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Beyond mesoscale eddies: Ocean dynamical signals and mapped SSH

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The long-term goal of this project is to enable improvements in the altimetric data products being used extensively by the international oceanographic community, by studying three particular dynamical signals that present difficulties for the optimal interpolation (OI) algorithms currently in use. Specifically, the research has three primary goals: (1) to study some particular oceanographic phenomena to characterize and understand their effects on SSH wavenumber-frequency spectra (or equivalently, SSH autocovariance functions), (2) to better understand the associated ocean physics, and (3) to use this knowledge to inform consideration of the consequences of different ways of handling such signals in OI algorithms.

Part of the work on the project was carried out by a postdoctoral researcher (Uriel Zajaczkovski) under the supervision of Farrar and Jayne. Zajaczkovski has been working on a paper to document and interpret the geographical variability of the space-time propagation of mesoscale SSH variability. He is preparing a manuscript on the subject, but progress has slowed because Zajaczkovski started a new job.

We are completing a series of manuscripts on the long-range propagation of barotropic Rossby waves away from tropical instability waves in the Pacific Ocean. This work is relevant to the current project because these monthly period waves are distorted in the widely used AVISO mapped altimetry product. We have produced a new gridded data product from the along-track altimetry and have found that these waves propagate 1000's of kilometers from their generation site near the equator. One of these three manuscripts (a theoretical study on the horizontal transport of energy by Rossby waves) was submitted and accepted for publication this year, and two of the others are in review. Our analysis also shows that the waves make a significant nonlocal contribution to eddy kinetic energy, and we expect to prepare and submit a fourth paper on this topic during the final year of the grant.

We also contributed to two chapters of the book, *Satellite Altimetry Over Ocean and Land Surfaces* (Stammer and Cazenave, editors) and to a very long paper on the ability of SWOT and a potential Doppler Scatterometer mission to resolve ocean vorticity (Chelton et al., 2019).

Another activity that we would like to note is that Farrar contributed substantially as a peer reviewer to a manuscript on the resolution of the AVISO/DUACS SSH product (Ballarotta et al., 2019), with a 15-page review that is available online with the manuscript:
https://os.copernicus.org/preprints/os-2018-156/os-2018-156-RR1.pdf
This review is directly relevant to the topic of this project.

Submitted and published:

Durland, T.S. and J.T. Farrar, 2020: Another Note on Rossby Wave Energy Flux. *J. Phys. Oceanogr.*, https://doi.org/10.1175/JPO-D-19-0237.1

T. Lee, J.T. Farrar, S. Arnault, D. Meyssignac, W. Han, and T. Durland. Monitoring and interpreting the tropical oceans by satellite altimetry. In D. Stammer and A. Cazenave, editors, *Satellite Altimetry Over Ocean and Land Surfaces*. CRC Press, Taylor and Francis Group, 2018.

R. Morrow, L.-L. Fu, J.T. Farrar, H. Seo, and P.-Y. Le Traon. Ocean eddies and mesoscale variability. In D. Stammer and A. Cazenave, editors, *Satellite Altimetry Over Ocean and Land Surfaces*. CRC Press, Taylor and Francis Group, 2018.

D. B. Chelton, M. G. Schlax, R. M. Samelson, J.T. Farrar, M. J. Molemaker, J. C. McWilliams, and J. Gula. Prospects for future satellite estimation of small-scale variability of ocean surface velocity and vorticity. *Progress in Oceanography*, 2019.

Submitted (in revision):

Farrar, J.T., T.S. Durland, S.R. Jayne, and J.F. Price, 2020: Long-distance radiation of Rossby waves from the equatorial current system. Submitted to *J. Phys. Oceanogr.*

Durland, T.S. and J.T. Farrar, 2020: A model of 33-day barotropic Rossby waves in the North Pacific. Submitted to *J. Phys. Oceanogr.*