

A.22 DSCOVER Earth Science Algorithms

NOTICE: Amended April 14, 2014. This Amendment releases the final text for A.22, DSCOVER Earth Science Algorithms, which replaces in its entirety the placeholder text provided on ROSES 2014 release. Notices of Intent are requested by May 12, 2014; proposals are due July 14, 2014.

1. Scope of Solicitation

NASA's Earth Science Research aims to utilize global measurements to better understand the Earth system and interactions among its components as steps toward ultimate prediction of Earth system behavior. To achieve this goal, a combination of shorter-term process-oriented measurements is complemented by longer-term satellite measurements of a limited number of environmental properties. For the latter, a key requirement is the provision of well-calibrated, multiyear data.

The Deep Space Climate Observatory ([DSCOVER](#)) mission is a multiagency (National Oceanic and Atmospheric Administration [NOAA], U.S. Air Force, and NASA) mission planned for launch in 2015 with the primary goal of making unique space weather measurements from the first Sun-Earth Lagrange point (L1). The L1 point is on the direct line between Earth and the Sun located 1.5 million km sunward from Earth. The spacecraft will be orbiting this point in a six-month Lissajous orbit with a spacecraft-Earth-Sun angle varying between 4 and 15 degrees. The primary science objective of the DSCOVER mission is to provide solar wind thermal plasma and magnetic field measurements to enable space weather forecasting by NOAA.

NASA has integrated two Earth-observing instruments, the Earth Polychromatic Imaging Camera (EPIC) and the National Institute of Standards and Technology (NIST) Advanced Radiometer (NISTAR) to the DSCOVER satellite. User guides and descriptions for these two instruments are available at <http://avdc.gsfc.nasa.gov/pub/DSCOVER>.

Proposals are sought in two topical areas:

1. To develop and implement the necessary algorithms and processes to enable various data products from EPIC sunrise to sunset observations once on orbit (such as ozone or cloud maps), as well as proposals to improve the calibration of EPIC based on in-flight data;
2. To determine the Earth reflected and radiated irradiance with an accuracy of 1.5% or better from NISTAR, as well as proposals to improve the NISTAR calibrations based on in-flight data.

EPIC images radiances from the sunlit face of the Earth on a 2048 x 2048 pixel CCD in 10 narrowband channels (ultraviolet [UV] and visible) with a nadir sampling field of view of approximately 8 km and an estimated resolvable size of 17 km for visible wavelengths. The 10 spectral bands, their Full Width at Half Maximum (FWHM), and some primary applications are:

<u>Wavelength (nm)</u>	<u>Full Width (nm)</u>	<u>Primary Application</u>
<u>317.5 ± 0.1</u>	<u>1 ± 0.2</u>	<u>Ozone, SO₂</u>
<u>325 ± 0.1</u>	<u>2 ± 0.2</u>	<u>Ozone</u>
<u>340 ± 0.3</u>	<u>3 ± 0.6</u>	<u>Ozone, Aerosols</u>
<u>388 ± 0.3</u>	<u>3 ± 0.6</u>	<u>Aerosols, Clouds</u>
<u>443 ± 1</u>	<u>3 ± 0.6</u>	<u>Aerosols</u>
<u>551 ± 1</u>	<u>3 ± 0.6</u>	<u>Aerosols, Vegetation</u>
<u>680 ± 0.2</u>	<u>2 ± 0.4</u>	<u>Aerosols, Vegetation, Clouds</u>
<u>687.75 ± 0.2</u>	<u>0.8 ± 0.2</u>	<u>Cloud Height</u>
<u>764 ± 0.2</u>	<u>1 ± 0.2</u>	<u>Cloud Height</u>
<u>779.5 ± 0.3</u>	<u>2 ± 0.4</u>	<u>Clouds</u>

Four pixels will be averaged onboard the spacecraft yielding downloaded images of 1024 x 1024 elements at an estimated resolvable size of 24 km. The time cadence of these spectral band images from EPIC will be provided on a best effort basis given existing ground system and network capabilities and will be no faster than 10 spectral band images every hour. The DSCOVR project will provide raw instrument data, EPIC Level-1 images in CCD counts that are geolocated and both dark-current and stray-light corrected. Calibration into radiances (Watts/m²/sr) will be given based on prelaunch calibration data. However, improvements in the Level-1 calibration, stray light, and dark current corrections are also solicited based on in-flight data imaging of Earth and the Moon.

The project will generate the "Earth from sunrise to sunset" Red-Green-Blue (RGB) images. This ROSES element is soliciting additional products from EPIC sunrise to sunset observations such as:

- Global ozone levels
- Aerosol index and aerosol optical depth
- Ultraviolet (UV) reflectivity of clouds over land and ocean
- Cloud height over land and ocean
- Cloud fraction
- Spectral surface reflectance
- Vegetation index and leaf area index

These measurements could contribute to assessing the utility for using L1 observations of Earth to integrate data from multiple spaceborne, as well as surface and airborne observation platforms, to develop self-consistent global products. Proposals are, therefore, sought to develop algorithms to provide other products of utility to the Earth science research and applications communities.

NISTAR measures the absolute "irradiance" as a single pixel integrated over the entire sunlit face of the Earth in four broadband channels:

1. A visible to far infrared (0.2 to 100 μm) channel to measure total radiant power in the UV, visible, and infrared wavelengths.

2. A solar (0.2 to 4 μm) channel to measure reflected solar radiance in the UV, visible, and near infrared wavelengths.
3. A near infrared (0.7 to 4 μm) channel to measure reflected infrared solar radiance.
4. A photodiode (0.3 to 1 μm) channel for calibration reference for the cavity radiometers.

Proposals are sought to determine the Earth reflected and radiated irradiance with an accuracy of 1.5% or better. Also, proposals to improve the NISTAR calibrations based on in-flight data are solicited.

2. Requirements

Proposals will be considered that will introduce a new data product/algorithm yielding a new Algorithm Theoretical Basis Document (ATBD) or equivalent for peer review. Proposals are expected to detail the instrument-specific algorithm, significant science, supporting and calibration/validation activities, and timelines for delivery of the ATBD and the initial data product release to the community. All produced data products are expected to be archived at the Atmospheric Science Data Center (ASDC) at the NASA Langley Research Center.

Proposed calibration and validation activities may involve a single or multiple data products. The scientific justification for such activities must be compelling and should be the focus of the proposed data product or algorithm or suite of algorithms. New field validation campaigns are not solicited. Proposers may make use of existing field-based observations and requests for additional observations using existing instruments and networks will be considered.

3. Summary of Key Information

Expected program budget for first year of new awards	~ \$2.0M
Number of new awards pending adequate proposals of merit	~8-9
Maximum duration of awards	3 years
Due date for Notice of Intent	See Tables 2 and 3 in the <i>ROSES Summary of Solicitation</i> .
Due date for Proposals	See Tables 2 and 3 in the <i>ROSES Summary of Solicitation</i> .
Planning date for start of investigation	6 months after proposal due date.
Page limit for the central Science-Technical-Management section of proposal	15 pp; see also Chapter 2 of the <i>NASA Guidebook for Proposers</i>
Relevance to NASA	This program is relevant to the Earth Science questions and goals in the NASA Science Plan; see Table 1 of ROSES and the reference therein. Proposals that are relevant to this program are, by definition, relevant to NASA.

General information and overview of this solicitation	See the <i>ROSES Summary of Solicitation</i> .
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/ .
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted. See Section IV of the <i>ROSES Summary of Solicitation</i> and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov/ (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH14ZDA001N-DSCOV
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