

Sea Level Mapped from Space Using GPS Reflections



The GPS signal used for satellite navigation could help improve understanding of ocean currents, according to new research published in *Geophysical Research Letters* by National Oceanography Centre (NOC) scientists, alongside colleagues from the University of Michigan and Jet Propulsion Laboratory. As part of this research, sea surface height has been measured from space using GPS signals reflected off the sea surface for the first time. Information from these GPS signal reflections can be potentially used by scientists to monitor ocean currents by measuring the slopes currents cause in the ocean's surface.

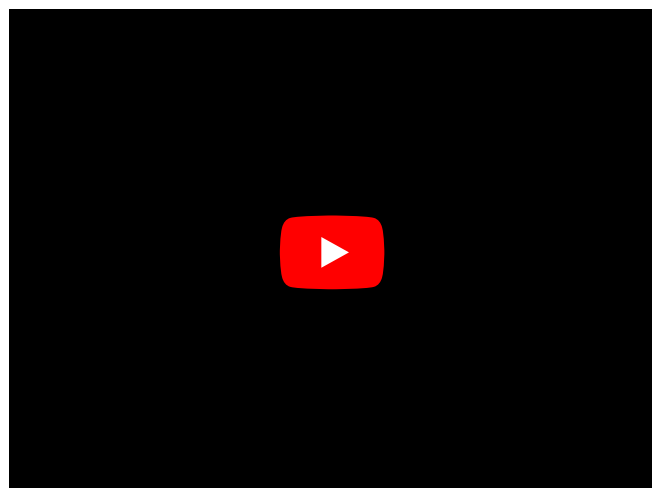
Ocean surface height measurements are routinely made from space by radar altimeters, but this new study is the first that uses the GPS reflections. The data for this research was

acquired from the TechDemoSat-1 satellite, launched in 2014 by Surrey Satellite Technology Ltd.

Dr Paolo Cipollini from NOC, who co-authored this research, concluded that the sea surface is not flat at all, especially when looked at over long distances. The largest 'bulges' are due to variations in the Earth's gravity field. On top of those there are smaller, shorter variations due to sea surface currents. The researchers are really encouraged by the results obtained since it demonstrates for the first time that it is possible to map the overall sea surface height from space using the GPS-reflections technique. In the near future currents possibly can be mapped from space by detecting even smaller variations in sea surface height.

GNSS-Reflectometry

GNSS-Reflectometry (GNSS-R) is the general term for reflectometry using navigation signals, including GPS as well as the European equivalent Galileo. The advantage of using GNSS-R is that it uses the GNSS transmitters already in orbit, and the lightweight, low-power receivers can be launched into space relatively cost-effectively. Existing satellite altimeters, although very accurate, are not in enough number to sample the ocean well at scales below 100km. A constellation of GNSS-Reflectometry receivers would provide a thirty-fold improvement on the amount of data that could be gathered. Such a constellation will be launched in late 2016 as part of the NASA CYGNSS mission, watch an animation of this below.



NOC's involvement with research in GNSS-R has been led by Christine Gommenginger, the head of Satellite Oceanography at the NOC. Results published by NOC scientists in 2015 have already demonstrated the capabilities of spaceborne GNSS-R for ocean surface wind speed retrieval.

This research is partly supported by Natural Environmental Research Council (NERC) National Capability funding, and forms part of the NOC's ongoing use of satellite data to investigate the ocean on a global scale.