Jason-1 monitoring and prediction capabilities on the continental shelf

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The Naval Research Laboratory will examine the Jason-1 altimeter ability to provide increased real time observation capability particularly in the Asian marginal seas (South China Sea, East China Sea, Yellow Sea, Sea of Japan). Water properties within each sea are strongly influenced by the flow through the connecting Taiwan and Korea Straits. The sea level drop across the straits is expected to provide an estimate of the flow, and this information will be vital to future ocean environment monitoring systems.

Each Asian Marginal Sea is unique in its characteristics, and each basin has been studied to an extent in isolation. However, the connection of these seas to one another and to the open ocean allows changes in circulation and properties within one basin to affect another. Using TOPEX/POSEIDON data the Naval Research Laboratory (NRL) has demonstrated that local wind events produce large sea surface set-down in the northern Yellow Sea [Jacobs et al., 1998]. The changed surface height causes a pressure gradient that forces Kuroshio water northward across the shelf break. The open ocean Kuroshio water carries warm and relatively high salinity water that is mixed into the Yellow Sea region. These shelf waters control the water mass properties transported through the Korea Strait into the Sea of Japan. In addition, coastally trapped shelf waves propagate from the northern Yellow Sea southward along the Chinese coast at a speed of 12 m/s. Using satellite altimeter data, the coastal waves are observed to pass through the Taiwan Strait into the South China Sea. Thus, the local winds in the Yellow Sea have influences that impact both the Japan/East Sea and the South China Sea.

An intensive in situ study of the Korea Strait has been conducted as part of this work (figure 1).
The deployment consists of
11 moorings. Each mooring contains an Acoustic Doppler Current Profiler (ADCP), which measures velocities throughout the water column, and a pressure gauge. The dynamics and forcing that control the flow through the strait are not well understood. The transport variations in response to sea level changes across the strait will be examined. The transient changes in response to sea level changes are expected to take the form of large scale Kelvin waves propagating northeastward along the Japan coast and southwestward along the Korean coast of the Tsushima Strait [Ohshima, 1994]. The importance of the geostrophic control versus hydraulic control [Mattsson, 1995] within the Tsushima Strait is still a widely debated issue, and the altimeter data in combination with the in-situ measurements will aid in answering these questions. Thus, the Jason-1 altimeter data will be used to monitor the SSH difference between the East China Sea and the Sea of Japan

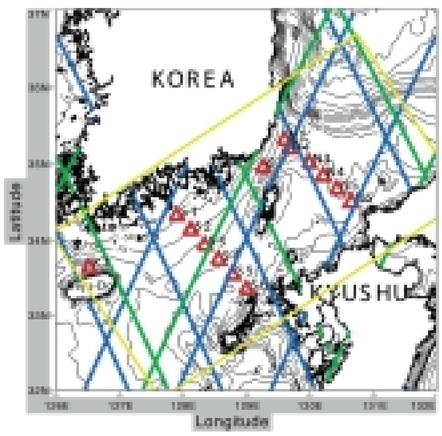

Figure 1: The position of the in-situ ADCP and PG instruments, T/P ground tracks (green), Geosat ground tracks (blue), and the domain of the local adjoint assimilation model. The model will be used to form a solution that minimizes the difference to dynamical equations, the in-situ measurements, and altimeter sea level variations.

which is related to the pressure head driving the transport through the strait.

A regional Asian marginal seas sigma coordinate model is presently being set up to study this area (figure 2). The model will cover the area 10°S to 55°N and 100°E to 155°E. The synoptic open ocean boundary conditions at 155°E will be set from a model covering the entire Pacific Ocean assimilating SSH and SST observations in real time. Be recreating the observations using numerical models, we demonstrate the accuracy of the model physics. Within the numerical models, we may also remove particular physical processes to further test hypotheses related to the sea surface height. For example, wind stress may be applied to the area covering only the Yellow Sea to determine the sensitivity of the Korea Strait transport to wind stress over this limited area.

Within the Korea Strait we intend to use our understanding of the dynamics along with the observations to provide an optimal estimate of the flow. An inverse model will provide an understanding of the inflow and outflow dynamics. Assimilation of the Tsushima Strait data into the model will proceed along two lines. First, an approach based on the vertically integrated equations to determine the vertically averaged fields of current and surface height. The assimilation technique will be further developed to include depth dependent effects, expected to play a significant role in the Strait. An understanding of the dynamics in the Tsushima Strait will be provided through this inverse solution by examining the splitting of the flow as it enters the Sea of Japan in connection with events in the Yellow and East China Seas, instability in the strait, and waves propagating upstream from the unstable currents within the Sea of Japan. This provides a capability to study the processes of importance in relation to observed transition of regional currents from one state to another.

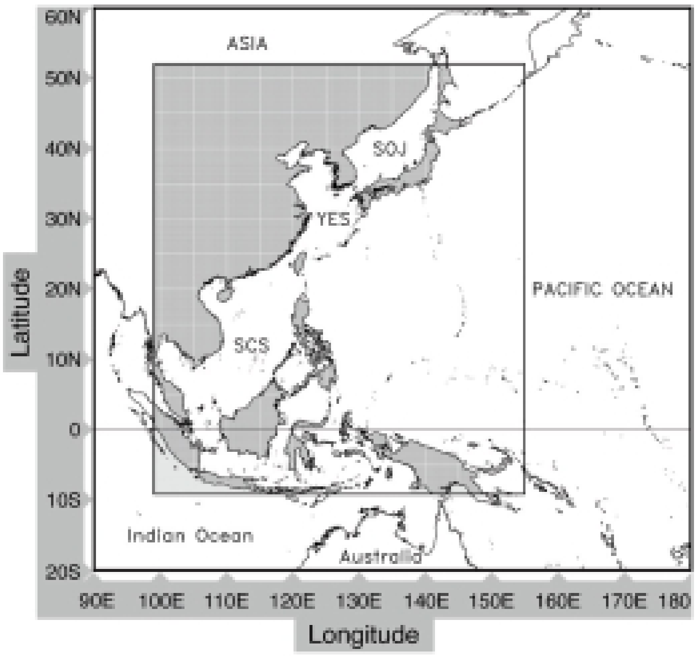

Figure 2: The sigma coordinate model domain for the East Asian Marginal Seas. The seas to be studied include the South China Sea, the Yellow Sea, the East China Sea, and the Sea of Japan (Japan/East Sea). The model resolution is 1/8 degree, forced by synoptic boundary conditions based on a global altimeter-assimilative model, observed wind stress, heat flux, and buoyancy fluxes.

References

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