

## **Tides in the Ullung Basin of the Japan/East Sea**

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From June 1999 to June 2001, 23 pressure-sensor-equipped inverted echo sounders (PIES) were deployed in a 2-D array covering the Ullung Basin (UB) of the Japan/East Sea. The main purpose of the study was the temporal mapping of the thermal structure of the UB. However, tidal pressure fluctuations were also measured by this array. Tidal coefficients were extracted from each pressure time series, and combined with coefficients from coastal tide stations and some tidal current coefficients from shallower water in the southwestern part of the UB to form cotidal maps of the entire UB. This was accomplished by assimilating the tidal data into a barotropic tide model through a strong-constraint variational approach making use of an adjoint model. The data were fitted to the shallow water equations in a least-squares sense by adjusting only the incoming gravity waves along the model boundaries. From the model output, we computed amplitude and phase maps of surface-height fluctuations and barotropic currents for the principal tide constituents. Surface height prediction errors were  $\sim 0.7$  cm for the PIES sites and  $\sim 1.3$  cm for the coastal tide stations. Barotropic current prediction errors for the current sites were  $\sim 3.0$  cm/s,