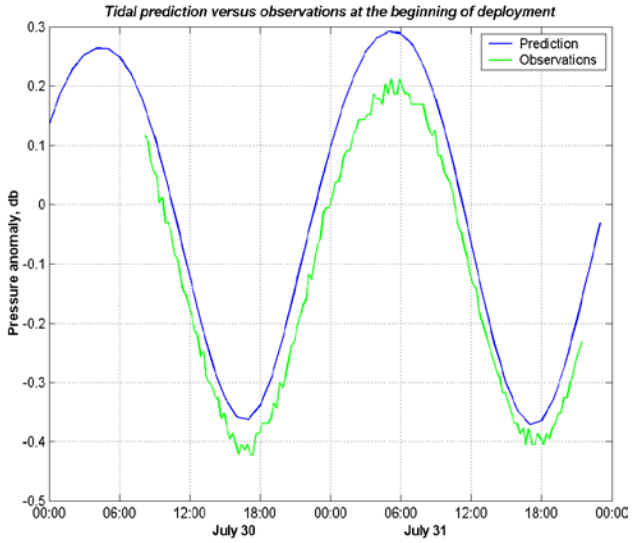
Gulf of Mexico
Water Depth Assessment at the Neptune Site

Project Characteristics:

- *Offshore Deepwater Design Support for Tension Leg Platform (TLP)*
- *Assessment of Mean Water Column Density*
- *Atmospheric Pressure*
- *Metocean Measurements and Analysis*
- *Assessment of Water Depth Relative to Mean Sea Level with an Error Budget*

Highly accurate mean water depth measurements were performed in connection with the design of seafloor structures and tendons for a Tension Leg Platform in the Gulf of Mexico at the Neptune site (approximate position: 27° 23' N, 89° 55' W) in a water depth of about 4200 ft (1280 m). Water depth was determined using high-precision pressure measurements, combined with a water column density profile. The instantaneous depth measurements were adjusted to account for the instantaneous sea surface height anomaly (relative to MSL) at the moment the measurements were collected.

Water depth relative to mean sea level (MSL) was measured at two locations using high-accuracy absolute pressure sensors (SeaBird Electronics SBE-26 and SBE-53 tide gauges) mounted on a seafloor platform and on an ROV (equipped with a ***Tritech SeaKing704*** bathymetric survey unit with a Paroscientific Digiquartz Depth Sensor), combined with supporting data (atmospheric pressure and water density profile). The procedure involved the following steps: (i) Measure water depth instantaneously using a combination of pressure and density measurements from an ROV; (ii) Correct the instantaneous depth measurements to reference them to long-term mean sea level, using a combination of bottom-moored pressure measurements, density measurements, historical density data, and satellite altimeter data; and (iii) Estimate the time variability of sea level.



Two days of the deployment

The analysis of the pressure records revealed dominance of tidal fluctuations. The Tidal Harmonic Analysis was used to calculate tidal constituents, residual variations of bottom pressure and water level offset caused by tidal variability at any specific time of the deployment operation. Tidal variations accounted for more than 90% of the total bottom pressure variability, but not of the water depth variability. The analysis of satellite altimeter data revealed a significant role of meso-scale processes in maintaining water depth variability. These meso-scale variations of water depth had little reflection in the bottom pressure records since the depth anomaly in such a case was compensated in pressure readings by the density anomaly. This is consistent with the physical dynamics of the baroclinic (density driven) processes on the rotating earth.

The data and analysis were applied to refine the tendon design for a Tension Leg Platform (TLP) in the Gulf of Mexico.

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