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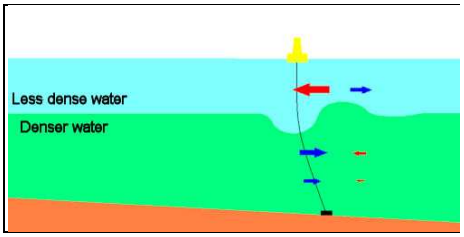
Environmental data acquisition for the global network

REAL TIME SOLITON DETECTION AND FORECAST SYSTEM ASSISTS WITH SUBSEA PIPELINE MAINTENANCE

Alphecca Systems have developed an automated real time soliton detection and forecast capability for the ARTEMeS data acquisition system.

Solitons are solitary subsurface waves that can propagate along the boundary between water layers having different densities, often at the depth of the seasonal thermocline. Generally occurring only in specific regions, solitons are often associated with large but short-term current velocities that can cause severe disruption to subsea operations while showing little indication of their presence at the surface.



The diagram to the left shows a soliton travelling from right to left.

Red arrows show currents in the direction of the wave propagation, while blue arrows show currents in the reversed direction.

Working together with UTEC Geomarine, Alphecca Systems developed a surface buoy equipped with RDI Quartermaster ADCP current profiler, GPS location sensor, Iridium transceiver and a sophisticated industrial microcontroller. The ADCP was configured to measure full current profiles down to approximately 240m, at intervals of two minutes. At the same time, the buoy velocity was determined from GPS locations and used to derive a current profile corrected for buoy motion.

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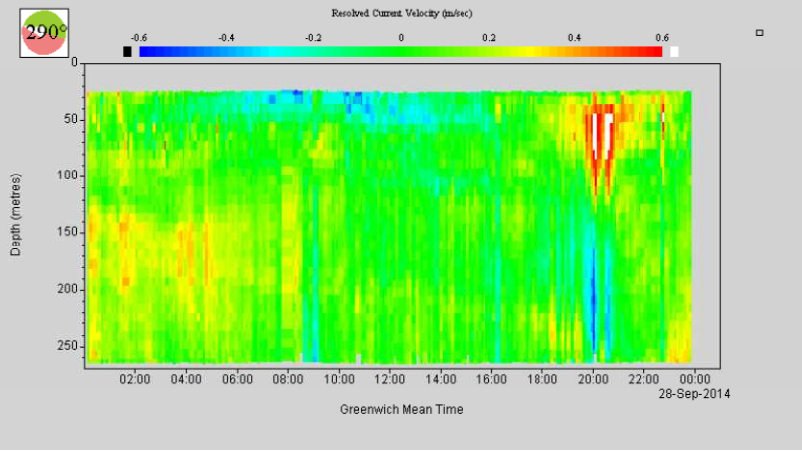
Data from the instruments were compressed and delivered to an ARTEMeS server via the Iridium satellite network.

On receipt at the server, the data were decompressed and decoded to derive values of current velocity throughout the profile, buoy motion and other parameters. The resulting values were then acquired by the ARTEMeS server and made available for display on secure web pages.

The display (right) shows the current profile recorded by the RDI ADCP.

Currents have been resolved along the direction 290°.

The twin high current event at about 20:00 was a strong soliton that was observed at several locations in S China Sea.



Once acquired by the server, an automatic process was used to analyse the data in order to detect if the signature of a soliton was present in the current profile.

A separate process was developed that would model the trajectory of a soliton over a period of a few hours. This model requires only the location and time of a detected soliton in order to generate forecasts of soliton arrival at other nearby locations.

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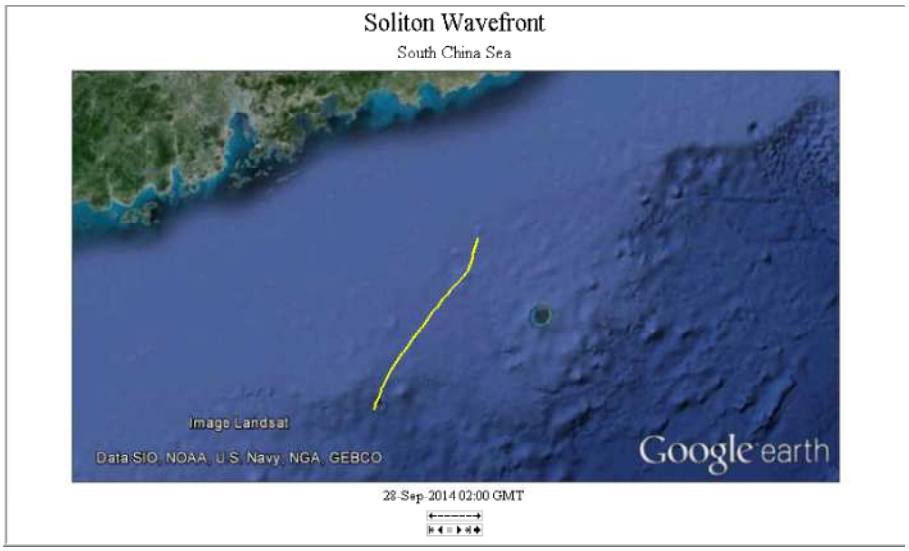
Animated displays of soliton wavefront propagation were also made available to web pages.



This figure shows the animated soliton wavefront display available on the ARTEMeS server.

The display updates in real time showing the forecast progression of the soliton.

ARTEMeS is a web-based real time system that offers unique server-side processing capability in addition to highly interactive and scientifically sound display components.

Functional demonstrations of the technology described in this note may be seen by logging on to the ARTEMeS server at
http://www.alphecca.co.uk

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