Analysis of Near Surface Circulation of the Japan East Sea

Pearn P. Niiler
Scripps Institution of Oceanography
9500 Gilman Drive
MC 0213
La Jolla, CA 92093
Phone: (858) 534-0378 fax: (858) 534-7931 email: pniiler@ucsd.edu

Dong-Kyu Lee
Department of Marine Sciences, Pusan National University
Busan, 609-735, Korea
Phone: (51)510-2180 Fax: (51)581-2963 email: lee@po.ocean.pusan.ac.kr

N00014-98-1-0235

LONG TERM GOALS

The long-term goal is to study the variability of the upper ocean current systems and their relationship to meteorological forcing. To this end, spatially coherent field observations are required of the ocean response and the atmospheric forcing. A new instrument, the MINIMET, a water following drifter, was designed as a tool to obtain ocean and atmospheric data. Arrays of MINIMETS will be utilized in a coordinated field experiment in marginal seas to study wind-driven ocean currents.

OBJECTIVES

The scientific objectives are to obtain direct measurements of ocean circulation on various time and space scales that are of sufficient spatial density and time duration so both seasonal means and intra-seasonal variations can be determined. This data will be used to test model dynamics, both in the processes that determine the mean motions, as well as the exchange of energy and momentum between the mean and the eddies. A comparison of the MINIMET observations of the circulation field and wind field with models and satellite observations will be made.

APPROACH

In marginal seas, circulation patterns are spatially complex and seasonably variable. Lagrangian techniques are well suited for developing quantitative estimates of the circulation in the areas where the general pattern of currents are not well known. Wind fields are complex, often affected by mountains or other land boundaries. Large numbers of drifters were deployed from volunteer ships in the Japan-East Sea to map the circulation patterns. In the period of 1998-2001 we released 56 MINIMETs and 33 SVP drifters from VOS and research vessels. Data from the NASA/QuikSCAT was used for verification of the wind observations.

WORK COMPLETED

Data processing has been completed from a uniform format from a suite of 131 SVP, 44 MINIMET and 72 NAVY drifters. Data from QuikSCAT has been interpolated on to the drifter tracks and the co-located data has been analyzed. Numerical model data from NRL has been accessed and is under investigation. The final year of this project will be used for completion of the analyses and dynamical interpretations.

RESULTS

Comparison of the QuikSCAT and the observed winds in the Japan-East Sea show that there was an improvement of the MINIMET direction observing capability in 1997-2000 period, compared to the initial deployments in 1996-97 in the Labrador Sea (figure 1).

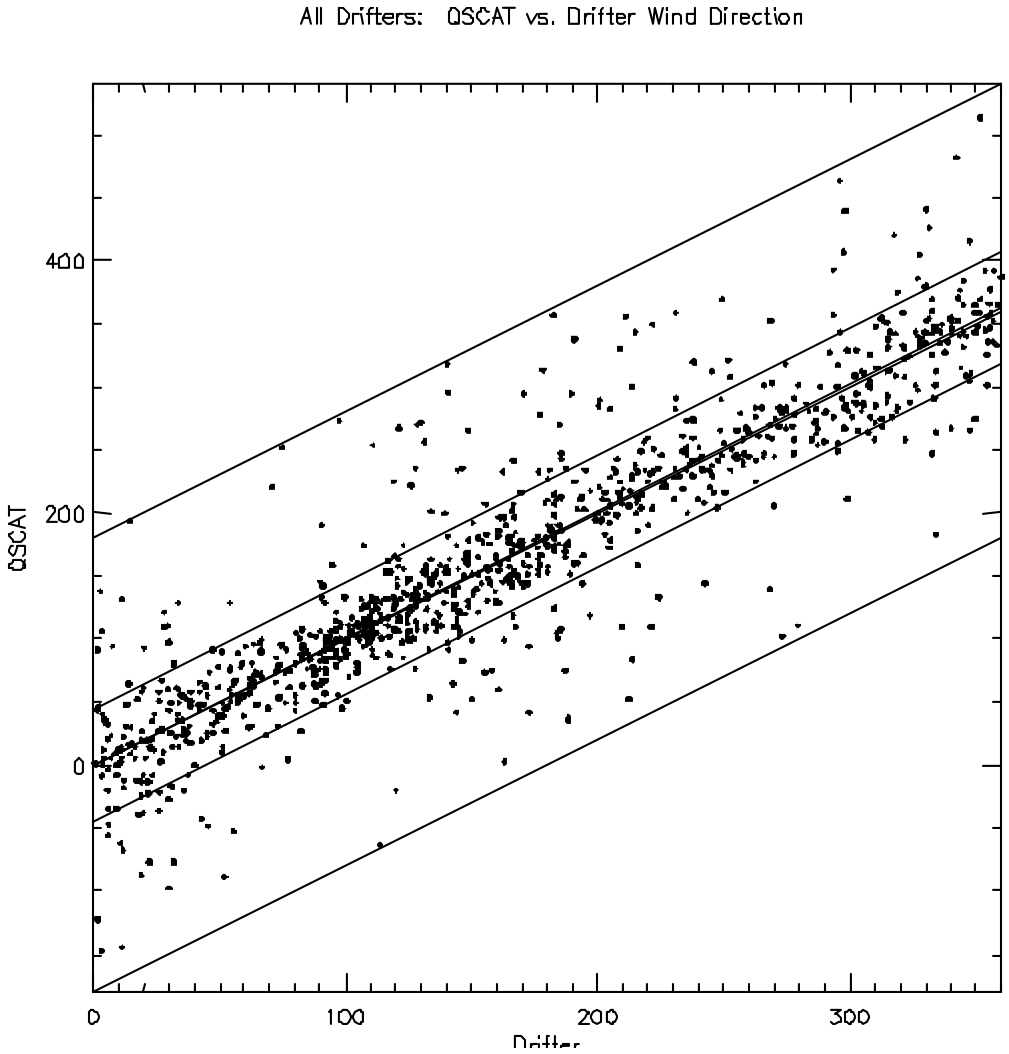

Figure 1. Comparison of QuikSCAT and observed wind direction in the Japan East Sea
[Scatter plot shows agreement between QuikSCAT wind direction and observed wind direction from drifters.]

There was an increase of 185 % of velocity observations from drifters in the Japan-East Sea since 1998. The computation of the mean velocity and the eddy energy is now more complete spatially and more robust in accuracy (Figure 2).

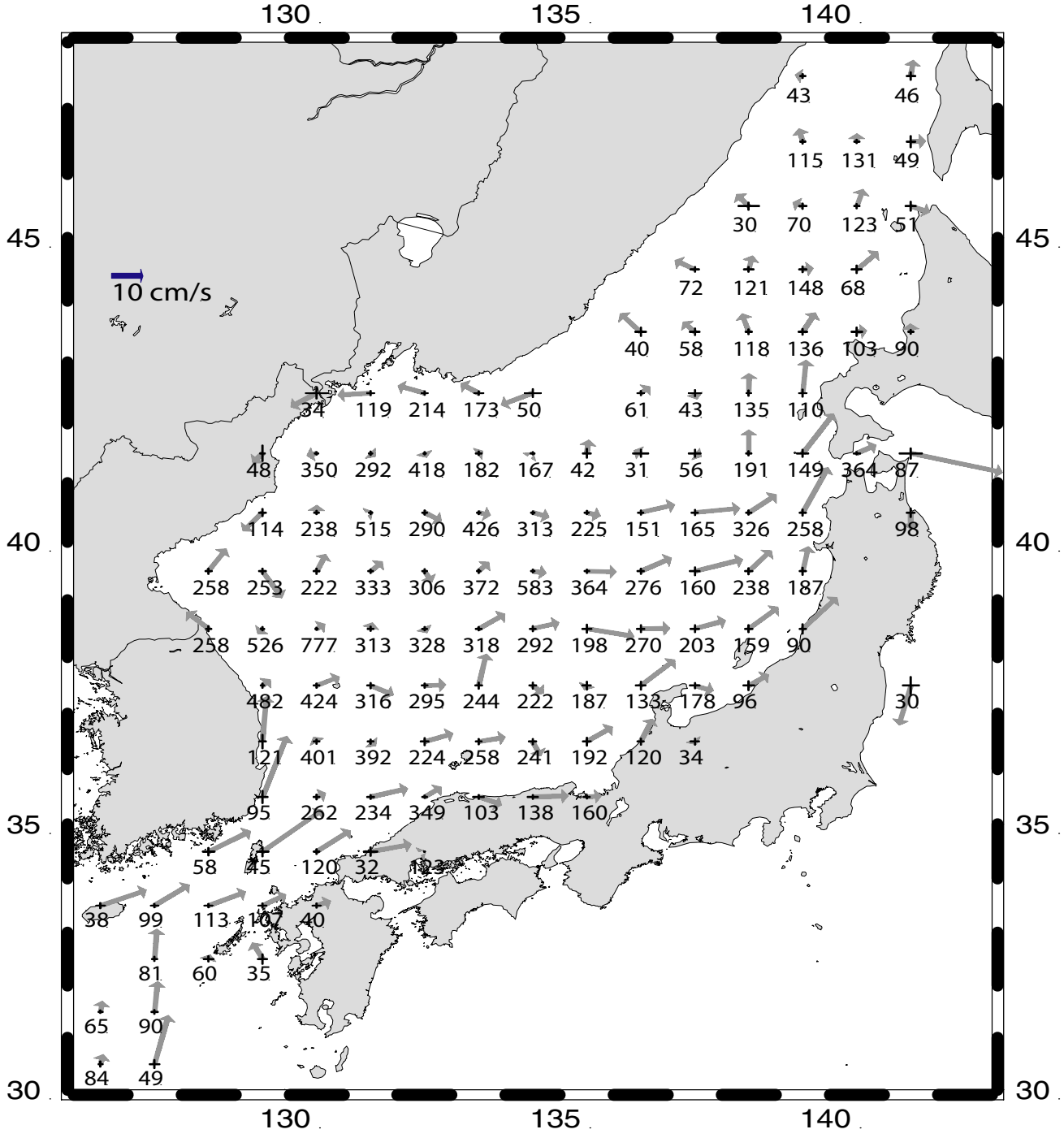

Figure 2. Mean Current and Standard Error
[Plot of mean current and standard error. Computation of the mean velocity and the eddy energy is now more complete spatially]

IMPACT/APPLICATIONS

TRANSITIONS

The MINIMET drifter is available on a commercial basis. NAVOCEANO and NOAA Hurricane Center at AOML are now using these drifters in strategic operations.

RELATED PROJECTS

NOAA/OGP funded "Global Drifter Program"

PUBLICATIONS

Hall, M.M., P.P. Niiler and W.J. Schmitz, Jr.: Mean circulation in the eastern North Pacific along 152 West. *Deep-Sea Research I, Vol. 44, No. 7*, 1137 – 1146. (1997)

Lee, Dong-Kyu, Jae-Chul Lee, and Heung-Jae Lie, A Circulation study of the East Sea using satellite-tracked drifters, *Journal of the Korean Fisheries Society, 30*, (6), Pusan, Korea. (1997)

Van Meurs, Pim and Pearn P. Niiler, Temporal variability of the large scale geostrophic surface velocity in the northeast Pacific. *J. Phys. Oceano., 27*, 2288-2297, 1997.

Van Meurs, Pim, Interactions between near-inertial mixed layer currents and the mesoscale: The importance of spatial variabilities in the vorticity field, *J. Phys. Oceono., 28*(7), 1363–1388. (1998)

Lee, Dong-Kyu, Pearn P. Niiler: The near-inertial energy drainage from the ocean surface to the deep layer. *J. Geophys. Res., Vol. 103, No C4,* 7579 – 7591. (1998)

Lee, Dong-Kyu, Pearn P. Niiler, Sang-Ryong Lee, Kuh Kim, Heung-Jai Lie, Energetics of the Surface Circulation of the Japan/East Sea, *J. Geophys. Res., 105*(C8), 19,561-19573. (2000)

Lee, Dong-Kyu, Pearn P. Niiler, Moon-Sik Suk, Comparison of Ocean Currents Observed from Drifters and TP/ERS in the East Sea, *Ocean and Polar Research, 23(2)*, 133-139. (2001)

PATENTS

None