This has been an eventful period for the NASA GES DISC and the Giovanni data visualization and analysis system. Just last week, the 2012 Gregory G. Leptoukh Online Giovanni Workshop took place, a virtual meeting in which 25 presentations showed the diversity of scientific topics to which Giovanni contributes. In addition to those presentations, a preview of the next-generation Giovanni, Giovanni-4, was given, attracting nearly 70 enthralled participants to the “virtual meeting room.”

In coming weeks, all of the presentations from this inaugural meeting will be placed online, along with the transcripts of the chat sessions which accompanied each presentation. Though the meeting was “silent,” the chat dialogue during the sessions was spirited and interactive. Avenues for new research investigations were discussed, and ideas for Giovanni enhancements were frequently mentioned.

Another way to view the research to which Giovanni contributes is to examine the research papers that are published utilizing data and visualizations derived from the system. Papers describing research involving Giovanni are continuing to appear at a remarkable rate, as increasing numbers of scientists discover the data in Giovanni and how easy it is to use the system. (Giovanni-4 should be even easier to use once it is fully implemented.)

This special research issue of the Giovanni News profiles eight papers published in 2012 which describe research involving Giovanni. (The full citations can be found on our 2012 Giovanni publications page, http://disc.sci.gsfc.nasa.gov/giovanni/additional/publications/giovanni_2012_publications.) The topics range from loggerhead turtle tracking to soot falling on the glaciers of the Himalayas. These research investigations demonstrate the spectrum of science that uses NASA data, to address the conundrums and challenges of Earth’s environment, as it constantly changes, both naturally and due to the influence of humanity.

We welcome your comments.

Your Editors,

James Acker and Wainie Youn

NASA’s GODDARD SPACE FLIGHT CENTER
GODDARD EARTH SCIENCES DATA AND INFORMATION SERVICES CENTER (GES DISC)
GREENBELT, MARYLAND 20771
Movement patterns for a critically endangered species, the leatherback turtle (Dermochelys coriacea), linked to foraging success and population status

Authors: Helen Bailey, Sabrina Fossette, Steven J. Bograd, George L. Shillinger, Alan M. Swithenbank, Jean-Yves Georges, Philippe Gaspar, K. H. Patrik Strömberg, Frank V. Paladino, James R. Spotila, Barbara A. Block, and Graeme C. Hays

The authors examined how endangered leatherback turtles foraged for food in the open ocean. They found distinct differences between leatherback turtles in the Eastern Pacific Ocean and the North Atlantic Ocean. In the Atlantic, it was easy to tell when the turtles were foraging and when they were travelling, because their swimming speed was much faster when they were travelling. In the Pacific, however, the turtles always seemed to swim at about the same speed. The researchers concluded that this behavior indicated turtles in the eastern Pacific rarely found places where a slow-swimming foraging behavior was useful. One consequence of these observations is that the eastern Pacific leatherbacks are having a much more difficult time finding food, making it more difficult for this population to increase. The authors also examined how deep the turtles dove in the oceanic water column in their search for food.

In this study, Giovanni was used to plot a long-term mean of 8-day chlorophyll a concentrations for the period 2002-2010. Tracks of leatherback turtles tagged with satellite transmitters were overlain on the chlorophyll a concentration map. The map shows that the North Atlantic population moves between the high latitudes where the spring bloom occurs, and the subtropics, while the Pacific population moves between the coast of Central America and the southeast Pacific, sometimes in areas with very low chlorophyll concentrations.
Long-range transportation of anthropogenic aerosols over eastern coastal region of India: Investigation of sources and impact on regional climate change

Authors: S.K. Das and A. Jayaraman

In this study, the authors sought to distinguish the primary components and sources of increased atmospheric aerosols over a remote coastal location in southern India, Kalpakkam (Tamil Nadu province). One of the difficulties of such an effort for a coastal location is the influence of the local meteorology, characterized by the diurnal influence of land and sea breezes. (Land breezes occur at night, blowing toward the sea from the land, and sea breezes occur during the day, blowing from the sea toward the land, due to differences in the temperature of the land surface and the sea surface).

The researchers determined, using air parcel tracking, that observed increases in aerosol optical depth were primarily due to long-range transport of anthropogenic aerosols from the Indo-Gangetic Basin (IGB). In particular, black carbon in the atmospheric aerosols was found to be considerably higher when the wind blew from the IGB as compared to winds blowing from either the northern Indian Ocean or the central Bay of Bengal. Notably, for the case of wind blowing from the IGB, the researchers observed a 65% increase in atmospheric radiative forcing, which corresponds to a 70% increase in the aerosol heating rate.

MODIS aerosol optical depth data acquired from Giovanni were utilized in this research.
In the spring of 2010, volcanologists were fascinated, tourists were attracted, and European air travelers were confounded, as the eruption of the hard-to-pronounce Eyjafjallajökull volcano in Iceland sent thick ash plumes over the Atlantic Ocean toward Europe. The atmospheric ash layer from the volcano even made it to northern France, enabling researchers to accurately characterize it, using a variety of instruments, both on the ground and in space. The team based in Lille, France used NASA’s AERONET instruments, as well as LIDAR and solar flux measurements taken from the roof of its laboratory, to study the volcanic ash plume.

These observations allowed the researchers to test their model of the aerosol optical properties of volcanic ash suspended in the atmosphere. Two conclusions were that the volcanic ash appeared to have a generally smaller grain size than desert dust, and most of the ash particles were definitely non-spherical. They also reported that a “moderate” aerosol optical thickness value of 0.1 could result in a local cooling effect amounting to 9-12 watts per square meter. In this study, Giovanni provided a climatological value for the land surface spectral reflectance.
The Benguela Current upwelling system off the southwestern coast of Africa is one of the two most productive coastal upwelling zones in the world (the other is the Peru Current upwelling on the western coast of South America). Due to its immense productivity, the Benguela system supports several different fisheries. During past decades, occasional "crashes" of fish populations have occurred, leading oceanographers to investigate the dynamics of the Benguela system in more detail.

In this study, Mark Jury of the University of Puerto Rico - Mayaguez (who has used Giovanni in many research papers) investigated the physical oceanographic factors affecting the fish catch in the central Benguela upwelling zones. Giovanni supplied both SeaWiFS chlorophyll \( a \) data for a 10-year climatology and also the annual cycle of mixed layer depth, via the NASA Ocean Biogeochemical Model data portal.

Jury describes the factors which lead to increased fish catch as a weakening of southeasterly winds, which leads to an approximately 0.5 degree Celsius increase in ocean water temperature down to a depth of 200 meters. There is also a weak downwelling near the coast, which keeps the chlorophyll concentration at an optimum level for the Benguela fishery.

Intriguingly, Jury notes that climate teleconnections influence the interannual meteorological forcing by a pressure trough in the South Atlantic, which he determined to be a primary factor affecting fish catch in the central Benguela system.

This remarkable MODIS image acquired on November 21, 2010, shows a large phytoplankton bloom in the Benguela current upwelling system off the coast of Namibia. The light blue color indicates that it is probably composed largely of coccolithophores, with other "greener" phytoplankton mixed in.
The Sahara Desert is a major producer of dust storms, which send dust every year hundreds of miles over the Atlantic Ocean toward North and South America, and over the Mediterranean Sea toward Europe. This study examined a dust storm event occurring at an unusual time of the year, early February 2009. Data from MODIS-Aqua, the Ozone Measuring Instrument (OMI) on the Aura satellite, and CALIPSO LIDAR data were used in combination with the Dust Regional Atmospheric Modeling (DREAM) output data. Using this combination of sensors and model data, the researchers determined the source of the dust storms to be near the borders of Chad, Nigeria, and Libya, and the altitude the dust reached to be 2.5 kilometers. The dust from these storms was transported over the eastern Mediterranean, reaching Greece. Giovanni provided OMI Aerosol Index (AI) data to this research effort.

This MODIS image of a Saharan dust storm casting dust over the Mediterranean Sea was acquired on January 23, 2009, just a few days before the event which was studied in the research paper summarized here.
Cyanobacteria, also known as blue-green algae, are one of the most ancient forms of life on Earth. They are also, unfortunately, a form of toxic algae, so that the occurrence of cyanobacteria in large numbers is classified as a Hazardous Algal Bloom (HAB).

In this research, the authors studied the reappearance of cyanobacteria blooms in Lake Erie, one of the Great Lakes, which began in the 1990s. Cyanobacteria blooms had been absent from Lake Erie for 20 years starting in the 1970s, which was attributed to the reduction of phosphorus nutrient input to the lake. Analysis of the lake water indicated that phosphorus concentrations were increasing, and there was also an invasion of a mussel species called *Dreissena*, which had been previously cited as contributing to the occurrence of cyanobacteria blooms. Data from the MERIS instrument on the European ENVISAT satellite was used for this study, because the large number of visible wavelength bands on MERIS allowed spectral analysis. MODIS-Aqua sea surface temperature data at 4-kilometer resolution from Giovanni was used in the study to examine the annual cycle of surface water temperature in Lake Erie and its relationship to the occurrence of the blooms – the cyanobacteria enjoy water temperatures higher than 20 degrees Celsius, which does not usually happen in Lake Erie until June.
Intra-seasonal variability in Oceansat-2 scatterometer sea-surface winds over the Indian summer monsoon region


It may be surprising that Giovanni was used in a study examining the accuracy of surface wind data from India’s Oceansat-2 scatterometer, because Giovanni does not have any satellite surface wind data. (It does have model wind data in both the MERRA and NLDAS/GLDAS data portals, however.) In this study, the authors examined the accuracy of Oceansat-2 ocean wind data by comparing the data to wind output data from the European Centre for Medium Range Weather Forecasting (ECMWF) analysis surface winds over the Bay of Bengal and Arabian Sea, where Indian monsoons are spawned.

Giovanni was used in this study to examine Tropical Rainfall Measuring Mission (TRMM) 3B42 daily rainfall data, which were compared to wavelet transform periodicities of both 8-16- and 32-64-day duration. The authors found that intense rainfall activity occurred when both variability modes were in the positive phase.
A recent important discovery in cryospheric science was that human emissions of black carbon aerosols (generally known as soot) have a double-edged influence on Earth’s climate. Even though they may be hard to see, black carbon deposited on bright white ice reduces the reflectivity (albedo) of the ice, making it less effective at reflecting sunlight back into space. At the same time, black carbon absorbs sunlight, heating up and melting ice more rapidly. For that reason, estimating the amount of black carbon that is deposited on Earth’s “third pole,” the Himalayan ice pack, is important in determining its course of change.

The authors of this study used seven different estimation techniques to determine upper and lower bounds on the amount of black carbon the Himalayan ice pack receives. Their results indicate a range of 900-1300 micrograms per square meter were deposited on the ice during the pre-monsoon period (March-May) in 2006. This amount of deposition can reduce the visible albedo by about 5%.

Aerosol optical depth data from MODIS-Terra and MODIS-Aqua aerosol optical depth data from Giovanni were used to illustrate black carbon deposition events occurring on March 31 and April 17, 2006. It should also be noted that data from the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model were used in this investigation.