

SUPPLEMENT MATERIALS

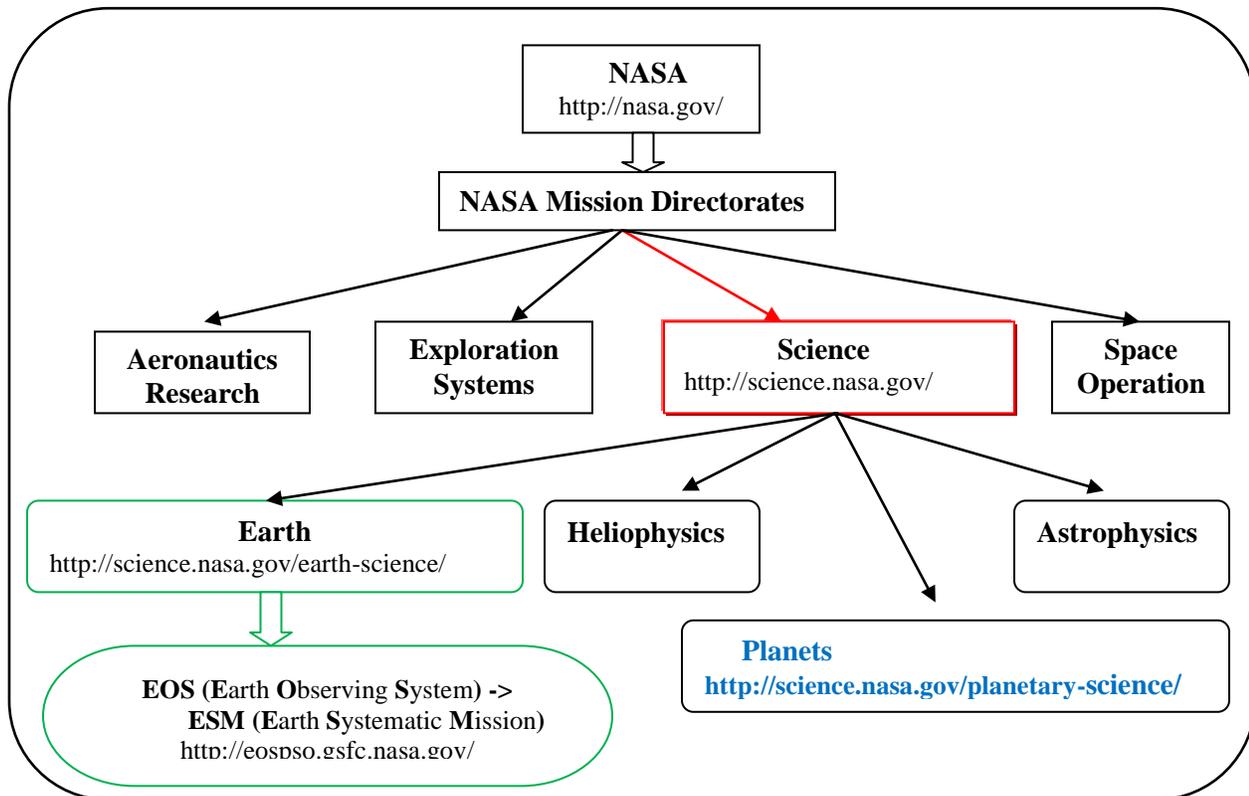


Figure 1. Flow diagram of NASA Mission Directorates.

NOTE: EOS was completed recently and ESM is a follow-up mission.

Overview of Earth Systematic Mission

(http://eosps0.gsfc.nasa.gov/eos_homepage/mission_profiles/index.php)

As a follow-on to the EOS missions, the Earth Systematic Missions (ESM) program will continue to advance our understanding of the climate system and climate change. The primary path toward meeting this objective is the mission outlined in the National Academy of Sciences (NAS) Earth Science Decadal Survey document released in 2007.

Decadal Survey

Following completion of the first decadal survey in 2007, the National Research Council (NRC) prioritized 15 satellite missions to enable NASA to provide the public with ongoing information about global climate and climate change. To comprehensively address the state of climate change, these decadal survey missions span multiple Earth science disciplines and are organized into three time-phased tiers. To learn more about the program, visit <http://decadal.gsfc.nasa.gov/> and <http://nasascience.nasa.gov/earth-science/decadal-surveys>.

Tier 1

Satellite missions in Tier 1 of the Decadal Survey will launch from 2010 – 2013. Four missions are planned and will measure climate change by examining solar and earth radiation, soil moisture and freeze/thaw cycles, ice sheet height differences, surface and ice sheet deformation from natural hazards, and vegetation structure.

Tier 2

Satellite missions in Tier 2 of the Decadal Survey will launch from 2013 – 2016. Five missions will explore land surface composition and mineral characterization; vegetation changes; global atmospheric column carbon dioxide (CO₂); ocean, lake and river water levels; atmospheric gas columns; ocean color; and aerosol and climate profiles. As a result, the Tier 2 missions will describe ecosystem health, improve air quality forecasts, and increase understanding of ocean biogeochemistry.

Tier 3

Satellite missions in the final tier of the Decadal Survey will launch from 2016 – 2020. Six missions comprise Tier 3, with four centered on the collection of data for natural hazard prediction, weather forecasting, and water resource management and two focused on stratospheric air quality, tropospheric wind measurements, and pollution transport.

Precipitation Missions

Inter-Agency Partnerships

ESSP

Missions in the NASA Earth System Science (ESSP) program are characterized by innovative design and relatively rapid implementation. These are focused missions that uniquely examine important components and physical processes within the global climate systems, including atmospheric CO₂ distribution, sea surface salinity variation, mass water movement, and the vertical structure of clouds and aerosols.

To learn more about the program, visit <http://nasascience.nasa.gov/about-us/smd-programs/earth-system-science-pathfinder>.

A-Train

The Afternoon Train, or "A-Train", for short, is a constellation of satellites that travel one behind the other, along the same track, as they orbit Earth. Four satellites currently fly in the "A-Train" — Aqua, CloudSat, CALIPSO, and Aura—with a fifth, Glory, and sixth, GCOM-W1, scheduled to join in 2010 and 2011, respectively. The "A-Train" satellites cross the equator within a few minutes of each other at around 1:30 p.m. local time. By combining different sets of nearly simultaneous observations from these satellites, scientists are able to study important parameters related to climate change.

Venture Class

The NASA Science Mission Directorate/Earth Science Division's (SMD/ESD) Earth Venture is a Program element within the Earth System Science Pathfinder Program (ESSP) consisting of a series of new science-driven, competitively selected, low cost missions that will provide opportunity for investment in innovative Earth science to enhance our capability to better understand the current state of the Earth system and to enable continual improvement in the prediction of future changes. Earth Venture has been established, in part, in response to

recommendations from the Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond (The National Academies Press, 2007) to initiate a series of missions deemed "venture class". The Venture-class mission formulation activities has resulted in a scientifically broad-reaching Program element that will solicit, through a series of frequent openly-competed solicitations, innovative research and application missions that might address any area of Earth science.

Earth Science Data

(<http://science.nasa.gov/earth-science/earth-science-data/>)

EARTH OBSERVING SYSTEM DATA AND INFORMATION SYSTEM (EOSDIS)

The **Earth Observing System Data and Information System** (EOSDIS) The Earth Observing System Data and Information System (EOSDIS) is a major core capability within NASA's Earth Science Data Systems Program. EOSDIS ingests, processes, archives and distributes data from a large number of Earth observing satellites. EOSDIS consists of a set of processing facilities and **Earth Science Data Centers** distributed across the United States and serves hundreds of thousands of users around the world, providing hundreds of millions of data files each year covering many Earth science disciplines.

CLOUDSAT DATA PROCESSING CENTER

CloudSat Standard Data Products are distributed by the CloudSat Data Processing Center, located at the Cooperative Institute for Research in the Atmosphere at Colorado State University in Fort Collins. The CloudSat mission was selected as a NASA Earth System Science Pathfinder satellite mission in 1999 to provide observations necessary to advance our understanding of cloud abundance, distribution, structure, and radiative properties. CloudSat was co-manifested with the CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) satellite aboard a Delta II rocket for its launch on 28 April 2006. In a series of maneuvers, CloudSat and CALIPSO joined the A-Train constellation of satellites.

LABORATORY FOR ATMOSPHERIC AND SPACE PHYSICS (LASP) INTERACTIVE SOLAR IRRADIANCE DATA CENTER

The Solar Radiation and Climate Experiment *SORCE* is a NASA-sponsored satellite mission that is providing state-of-the-art measurements of incoming x-ray, ultraviolet, visible, near-infrared, and total solar radiation. The measurements provided by *SORCE* specifically address long-term climate change, natural variability and enhanced climate prediction, and atmospheric ozone and UV-B radiation. These measurements are critical to studies of the Sun; its effect on our Earth system; and its influence on humankind. The LASP Interactive Solar Irradiance Data Center provides a variety of solar irradiance datasets, including daily measurements, reference spectra, composite time series, and model results.

PRECIPITATION PROCESSING SYSTEM (PPS)

The Tropical Rainfall Measuring Mission (TRMM) data are generated by the Precipitation Processing System (PPS). PPS is responsible for processing, analyzing, and archiving data from the current TRMM mission as well as the upcoming Global Precipitation Mission (GPM). PPS also provides validation data from multiple TRMM ground radar sites. The data products are available to the science community and the general public from the PPS online FTP archive.

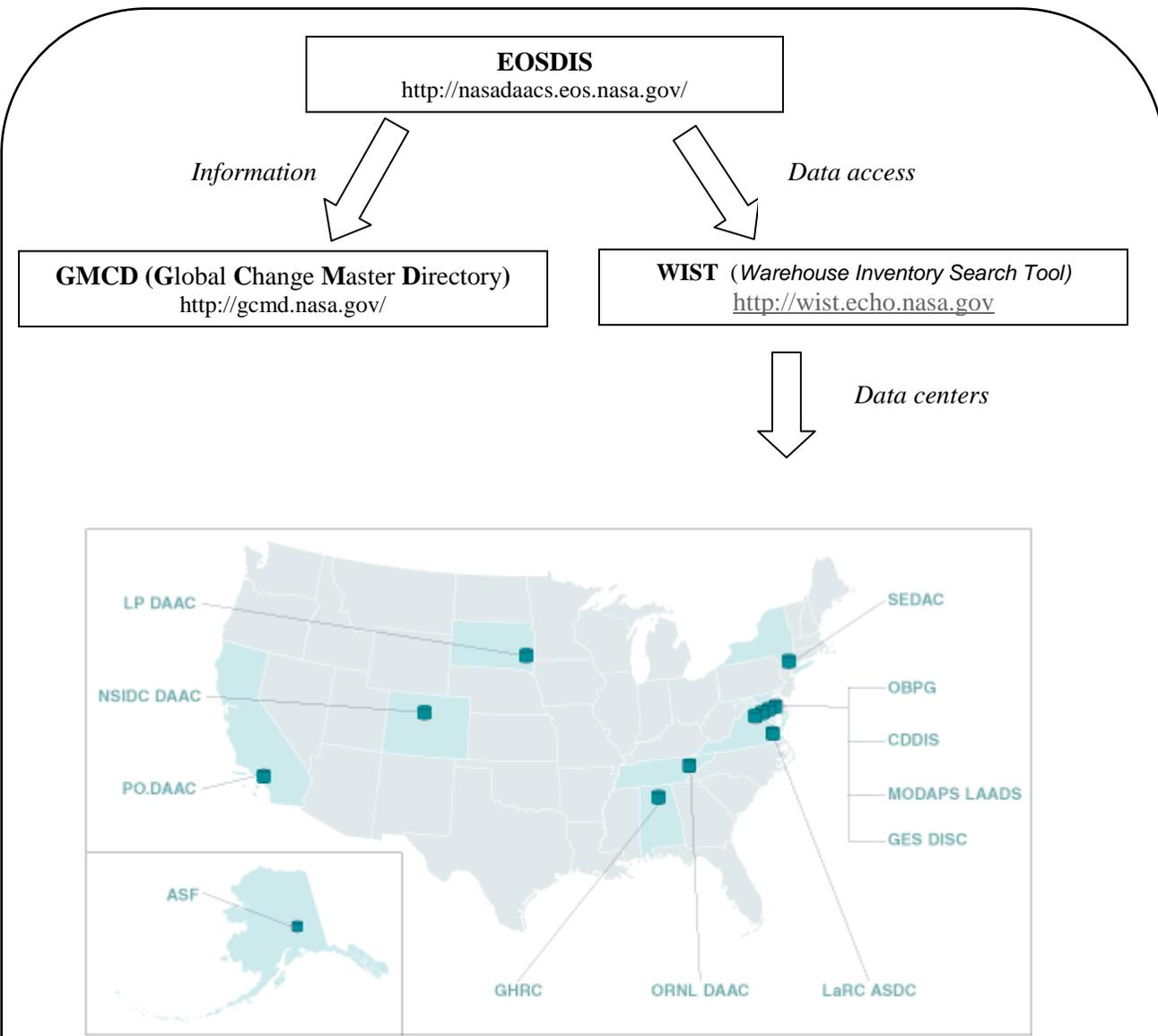


Figure 2. Earth Science Data Centers (called Distributed Active Archive Centers (DAACs), see brief overview below).

BRIEF OVERVIEW OF DATA CENTERS:

<p><u>Alaska Satellite Facility SAR Data Center (ASF SDC)</u></p> <p>The ASF SAR Data Center (SDC) is located in the Geophysical Institute at the University of Alaska Fairbanks. The Data Center is supported by NASA to acquire, process, archive, and distribute Synthetic Aperture Radar (SAR) data from polar-orbiting satellites.</p> <p>+ http://www.asf.alaska.edu</p>	<ul style="list-style-type: none"> • Synthetic Aperture Radar (SAR) • Sea Ice • Polar Processes • Geophysics
<p><u>Crustal Dynamics Data Information System (CDDIS)</u></p> <p>The CDDIS serves as NASA's archive of space geodesy data. The system archives and distributes Global Positioning System (GPS), Global Navigation Satellite System (GLONASS), laser ranging, Very Long Baseline Interferometry (VLBI), and Doppler Orbitography and Radio-positioning Integrated by Satellite (DORIS) data.</p> <p>+ http://cddis.gsfc.nasa.gov</p>	<ul style="list-style-type: none"> • Space Geodesy
<p><u>Global Hydrology Resource Center (GHRC)</u></p> <p>The GHRC provides both historical and current Earth science data, information, and products from satellite, airborne, and surface-based instruments. The GHRC acquires basic data streams and produces derived products from many instruments spread across a variety of instrument platforms.</p> <p>+ http://ghrc.nsstc.nasa.gov</p>	<ul style="list-style-type: none"> • Hydrologic Cycle • Severe Weather Interactions • Lightning • Atmospheric Convection
<p><u>Goddard Earth Sciences Data and Information Services Center (GES DISC)</u></p> <p>The GES DISC DAAC provides remote sensing and modeled data and information services to enable the use and usability of global climate science data by science and applications researchers.</p> <p>+ http://disc.gsfc.nasa.gov</p>	<ul style="list-style-type: none"> • Global Precipitation • Solar Irradiance • Atmospheric Composition • Atmospheric Dynamics • Global Modeling
<p><u>Land Processes (LP) DAAC</u></p> <p>The LP DAAC ingests, processes, distributes, and archives data for land-related EOS sensors. The LP DAAC promotes interdisciplinary study and understanding of Earth's integrated systems by providing data for the investigation, characterization, and monitoring of biologic, geologic, hydrologic, ecologic, and related conditions and processes.</p> <p>+ http://lpdaac.usgs.gov</p>	<ul style="list-style-type: none"> • Surface Reflectance • Land Cover • Vegetation Indices

<p><u>Level 1 Atmosphere Archive and Distribution System (MODAPS LAADS)</u></p> <p>The MODAPS LAADS provides access to Moderate Resolution Imaging Spectroradiometer (MODIS) Radiance (Level 1) and Atmosphere (Level 2 and Level 3) data products, and supports data from both the Aqua and Terra platforms.</p> <p>+ http://ladsweb.nascom.nasa.gov</p>	<ul style="list-style-type: none"> • Radiance • Atmosphere
<p><u>NASA Langley Research Center Atmospheric Science Data Center (LaRC ASDC)</u></p> <p>The NASA LaRC ASDC supports more than 35 projects and has more than 800 archived data sets. These data sets were obtained from satellite measurements, field experiments, and modeled data products.</p> <p>+ http://eosweb.larc.nasa.gov</p>	<ul style="list-style-type: none"> • Radiation Budget • Clouds • Aerosols • Tropospheric Chemistry
<p><u>National Snow and Ice Data Center (NSIDC) DAAC</u></p> <p>The NSIDC DAAC provides data and information for snow and ice processes, particularly interactions among snow, ice, atmosphere, and ocean, in support of research in global change detection and model validation. NSIDC also provides general data and information services to the cryospheric and polar processes research community.</p> <p>+ http://nsidc.org/daac</p>	<ul style="list-style-type: none"> • Snow • Ice • Cryosphere • Climate
<p><u>Oak Ridge National Laboratory (ORNL) DAAC</u></p> <p>The ORNL DAAC provides data and information about the dynamics between the biological, geological, and chemical components of Earth's environment. These dynamics are influenced by interactions between organisms and their physical surroundings, including soils, sediments, water, and air.</p> <p>+ http://daac.ornl.gov</p>	<ul style="list-style-type: none"> • Biogeochemical Dynamics • Ecological Data • Environmental Processes
<p><u>Ocean Biology Processing Group</u></p> <p>The OceanColor data facility archives and distributes ocean color data from several sensors, including Moderate Resolution Imaging Spectroradiometer (MODIS) Aqua, Sea-Viewing Wide Field-of-View Sensor (SeaWiFS), Ocean Color and Temperature Scanner (OCTS), and Coastal Zone Color Scanner (CZCS), as well as sea surface temperature data from MODIS on Terra and Aqua platforms.</p> <p>+ http://oceancolor.gsfc.nasa.gov</p>	<ul style="list-style-type: none"> • Ocean Biology • Ocean Color • Biogeochemistry • Sea Surface Temperature
<p><u>Physical Oceanography (PO) DAAC</u></p> <p>The NASA JPL PO.DAAC provides global oceanographic data from spaceborne instruments and produces higher level data products. Core holdings include ocean surface topography, ocean winds, and sea surface temperatures. Other holdings include data on significant wave</p>	<ul style="list-style-type: none"> • Sea Surface Temperature • Ocean Winds

<p>height, ionospheric electron content, atmospheric moisture, and heat flux, as well as in situ data related to the satellite data.</p> <p>+ http://podaac.jpl.nasa.gov</p> <p>podaac@podaac.jpl.nasa.gov</p>	<ul style="list-style-type: none"> • Circulation and Currents • Topography and Gravity
<p><u>Socioeconomic Data and Applications Data Center (SEDAC)</u></p> <p>SEDAC’s missions are to synthesize Earth science and socioeconomic data and information in ways useful to a wide range of decision makers and other applied users, and to provide an “Information Gateway” between the socioeconomic and Earth science data and information domains. SEDAC is operated by the Center for International Earth Science Information Network (CIESIN), a unit of the Earth Institute at Columbia University based at Lamont-Doherty Earth Observatory in Palisades, New York.</p> <p>+ http://sedac.ciesin.columbia.edu</p>	<ul style="list-style-type: none"> • Human Interactions • Land Use • Environmental Sustainability • Geospatial Data • Multilateral Environmental Agreements