Silver Anniversary for Ocean Altimetry Space Mission

August 10th 1992 marked the launch of the TOPEX/Poseidon satellite, the first major oceanographic focussed mission. Twenty five years, and three successor satellites, later the dataset begun by TOPEX/Poseidon is going strong providing sea surface height measurements.

TOPEX/Poseidon was a joint mission between NASA and France's CNES space agency, with the aim of mapping ocean surface topography to improve our understanding of ocean currents and global climate forecasting. It measured ninety five percent of the world's ice free oceans within each ten day revisit cycle. The satellite carried two instruments: a single-frequency Ku-band solid-state altimeter and a dual-frequency C- and Ku-band altimeter sending out pulses at 13.6 GHz and 5.3 GHz respectively. The two bands were selected due to atmospheric sensitivity, as the difference between them provides estimates of the ionospheric delay caused by the charged particles in the upper atmosphere that can delay the returned signal. The altimeter sends radio pulses towards the earth and measures the characteristics of the returned echo.

When TOPEX/Poseidon altimetry data is combined with other information from the satellite, it was able to calculate sea surface heights to an accuracy of 4.2 cm. In addition, the strength and shape of the return signal also allow the determination of wave height and wind speed. Despite TOPEX/Poseidon being planned as a three year mission, it was actually active for thirteen years, until January 2006.

The value in the sea level height measurements resulted in a succeeding mission, Jason-1, launched on December 7th 2001. It was put into a co-ordinated orbit with TOPEX/Poseidon and they both took measurements for three years, which allowed both increased data frequency and the opportunity for cross calibration of the instruments. Jason-1 carried a CNES Poseidon-2 Altimeter using the same C- and Ku-bands, and following the same methodology it had the ability to measure sea-surface height to an improved accuracy of 3.3 cm. It made observations for 12 years, and was also overlapped by its successor Jason-2.

Jason-2 was launched on the 20 June 2008. This satellite carried a CNES Poseidon-3 Altimeter with C- and Ku-bands with the intention of measuring sea height to within 2.5cm. With Jason-2, National Oceanic and Atmospheric Administration (NOAA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) took over the management of the data. The satellite is still active, however due to suspected radiation damage its orbit was lowered by 27 km, enabling it to produce an improved, high-resolution estimate of Earth's average sea surface height, which in turn will help improve the quality of maps of the ocean floor.

Following the established pattern, Jason-3 was launched on the 17th January 2016. It's carrying a Poseidon-3B radar altimeter, again using the same C and Ku bands and on a ten day revisit cycle.

Together these missions have provided a 25 year dataset on sea surface height, which has been used for applications such as:

- El Niño and La Niña forecasting
- Extreme weather forecasting for hurricanes, floods and droughts
- Ocean circulation modelling for seasons and how this affects climate through by moving heat around the globe
- Tidal forecasting and showing how this energy plays an important role in mixing water within the oceans
- Measurement of inland water levels – at Pixalytics we have a product that we have used to measure river levels in the Congo and is part of the work we are doing on our International Partnership Programme work in Uganda.

In the future, the dataset will be taken forward by the Jason Continuity of Service (Jason-CS) on the Sentinel-6 ocean mission which is expected to be launched in 2020.

Overall, altimetry data from this series of missions is a fantastic resource for operational oceanography and inland water applications, and we look forward to its next twenty five years!