

Gliders Monitor Western Boundary Current Transport in the Solomon Sea

On-site Operations and Local Relations

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1. 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 part of the shallow overturning circulation that supports interannual to decadal climate variability in the Pacific. This project seeks to observe and understand how and why transport through the Solomon Sea varies. Underwater gliders are used to make several 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 and decadal variability, and any local impacts affecting Solomon Sea residents.

The glider data can be viewed 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 including those building simulation and prediction models that include ENSO and the Pacific's shallow overturning circulation.

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 Russ Davis (Scripps/UCSD) as PI and Kessler as Co-PI. The non-operational aspects of this project, including the scientific accomplishments and data output, are discussed in the longer Davis-Kessler report, which includes figures and Powerpoint slides.

2. Scientific and Observing System Accomplishments

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; (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 demand as *quid pro quo* that the findings be shared accessibly with them (beyond simply 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 and colleges and in the villages we work from (see Education and Outreach, below). 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, but these consultations range widely over developments in international climate science. 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.

Working in these deeply undeveloped countries also poses challenges that need local contacts to resolve. As a recent example, one of our gliders failed in October 2010. It stopped transmitting and appeared lost. Then in late January 2011 it unexpectedly reported from near Manus Island, PNG, about 1000km away from its last position. I had a contact in Manus, and was able to quickly find a suitable boat there and organize a rescue. We recovered the glider, diagnosed the problem as a misassembly of the instrument, and in addition to recovering the instrument were able to correct the assembly of subsequent gliders.

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.

The PI made three trips to the region in FY2011 to support the project's objectives, each 2-3 weeks long: Sep-Oct 2010, Jan-Feb 2011, Jun-Jul 2011.

Scientific accomplishments and data output of this project are described in the companion report of the same title, with Russ Davis as PI and Kessler as Co-PI.

2.1. Outreach and Education

Partly to keep our EEZ clearances, the PI lectures at schools and colleges and meets with local stakeholders in Papua New Guinea and the Solomon Islands. These lectures explain the glider program and what we are learning about the local ocean, in terms appropriate to the audience. An ongoing connection is maintained with the Dept. of Environmental Science, University of Papua New Guinea (UPNG; Port Moresby), with the Solomon Islands College of Higher Education (SICHE; Honiara), and with the Solomon Islands Meteorological Service (SIMS, Honiara). During FY2011, the following lectures were given:

Jan 29 2011 Lecture and glider demonstration to Chief and villagers at Ponam, PNG
Jan 31 2011 Lecture to local government/business leaders at Lorengau, PNG Jul 11 2011
Lecture to Chief and villagers at Ghatere village, Kolombangara,
Solomon Islands
Jul 13 2011 Lecture to weather observers at SIMS, Honiara
Jul 4 2011 Lecture to "advanced" environmental science class at UPNG

In the U.S., the PI lectures to high school and university audiences about the glider program and the role of tropical ocean currents in the climate system. During FY2011, the following lectures were given:

Mar 4 2011 Central Washington University (Environmental Science class)
May 20 2011 U.Washington Bothell campus (Climate Science class)

3. Publications and Reports

3.1. Publications by Principal Investigators

Analyses of the Solomon Sea observations through 2010 are presented in

Davis, R.E., W.S. Kessler and J.T. Sherman, 2012: Gliders measure western boundary current transport from the South Pacific to the Equator. *J. Phys. Oceanogr.*, in preparation.

3.2. Other Relevant Publications

The following publications describe companion work that informs the glider sampling:

Cravatte, S., A. Ganachaud, Q.-P. Duong, W.S. Kessler, G. Eldin, and P. Dutrieux, 2011: Observed circulation in the Solomon Sea from SADCP data. *Prog. Oceanogr.*, **88**(1-4), doi: 10.1016/j.pocean.2010.12.015, 116-130.

Hristova, H. and W.S. Kessler, 2012: Surface circulation in the Solomon Sea derived from Lagrangian drifter observations. *J. Phys. Oceanogr.*, in press.