New NASA Ocean Observations and Coastal Applications

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Outline

NASA’s new Earth Science Ocean Science Missions for 2014
- Global Precipitation Measurement Core Observatory (GPM)
- Orbiting Carbon Observatory 2 (OCO-2)
- ISS-RapidScat

SSC Coastal Applications Project Highlights
- Enhanced Oil Slick Detection
- Impervious Cover App
- Water Quality Analysis Tool
- Sargassum Early Advisory System App
Global Precipitation Measurement Core Observatory

Launched Feb. 27, 2014

GPM provides observations of rain and snow worldwide every three hours
• active radar provides information on precipitation particles, layer-by-layer, within clouds
• passive microwave imager senses the total precipitation within all cloud layers.
• extend the capabilities of the TRMM sensors to detect falling snow, measure light rain and provide quantitative estimates of microphysical properties of precipitation particles.

GPM extends observations to higher latitudes, covering the globe from the Antarctic Circle to the Arctic Circle

GPM’s next-generation global precipitation data will lead to
• Improved knowledge of the Earth’s water cycle and its link to climate change
• New insights into precipitation microphysics, storm structures and large-scale atmospheric processes
• Extended capabilities in monitoring and predicting hurricanes and other extreme weather events
• Improved forecasting abilities for natural hazards, including floods, droughts and landslides
• Enhanced numerical prediction skills for weather and climate
• Better agricultural crop forecasting and monitoring of freshwater resources

GPM data is available at NASA Goddard’s Precipitation Processing Center website: http://pps.gsfc.nasa.gov/
Orbiting Carbon Observatory 2

Launched July 2, 2014

OCO-2 will collect space-based global measurements of atmospheric CO$_2$ with the precision, resolution, and coverage needed to characterize sources and sinks on regional scales ($\geq$1000km).

OCO-2 will record changes in CO$_2$ over yearly and seasonal cycles within each year.

To remove the effect of changes in CO$_2$ abundances each day and discriminate between seasonal variations and long term changes, OCO-2 will acquire measurements in the sun-synchronous orbit. This means that OCO-2 will measure carbon dioxide over a given point on Earth's surface at the same local mean solar time.

OCO-2 will acquire data in three different measurement modes: nadir, glint, and target.

- Glint mode provides highly accurate measurements over the ocean.
- Target mode views a specific surface target continuously as the satellite passes overhead and can collect a large number of measurements over calibration sites.

Launch in August 2014

Replacement for NASA’s QuikScat Earth satellite, which monitored ocean winds to provide measurements used in weather predictions, including hurricane monitoring.

Reuses hardware originally built to test parts of QuikScat to create an instrument for a fraction of the cost and time it would take to build and launch a new satellite.

Measure near-surface ocean wind speed and direction in Earth’s low- and mid-latitudes in any kind of weather except heavy rain.

Provides the first near-global direct observations of how ocean winds vary over the course of the day, while adding extra eyes in the tropics and mid-latitudes to track the formation and movement of tropical cyclones.

Radar instrument that operates at 13.4 GHz bouncing microwaves off the ocean surface and measures the returned echo strength with a precision comparable to that of QuikScat.

Several views of the same sea surface during the overflight of the instrument provide radar return signals that can be turned into estimates of wind speed and direction since surface roughness varies in a predictable way in relation to wind speed and direction.
SSC Science at a Glance

• Stennis Space Center (SSC) utilizes NASA Earth science assets to address a broad range of environmental issues such as ecosystem monitoring, water quality, and disaster management.

• SSC partners with local, state, federal and international organizations, including government, business and academia.

• SSC provides users with innovative capabilities to plan effectively, monitor efficiently, mitigate appropriately, and respond quickly.
Enhanced Ocean Oil Spill Detection

(Left) May 25, 2010, image of the oil slick from MODIS Aqua. (Right) Gallegos (NRL/NASA) et al. created an oil slick detection and forecasting system created for NOAA. This approach required radar data and/or sun-glinted imagery.

A neural network was trained to detect the edges of the oil slick.

Deepwater Horizon oil spill: 1) oil + sediment, 2) oil sheen, 3) new oil, and 4) emulsified oil from MODIS Aqua on May 23, 2010.

A new algorithm is under development to detect ocean oil spills when sun glint is not available.
Small increases in impervious cover can have a significant impact on urban heat islands, urban flooding, water quality, aquatic ecosystems, and associated conservation and restoration projects.

Accurate, up-to-date, easily accessible information helps urban planners, real estate developers, and environmental management agencies plan effectively, monitor efficiently, and mitigate appropriately.
By enabling consistent estuary-to-estuary comparisons, SSC’s Water Quality Analysis Tool is helping establish numeric nutrient limits for Florida coastal waters. The EPA is also planning to deploy it to other regional offices and state agencies.
Large *Sargassum* landings create significant economic hardships for coastal communities. In 2014 there have been unprecedented landings around the Gulf of Mexico. The SEAS web app will provide coastal managers and stakeholders with information and alerts of potential landings, and enable them to optimally utilize human and capitol resources.

The 2014 Sargassum landings on the coast of Texas have been unprecedented. This picture (courtesy of Claire Reiswerg) shows the extent of the landings on Galveston Island on May 22, 2014.
Science @ SSC – Helping People Solve Problems

Making a difference in the Gulf, across the country, and around the world.

More information at

http://GulfOfMexicoInitiative.nasa.gov

http://science.ssc.nasa.gov