Gliders monitor western boundary current transport in the Solomon Sea

William S. Kessler[1], Uwe Send[2], Russ Davis[2]
[1]NOAA/Pacific Marine Environmental Laboratory, Seattle WA
[2]Scripps Institution of Oceanography, La Jolla CA

Project Summary

The western boundary current in the Solomon Sea is the primary pathway by which waters from the subtropical South Pacific reach the equatorial zone and the Equatorial Undercurrent in particular. It is, therefore, an important link of the shallow overturning circulation that supports interannual to decadal climate variability in the Pacific, and which provides the "memory" carried by the ocean. This project seeks to observe and understand fluctuations of the transport through the Solomon Sea. Underwater gliders are used to make 9-12 transects each year crossing the Sea to build a time series of transport variability. Analysis of this time series is determining how and why transport and water properties vary, how these affect and are affected by ENSO (El Niño/Southern Oscillation) and decadal variability, and local impacts affecting Solomon Sea residents.

The glider data can be viewed and plotted in near real-time at spray.ucsd.edu and is available for downloading from this server with a password available on request. This data is intended to be useful to climate analysts seeking to understand and predict interannual-decadal variability in the Pacific, especially those building simulation and prediction models of ENSO and the Pacific's shallow overturning circulation.

The glider transects have been operating since July 2007, with increasingly-frequent crossings of the Solomon Sea towards our target of monthly sections. This repeat schedule is designed to accurately monitor the interannual transport fluctuations, primarily to resolve the ENSO signal; as almost no previous data was available, the target is based on our evolving experience with the initial years of glider sampling. To better understand the errors due to shorter-timescale variability, during FY12 we deployed PIES (Pressure Inverted Echo Sounders) and mini-temperature/salinity moorings at each end of the glider line. These measure summary cross-Sea values at hourly intervals, providing an estimate of short-term signals that the glider may have missed.

This report covers the part of the Solomon Sea glider project conducted by the PI (Kessler) at NOAA/PMEL. This element involves on-site operations in the Solomon Sea, and is conducted integrally as part of the parent project of the same title, with Drs. Uwe Send and Russ Davis (Scripps/UCSD) as PIs and Kessler as Co-PI. Other aspects of this project, including the scientific accomplishments and data output, are discussed in the longer Send-Davis-Kessler report.

The PMEL portion of the glider funding is entirely for PI travel to the Solomon Sea region. There are three goals for this travel: (1) To deploy and recover gliders and associated moorings; (2) To negotiate and maintain our EEZ clearances; (3) To manage in-country capabilities (operational contacts, boat charters, customs, internal shipping).

The glider program is different from many others in that we work from shore using local small boats; in addition, to fully sample the western boundary current, the gliders approach within 3km of the coast on both sides of the Solomon Sea. These mean that our operations are conspicuous to the local people, and that our sampling is sensitive to governments in that we make measurements very near to coasts, populations, and economic activity (fishing). Thus, relations with the two governments involved (Papua New Guinea and the Solomon Islands) can be delicate and require ongoing diplomacy to maintain. Both governments are wary of foreign researchers, and insist that the findings be shared accessibly with them (beyond the usual requirements of sending copies of the data and published articles) and that their peoples receive some benefit, typically by contributing to their educational systems, also by training local personnel. To meet this requirement, I give regular lectures at schools, colleges and churches. I meet with stakeholders and local government officials as requested. In the Solomon Islands where we have a substantial presence, I liaise with the Solomon Islands Meteorological Service and lecture to their personnel on results from this project. Since the national governments are weak and much actual governance is conducted locally, it is essential to meet regularly with provincial and tribal leaders so that they accept gliders in their fishing areas. Additional benefit results by being a visible, beneficial representative of the United States in these regions where Americans are not often seen.

The key difference between what is attempted here and more ordinary, limited-duration ocean observations is establishing an *ongoing monitoring* presence, with the development of a long time series essential to diagnosing the place of the western boundary current in the climate of the Pacific. That implies a correspondingly ongoing obligation to address the needs of the host countries (and they insist on this), and to be prepared to meet the unique challenges of working in such a remote region. It is this piece of the work that the PMEL funding supports.