national, regional and local planners and officials.

4. Governing Documents

Governing documents consist of documents that contain provisions or other pertinent requirements directly related to, and necessary for the performance of the activities specified by this document.



Only high level policy directives are included in this section. Other policy directives will be referenced in lower level documents at the appropriate level.

- Department of Commerce Strategic Plan 2018-2022
- National Space Weather Strategy and Action Plan and subsequent Space Policy Directives (SPDs)
- National Plan for Civil Earth Observations
- DOO 25-5 Section 10: Organization, management structure, and assignment of functions within the National Environmental Satellite, Data and Information Service (NESDIS)
- NOAA Administrative Order 216-108: Requirements Management
- NOAA Administrative Order NAO 212-15: Management of Environmental Data and Information
- NOAA Administrative Order NAO 212-16: Policy on NOAA Observing Systems Portfolio Management
- NOAA Administrative Order NAO 216-115A: Research and Development in NOAA
- NOAA Administrative Order NAO 216-105B: Policy on Research and Development Transitions
- NOAA FY2021 Annual Performance Plan / FY2019 Annual Performance Report

5. NESDIS Level Requirements (NLR)

The NLR serves as the basis for the development of more detailed lower level requirements to meet the NOAA mission and the NESDIS Primary Mission Essential Functions (PMEFs). Requirement 1 presents thematic product areas and product categories in which NESDIS has a commitment to provide continuity products. [REQ-002] - [REQ-005] are phrased as business statements followed by clarifying examples of how NESDIS meets these requirements. If a change to these requirements is necessary, then NESDIS will follow the requirements change management process outlined in the NESDIS Requirements Management Plan, NESDIS-PLN-1312.1.



[REQ-001] NESDIS will provide environmental data, information, products, services, and reports in the Foundational, Geophysical, and Analytical thematic product areas.

Foundational

Imagery
Sensor Data

Geophysical

Atmosphere	Cryosphere	Land & Surface Hydrology	Oceans, Freshwater and Coasts	Space
Atmospheric Composition and Air Quality	Lake and Sea Ice	Fires	Biology and Biogeochemistry	Heliosphere
Atmospheric Temperature	Snow and Glaciers	Flood	Surface Height	Ionosphere
Atmospheric Water Vapor		Surface Moisture	Topography and Bathymetry	Magnetosphere
Clouds		Surface Temperature	Water Pollution	Solar
Lightning		Vegetation	Water Temperature and Salinity	
Precipitation				
Radiation Budget				
Tropical Cyclone Characteristics				
Volcanic Eruption Characteristics				
Winds				

Analytical

Climate
Weather
Oceans, Freshwater & Coasts

Figure 1 - Thematic Product Areas and Product Categories

[REQ-002] NESDIS will develop, acquire, implement, or operate environmental data sources and systems as needed to fulfill its validated user requirements.

The following examples help establish the scope of work NESDIS does to fulfill this requirement.

1. Develop, launch and operate satellite systems and associated ground segments at mission specific availability.
2. Provide satellite command and control capability.
3. Continually evolve its space and ground architecture to improve observational capabilities, security, resiliency and efficiency.
4. Pursue international cooperation and contributions to NOAA's environmental satellite, data, and information programs.
5. Meet NOAA's operational needs from space by considering the entire global observing constellation, including observational platforms from a variety of public and private agencies and organizations.
6. Provide source-agnostic data ingest, processing, and distribution services for all approved (NOAA, international, interagency and commercial) data sources.
7. Supply a streamlined and consistent solution to perform instrument calibration and product validation.



8. Deliver data relay, direct broadcast, and rebroadcast services.
9. Provide search and rescue communications infrastructure.
10. Provide support to users throughout the life cycle of the project or program, including operations.

[REQ-003] NESDIS will provide secure, timely, and reliable delivery of accurate and high-quality near-real-time and retrospective data products and reports to fulfill NOAA's mission.

The following examples help establish the scope of work NESDIS does to fulfill this requirement.

1. Collaborate with other NOAA line offices to provide a robust suite of high quality, near real-time data and environmental information to meet NOAA's mission.
2. Deliver reliable and comprehensive near-real-time and retrospective data to users within and outside the federal sector, international partners, and others to assure maximum benefit for the Nation and scientific community.

[REQ-004] NESDIS will ensure the quality, accuracy, reliability, preservation, discoverability, and accessibility of the Nation's historical sensor, environmental, and model data archives consisting of data from NOAA, U.S., and global observing systems.

The following examples help establish the scope of work NESDIS does to fulfill this requirement.

1. Provide and maintain the systems, policies and procedures that enable long-term data stewardship in a cost-effective, efficient and reliable manner.
2. Archive the data collected by NOAA observing systems.
3. Ensure full, open and timely data policies to the greatest extent practical, except in circumstances where required by law, regulation, policy, security requirements, or contract.
4. Continually improve the discoverability and accessibility of environmental data to maximize benefits to the nation and the scientific community.
5. Provide products, assessments, and services through reimbursable agreements.

[REQ-005] NESDIS will conduct an integrated program of research and technology development in the application of observing systems, data systems, products, and reports to support NOAA's mission.

The following examples help establish the scope of work NESDIS does to fulfill this requirement.

1. Coordinate research and development activities with other NOAA Line Offices to ensure compatibility with the overall NOAA research and development programs.
2. Provide a streamlined, consistent approach to algorithm/product development, sustainment and transition to operations, applications and commercialization to accelerate the delivery of new products, merge a variety of data sources and increase responsiveness to user needs.
3. Continue to diversify our portfolio by ingesting, validating and certifying data and information from within NOAA, interagency and international partners, and commercial sources based on established priorities and requirement needs.



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4. Conduct research and development for future environmental satellite systems, to improve products from current systems, and improve environmental data storage, retrieval, and dissemination.
5. Leverage science conducted outside of NESDIS in order to enhance algorithm and product development.
6. Identify optimum future, space-based instruments and satellite configurations to meet user needs through evaluation of emerging technologies, technology maturation studies, flight demonstrations, and operational insertion efforts.
7. Validate commercially provided instrument, data, payload, and communication solutions to meet NOAA's mission requirements.



Appendix A: Glossary

Analyses: An interpretive message and imagery derived from geophysical products.

Continuity: Services that NESDIS intends to continue producing for the foreseeable future.

Data Product: Observations and measurements acquired by satellites and other sources – processed to any level (e.g., 1b, 12) or format before distribution to users. This includes products to support real-time needs, such as weather forecasting, and non-real-time needs, such as monitoring the environment and capturing trends.

Data Stewardship: A subset of Data Management and consists of the application of rigorous analyses and oversight to ensure that data sets meet the needs of users. This includes documenting measurement practices and processing practices (metadata); providing feedback on observing system performance; inter-comparison of data sets for validation; reprocessing (incorporate new data, apply new algorithms, perform bias corrections, integrate/blend data sets from different sources or observing systems); and recommending corrective action for errant or non-optimal operations.

Environmental Data: Recorded and derived observations and measurements of the physical, chemical, biological, geological, and geophysical properties and conditions of the oceans, atmosphere, space environment, sun, and solid earth, as well as correlative data, such as socioeconomic data, related documentation, and metadata. Media, including voice recordings and photographs, may be included.

Geographic Coverage: Global coverage denotes the observation of all points on the Earth or its atmosphere at least once per given time period.

Instrument: Remote sensing and in situ measurement devices for data collection.

Latency: The period from the time of observation of requisite data by the satellite until the data product produced from those data is available to the user at the distribution system.

Mission: The overall goal or purpose of an organization or organizational unit.

Near Real-Time Data: Data and products that are delivered to the user with latency and availability to meet established operational requirements. Examples include satellite radiance, imagery, etc.

Observing System: One or more sensing elements that directly or indirectly collect biological, physical, chemical, and/or socioeconomic observations of the Earth and space. Sensing elements may be deployed as individual sensors or in constellations and may include instrumentation or manual observations. Observing system platforms may be mobile or fixed and may be located in atmospheric, freshwater, marine, space, or terrestrial environments.

Operational Products: Data, information, user support, and reports that NESDIS generates and provides to the user community for the foreseeable future. They are originally derived from user requirements, user requests, operational precedence, congressional mandates and documented user interaction.

Refresh: The time interval between successive collections of measurements of the same parameter from the same geographical point.



Report: An authoritative document that describes the state of the environment based on data and is produced with expert review. Reports offer explanatory information and are written for non-experts.

Requirement: A statement of a function to be performed, a performance level to be achieved, or an interface to be met.

Requirement Attribute: The properties of a requirement that capture important additional information about a requirement. Examples of requirement attributes are: latency, refresh, and geographic coverage.

Service: The provision and distribution of data, products, information, user support, and reports in support of NOAA's mission.

System: The combination of elements that function together to produce the capability required to meet a need. The elements include all hardware, software, equipment, facilities, personnel, processes, and procedures needed for this purpose.



Appendix B: Acronyms

DOO	Department Organization Order
PMEF	Primary Mission Essential Function
IPL	Integrated Product List
NAO	NOAA Administrative Order
NESDIS	National Environmental Satellite, Data, and Information Service
NLR	NESDIS Level Requirements
NOAA	National Oceanic and Atmospheric Administration
OSAAP	Office of System Architecture and Advanced Planning
REQ	Requirement



Appendix C: High-level Description of Product Areas and Categories

Foundational Thematic Product Area

The NESDIS Foundational Thematic Product Area represents the raw sensor data generated from a satellite observing system, to include calibration and geolocation data. Products within this area are instrument specific and serve as building blocks for NESDIS Geophysical Products as well as for partner/end-user applications.

Product Category: Imagery

Products in the Imagery category include but are not limited to visible, near-infrared, infrared microwave and solar imagery at multiple wavelengths. These include but are not limited to direct interpretation of single-channel images and processed multi-channel images such as multispectral compositing, temporal combination of animated sequences, or multi-satellite mosaics, etc.

Product Category: Sensor Data

Products in the Sensor Data category include but are not limited to radiances, sensor radiometric calibration information and geolocation, timing information/adjustments, error characteristics of retrieved products, or radiances including biases, quality indicators for products or radiances, sensor and spacecraft housekeeping/health data, and in situ observations such as electrons, ions, energetic particles and electric and magnetic fields, etc.

Geophysical Thematic Product Area

The NESDIS Geophysical Thematic Products Area describes the earth, atmosphere and surrounding space environment. Geophysical products are derived through mathematical algorithms which process observing system foundational data. Geophysical products are distributed to our end user community in support of weather, climate, oceanic and space forecast and monitoring capabilities.

Product Category: Atmosphere

Product Sub-Category: Atmospheric Composition and Air Quality

Products in the Atmospheric Composition and Air Quality sub-category include but are not limited to aerosol detection, optical depth, particle size, height, ozone, methane, CO, CO₂, and other trace gasses, etc.

Product Sub-Category: Atmospheric Temperature

Products in the Atmospheric Temperature sub-category include but are not limited to near-surface air temperature and pressure, temperature profiles, atmospheric temperature indices, atmospheric pressure profile, virtual temperature, upper air temperature, etc.



Product Sub-Category: Atmospheric Water Vapor

Products in the Atmospheric Water Vapor sub-category include but are not limited to moisture profiles, total precipitable water, total precipitable water anomaly, and stability indices, etc.

Product Sub-Category: Clouds

Products in the Clouds sub-category include but are not limited to cloud mask, height (top and base), layers, optical properties, liquid/ice path, phase, particle size, etc.

Product Sub-Category: Lightning

Products in the Lightning sub-category include but are not limited to lightning events, groups and flashes.

Product Sub-Category: Precipitation

Products in the Precipitation sub-category include but are not limited to rain rate, snowfall rate, total rainfall estimate, rainfall potential and probability, Quantitative Precipitation Estimate and Climate Data Records, etc.

Product Sub-Category: Radiation Budget

Products in the Radiation Budget sub-category includes but is not limited to all incoming/outgoing radiances and irradiances, reflectance, emissivity, albedo, etc.

Product Sub-Category: Tropical Cyclone Characteristics

Products in the Tropical Cyclone Characteristics sub-category include but are not limited to tropical cyclone formation probabilistic forecasts, position and intensity estimates of tropical disturbances and cyclones and static and animated imagery of tropical disturbances, cyclones and areas of interest, etc.

Product Sub-Category: Volcanic Eruption Characteristics

Products in the Volcanic Eruption Characteristics sub-category include but are not limited to volcanic ash height and mass loading, volcanic multi-spectral and PCI imagery, volcanic ash grain size and shape distributions, volcanic SO₂ detection, hot spots from volcanic fire, volcanic clouds tracking and characterizing, etc.

Product Sub-Category: Winds

Products in the Wind sub-category include but are not limited to derived motion winds, near-surface and ocean surface winds, wind profiles and aircraft turbulence, etc.



Product Category: Cryosphere

Product Sub-Category: Lake and Sea Ice

Products in the Lake and Sea Ice sub-category include but are not limited to ice thickness, concentration, type, characterization, motions and surface temperature, ice maps/charts, etc.

Product Sub-Category: Snow and Glaciers

Products in the Snow and Glaciers sub-category include but are not limited to snow and glacial cover, thickness/depth, extent, surface temperature, density, size of snow particles in the snowpack and snow water equivalent, etc.

Product Category: Land and Surface Hydrology

Product Sub-Category: Fires

Products in the Fires sub-category include but are not limited to fire detection and mapping, smoke plumes and concentration and biomass burning and emissions, etc.

Product Sub-Category: Flood

Products in the Flood sub-category include but are not limited to near-real time, daily and multi-day composite flood maps, etc.

Product Sub-Category: Surface Moisture

Products in the Surface Moisture sub-category include but are not limited to soil moisture and evaporative stress information, vegetation water content and drought indices, etc.

Product Sub-Category: Surface Temperature

Products in the Surface Temperature sub-category include but are not limited to the skin temperature of the apparent surface of land (bare soil or vegetation), land surface temperature climate data record, etc.

Product Sub-Category: Vegetation

Products in the Vegetation sub-category include but are not limited to vegetation type and dynamic status (i.e., vegetation condition, fraction, density, and health indices), surface type, etc.

Product Category: Oceans, Freshwater, and Coasts

Product Sub-Category: Biology and Biogeochemistry

Products in the Biology and Biogeochemistry sub-category include but are not limited to remote sensing reflectances, ocean color, concentration of chlorophyll and suspended particulates, colored dissolved organic matter (CDOM), turbidity, surface and varying depths and diffuse attenuation coefficients, etc.



Product Sub-Category: Surface Height

Products in the Surface Height sub-category include but are not limited to surface height products for both large and small features from waves to tsunamis, etc.

Product Sub-Category: Topography and Bathymetry

Products in the Topography and Bathymetry sub-category include but are not limited to ocean bathymetry information, sea floor topography, water depths, coastal shoreline mapping, bathymetric and fishing maps, sediment thickness, and the combination of land topography, ocean bathymetry and glacial information, etc.

Product Sub-Category: Water Pollution

Products in the Water Pollution sub-category include but are not limited to oil spill mapping.

Product Sub-Category: Water Temperature and Salinity

Products in the Water Temperature and Salinity sub-category include but are not limited to Sea Surface Temperature (SST), Lake surface temperature, SST anomalies, SST hot spots, Degree heating weeks, Coral bleaching index, Coral bleaching alerts, Ocean Heat Content, and Salinity measurements, etc.

Product Category: Space

Product Sub-Category: Heliosphere

Products in the Heliosphere sub-category include but are not limited to solar wind measurements, solar irradiance, solar flux, etc.

Product Sub-Category: Ionosphere

Products in the Ionosphere sub-category include but are not limited to ionospheric monitoring, total electron count, energetic charged particles, etc.

Product Sub-Category: Magnetosphere

Products in the Magnetosphere sub-category include but are not limited to enhanced magnetic models, space environment magnetic field, magnetic field calculators, geomagnetic models, earth magnetic anomaly grid, gravity field database, magnetopause location and crossing detection, etc.

Product Sub-Category: Solar

Products in the Solar sub-category include but are not limited to sun spots, solar flares, coronal mass ejections, radiation storms, radio bursts, etc.



Analytical Thematic Product Area

NESDIS Analytical Products synthesize geophysical information into written reports, and human interpretive analyses and assessments. Beyond numerical representations of data, analytical products describe how geophysical products help us to monitor the environment for global changes and significant weather events. These products support national and international users responsible for environmental monitoring and weather forecasts.

Product Category: Climate

Products in the Climate sub-category include but are not limited to quantitative analysis of climate variables in the ocean, atmosphere, land, cryosphere, and regional climate summaries around the world including: United States National Climate Assessment, Annual State of the Climate, Monthly Monitoring, etc.

Product Category: Weather

Products in the Weather sub-category include but are not limited to interpretive analyses based on satellite data and its derived products in helping monitoring and forecasts of significant weather events including: Hurricane intensity & position, Significant Precipitation, Volcanic Ash, and Fire and Smoke, etc.

Product Category: Oceans, Freshwater, and Coasts

Products in the Oceans, Freshwater, and Coasts sub-category include but are not limited to qualitative analysis of ocean observations and marine data including: United States National Climate Assessment, Annual State of the Climate, Monthly Monitoring, Oil spill detection and monitoring, etc.



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