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Ocean waves can vary enormously in size and character. In 1958, a sudden seismic rockslide into Lituya Bay, AK, triggered the largest-ever tsunami peaking at a height of 1,720 ft. Tsunamis, of course, are incredibly fast and destructive, and a significant threat to life and infrastructure. Identifying and analyzing tsunamis is vitally important for detecting, responding to, and designing communities to withstand their strikes.In contrast, Earth’s rotation can produce Rossby waves, which are slow-moving, shorter, under 10 cm waves thousands of kilometers long that can take decades to cross the Pacific. While Rossby waves are subtle in their nature, they are tied to the development of El Niño and other ocean climate events with the possibility of altering weather patterns perhaps ten years or longer after they form.Tsunamis can form with very little warning across vast areas of the planet and Rossby waves are very long yet cannot be identified by the naked eye. Both situations mean they are very difficult to easily detect. However, NASA has specialized instruments and platforms that can spot and provide details on these and other important ocean waves to give scientists, decision makers, and leaders the information they need for their research and planning.Learn more by exploring our various ocean waves-related articles, tools, and datasets. Access a range of datasets and data tools to further your air quality research. NASA's theme this past Earth Day was The Ocean Touches Everything, and this is no exaggeration. The global ocean covers more than 70% of Earth’s surface and contains 97% of the planet's water. The ocean is a vast and critical reservoir that supports a diversity of life, helps regulate climate, provides a large amount of the planet’s oxygen, and stores an abundance of carbon dioxide. NASA satellite, airborne, and in-situ missions and projects are constantly collecting data about the global ocean. The Gulf Stream off the East Coast of the U.S. is a vital ocean component. This map view shows the Gulf Stream on May 29, 2024, as a ribbon of dark red hugging the coast. This warm, swift current starts in the Gulf of Mexico, flows through the straits of Florida and toward North Carolina, then turns eastward as it moves toward northwestern Europe to become the North Atlantic Current. The base true-color corrected reflectance image was acquired by the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the joint NASA/NOAA NOAA-20 satellite. Overlaid on the base image is Sea Surface Temperature from the Group for High Resolution Sea Surface Temperature (GHRSST). The Multiscale Ultrahigh Resolution (MUR) L4 analysis is based upon nighttime GHRSST L2P skin and subskin SST observations from several instruments, including the NASA Advanced Microwave Scanning Radiometer-EOS (AMSR-E), the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Aqua and Terra platforms, the U.S. Navy microwave WindSat radiometer, and in-situ SST observations from the NOAA iQuam project. Visit Worldview to visualize near real-time imagery from NASA's EOSDIS; explore past imagery in our Worldview weekly image archive. Dataset MUR-JPL-L4-GLOB-v4.1 doi:10.5067/GHGMR-4FJ04 The Moderate Resolution Imaging Spectroradiometer (MODIS) continually collects data in 36 spectral channels with global coverage every 1 to 2 days. Its exceptionally broad spectral range enables MODIS data to be used in studies across numerous disciplines, including vegetative health, changes in land cover and land use, oceans and ocean biology, sea surface temperature, and cloud analysis. It also is used extensively for monitoring fires and natural hazards along with oil spills. An important attribute of MODIS data is the availability of MODIS data products in real-time and near real-time. Direct broadcast stations around the world download raw MODIS data in real-time directly from the satellite, while NASA’s Land, Atmosphere Near Real-time Capability for EOS (LANCE) provides several MODIS products within three hours of satellite observation. MODIS filenames (i.e., the local granule ID) follow a naming convention which gives useful information regarding the specific product. Product short name designations are as follows: MOD for Terra MODIS, MYD for Aqua MODIS, and MCD for Terra and Aqua combined MODIS.In this example of a swath product, the filename MOD14.A2023082.0430.061.2023082091705.hdf indicates:MOD14 - Product Short NameA2023082 - Julian Date of Acquisition (AYYYYDDD)0430 - Hours and Minutes of Acquisition (HHMM)061 - Collection Version2023082091705 - Julian Date of Production (YYYYDDDHHMMSS).hdf - Data Format (HDF-EOS)In this example of a tiled product, the filename MCD19A2.A2023081.h22v02.061.2023082164002.hdf indicates:MCD19A2 - Product Short NameA2023081 - Julian Date of Acquisition (AYYYYDDD)h22v02 - Tile Identifier (horizontalXXverticalYY)061 - Collection Version2023082164002 - Julian Date of Production (YYYYDDDHHMMSS).hdf - Data Format (HDF-EOS)In this example for a Climate Modeling Grid (CMG) product, the filename MYD09CMG.A2023081.061.2023083032243.hdf indicates:MYD09CMG - Product Short NameA2023081 - Julian Date of Acquisition (AYYYYDDD)061 - Collection Version2023083032243 - Julian Date of Production (YYYYDDDHHMMSS).hdf - Data Format (HDF-EOS)MODIS Product Long NameThe MODIS Product Long Name (i.e., Collection-Level) naming convention provides useful information regarding the product and indicates if the associated files for the dataset are swath, Sinusoidal tile grid, or CMG. Swath products are produced in 5-minute temporal increments of satellite acquisition.In this example for a swath dataset, all products belonging to the MODIS/Terra Thermal Anomalies/Fire 5-Minute L2 Swath 1 km V061 collection have the following characteristics:MODIS/Terra - Instrument/SatelliteThermal Anomalies/Fire - Geophysical Parameter5-Minute - Temporal ResolutionL2 - Processing LevelSwath - Swath1 km - Spatial ResolutionV061 - Collection VersionIn this example for a tiled dataset, all products belonging to the MODIS/Terra+Aqua Land Aerosol Optical Depth Daily L2G Global 1 km SIN Grid V061 collection have the following characteristics:MODIS/Terra+Aqua - Instrument/SatelliteLand Aerosol Optical Depth - Geophysical ParameterDaily - Temporal ResolutionL2G - Processing LevelGlobal - Global Coverage1 km – Spatial ResolutionSIN Grid - Sinusoidal GridV061 - Collection VersionIn this example for a CMG dataset, all products belonging to the MODIS/Aqua Surface Reflectance Daily L3 Global 0.05 Deg CMG V061 collection have the following characteristics:MODIS/Aqua - Instrument/SatelliteSurface Reflectance - Geophysical ParameterDaily - Temporal ResolutionL3 - Processing LevelGlobal - Global Coverage0.05 Deg - Spatial ResolutionCMG - Climate Modeling GridV061 - Collection Version Most standard MODIS Land products use this Sinusoidal grid tiling system. Tiles are 10 degrees by 10 degrees at the equator. The tile coordinate system starts at (0,0) (horizontal tile number, vertical tile number) in the upper left corner and proceeds right (horizontal) and downward (vertical). The tile in the bottom right corner is (h35,v17). The Climate Modeling Grid (CMG) products provide global coverage in a Geographic Latitude and Longitude projection at a resolution of 0.05 degrees (5,600 meters at the equator). The geographic coordinates of the upper-left corner of the upper-left pixel of a MODIS CMG image are -180.00 degrees longitude, 90.00 degrees latitude. The geographic coordinates of the lower-right corner of the lower right pixel are 180.00 degrees longitude, -90.00 degrees latitude. NASA distributes MODIS Land data processed to Level 2 or higher.MODIS Processing DescriptionAlong with all the data from other instruments on board the Terra and Aqua platforms, MODIS data are transferred to ground stations in White Sands, New Mexico, via the Tracking and Data Relay Satellite System (TDRSS). The data are then sent to the EOS Data and Operations System (EDOS) at the Goddard Space Flight Center. After Level 0 processing at EDOS, the Goddard Earth Sciences Data and Information Services Center (GES DISC) produces the Level 1A, Level 1B, geolocation, and cloud mask products.Higher-level MODIS land and atmosphere products are produced by the MODIS Adaptive Processing System (MODAPS), and then are parceled out among three DAACs for distribution. Ocean color products are produced by the Ocean Color Data Processing System (OCDPS) and distributed to the science and applications community. MODIS products have two sources of metadata: the embedded HDF metadata, and the external ECS metadata. The HDF metadata contains valuable information including global attributes and dataset specific attributes pertaining to the granule. The structure of this metadata is broadly similar to that of an ASTER HDF file. The ECS (generated by the EOSDIS Core System) .met file is the external metadata file in XML format, which is delivered to the user along with the MODIS product. It provides a subset of the HDF metadata. Some key features of certain MODIS metadata attributes include the following:The Xdim and Ydim represent the rows and columns of the data, respectively.The Projection and ProjParams identify the projection and its corresponding projection parameters.The Sinusoidal Projection is used for most of the gridded MODIS land products, and has a unique sphere measuring 6371007.181 meters.The UpperLeftPointMtrs is in projection coordinates, and identifies the very upper left corner of the upper left pixel of the image data.The LowerRightMtrs identifies the very lower right corner of the lower right pixel of the image data. These projection coordinates are the only metadata that accurately reflect the extreme corners of the gridded image.There are additional BOUNDINGRECTANGLE and GRINGPOINT fields within the metadata, which represent the latitude and longitude coordinates of the geographic tile corresponding to the data.The dataset attributes contain specific SDS information such as the data range and applicable scaling factors for the data. The LP DAAC data products page provides these details within a concise document for each of the products. An HDF-EOS file also contains EOS core metadata essential for EOS search services. Any tool that processes standard HDF files can read an HDF-EOS file. However, it is difficult for a standard HDF call to interpret HDF-EOS geolocation or temporal information without further knowledge of the file structure. Early in the mission, the MODIS Science Team decided to maintain a record of multiple data versions of Aqua- and Terra-derived MODIS products from a unique temporal bracket. Called the “Golden Month,” it covers 40 days of acquired data and all derived products from August 29, 2002 to October 7, 2002 (2002-241 to 2002-280). Several reasons define this choice of acquisition window, which include the following:This acquisition window provides the first interval when both Terra and Aqua MODIS data were collected uninterrupted.Previous (V003, V004, V005, and V006) and subsequent (V061) data versions are available.It avoids the end of July 2002 Aqua safe-hold incident.It includes the end of the Northern Hemisphere growing season.The period contains the fall equinox, which ensures that both hemispheres are illuminated.It includes two full 16-day periods (2002-241 to 2002-272).It includes all 8-day periods overlapping September 2002. The Ocean Color Level 3 and 4 Browser provides access to products produced and archived by NASA's Ocean Biology Processing Group and Ocean Biology Distributed Active Archive Center (OB.DAAC). Users can obtain links to download the data directly, save images, and order or extract netCDF data file(s).Ocean color images are added daily and can be filtered by product status, instrument, product, period, and resolution. The global ocean covers more than 70 percent of Earth’s surface and contains 97 percent of the planet’s water. Data collected by NASA’s Earth-observing instruments help scientists understand how the ocean supports a vast abundance of life, regulates the climate, provides a large amount of the planet’s oxygen, and stores an abundance of carbon dioxide.Our data products include information about ocean processes including ocean circulation and surface winds; heat exchange between the ocean and atmosphere, including sea surface temperature, sea surface salinity, and sea surface height; and factors impacting water quality, including turbidity, chlorophyll concentrations, and colored dissolved organic matter. In addition, our ocean data provide optical information that aids in assessing trends in global mean sea level. Access a range of datasets and data tools to further your ocean research. Ocean color is a measure of sunlight that is reflected by the water and its components, such as phytoplankton, sediments, and colored dissolved organic matter (CDOM). Remotely collected ocean color data can be used as a substitute for directly sampling and examining water quality in any body of water. For example, estimates of chlorophyll-a in phytoplankton concentrations calculated from ocean color data are used as an indicator for harmful algal blooms (HABs), which occur when algae containing toxins grow out of control. These blooms can wreak havoc on the organisms that live in or depend on that ecosystem and can contaminate seafood. The primary instruments for measuring ocean color include the Moderate Resolution Imaging Spectroradiometers (MODIS) aboard NASA’s Terra and Aqua satellites, the Visible Infrared Imaging Radiometer Suite (VIIRS) on the joint NASA/NOAA Suomi National Polar-orbiting Partnership (Suomi NPP) and NOAA-20 satellites, and the Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) satellite. The joint NASA/USGS Landsat series of satellites and the ESA Sentinel-2 satellites can also be used for observations of coastal waters and lakes. Access a range of datasets and data tools to further your ocean color research.