Salient results from OSTST 2017-2020: SSH Eddy Identification and Tracking and Modeling the Ocean Mesoscale

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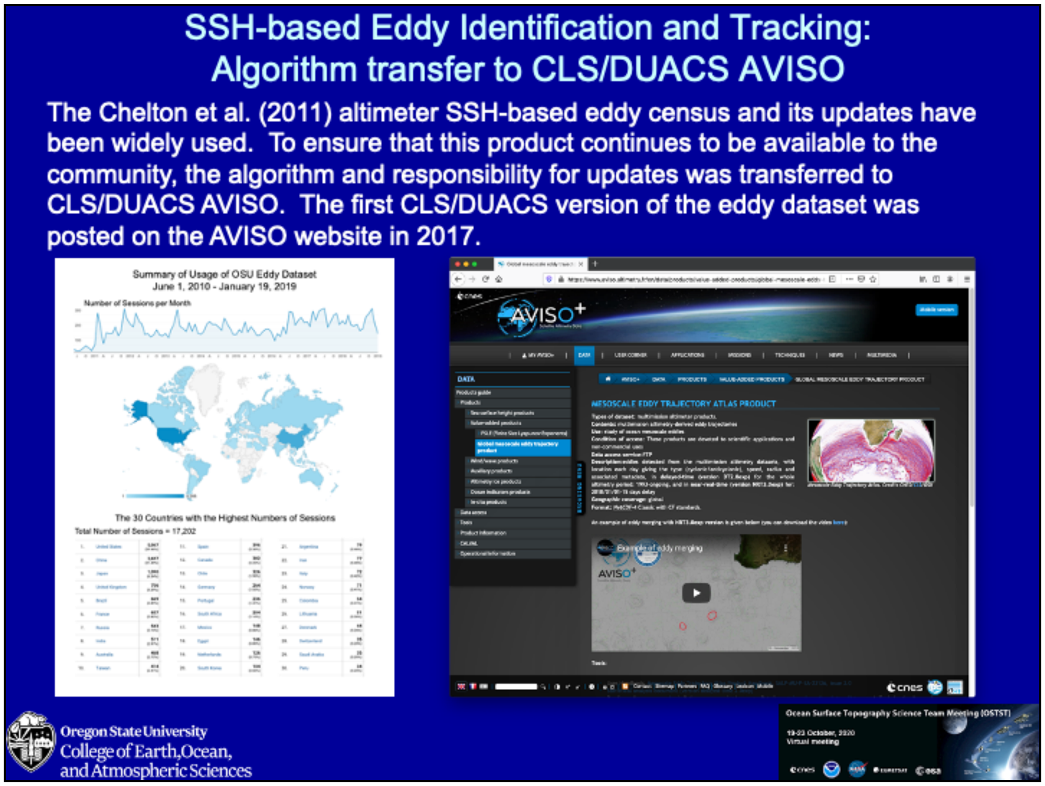
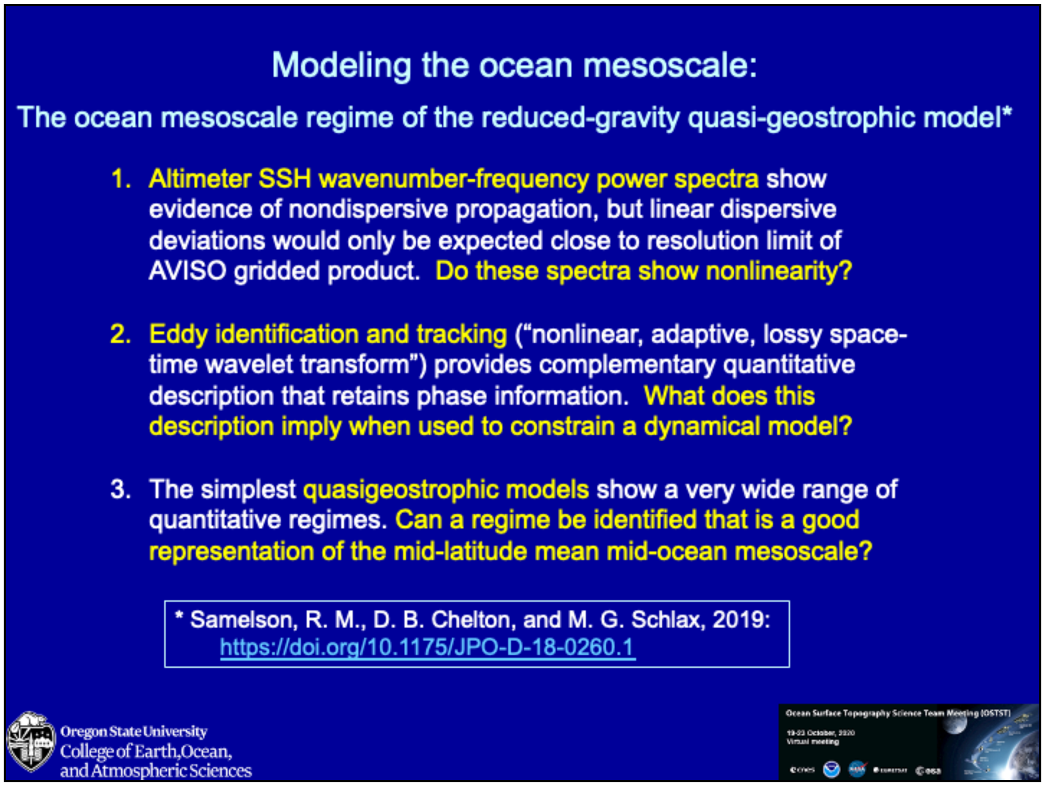
Two OSTST-supported results from 2017-2020 are highlighted.



Chelton, D. B., M. G. Schlax, and R. M. Samelson, 2011. Global observations of nonlinear mesoscale eddies. Progress in Oceanography, 91, 167-216, doi:10.1016/j.pocean.2011.01.002.

https://www.aviso.altimetry.fr/en/data/products/value-added-products/global-mesoscale-eddy-trajectory-product.html



This work is described in the following publication:

Samelson, R. M., D. B. Chelton, and M. G. Schlax, 2019. The ocean mesoscale regime of the reduced-gravity quasi-geostrophic model. J. Phys. Oceanogr., 49, 2469–2498, DOI: 10.1175/JPO-D-18-0260.1; see also links to informal errata and source code at

http://www-poa.coas.oregonstate.edu/~rms/ms/jpo2019omrqg_jpo-d-18-0260.1_errata_eqs_26_27_Fig16.pdf

and
https://github.com/rsamelson/quasigeostrophic_spectral_layer_model/tree/master/qg_1layer_dp.

That study built primarily on three previous publications:

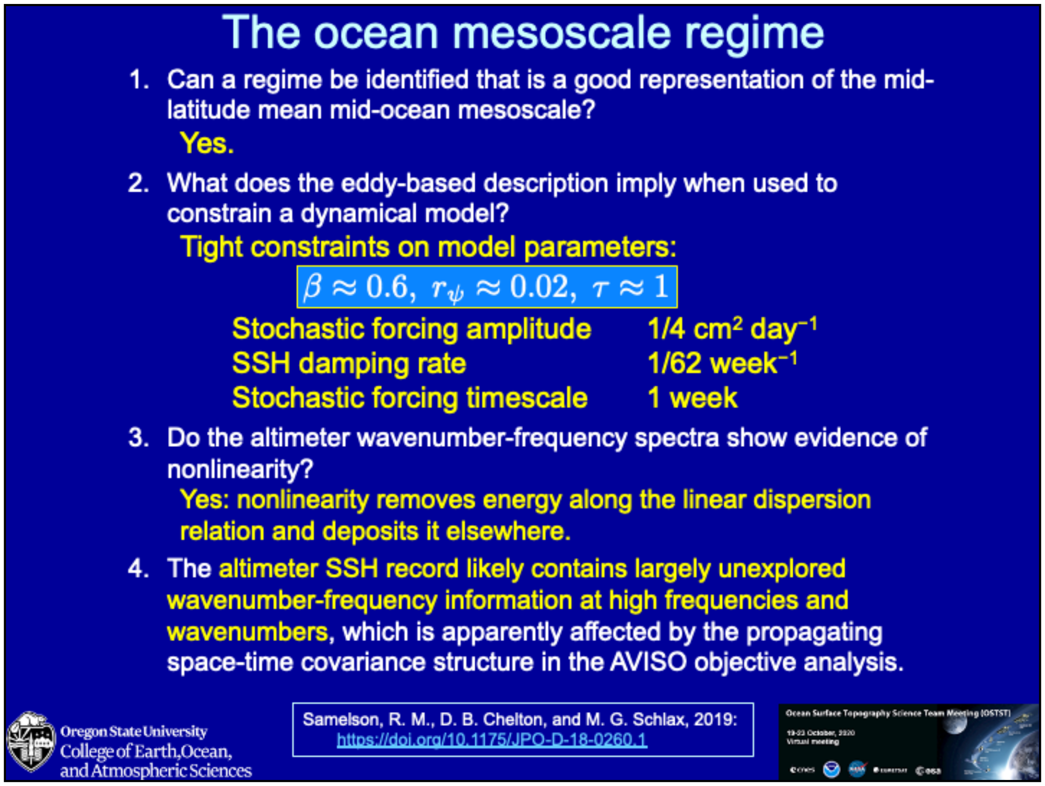
Samelson, R. M., M. G. Schlax, and D. B. Chelton, 2016. A linear stochastic field model of mid-latitude mesoscale sea-surface height variability. J. Phys. Oceanogr., 46, 3103–3120, doi: 10.1175/JPO-D-16-0060.1; see also link to informal errata at

http://www-poa.coas.oregonstate.edu/~rms/ms/jpo2016sfm_jpo-d-16-

0060_1_errata_AVISO_Sk_FigA1.pdf.

Samelson, R. M., M. G. Schlax, and D. B. Chelton, 2014. Randomness, symmetry, and scaling of mesoscale eddy lifecycles. J. Phys. Oceanogr., 44, 1012–1029, doi: 10.1175/JPO-D-13-0161.1; corrigendum doi: 10.1175/JPO-D-14-0139.1.

Chelton, D. B., M. G. Schlax, and R. M. Samelson, 2011. Global observations of nonlinear mesoscale eddies. Progress in Oceanography, 91, 167-216, doi:10.1016/j.pocean.2011.01.002.



Conclusion 1: The sought-after regime can be found and fits probability distribution functions as well as mean statistics: it is a remarkably good fit for such a simple model!

Conclusion 2: The corresponding physical constraints or rates implied by the parameter values that define the regime are as indicated on the slide.

Conclusion 3: Additional evidence for nonlinearity of the observed wavenumber-frequency spectra can be extracted from the model comparison through a linear inversion of the observed spectra using the transfer function for the linearized dynamics. This analysis indicates that nonlinearity removes energy along the linear dispersion relation and deposits it elsewhere.

Conclusion 4: The same linear inversion suggests that the propagating space-time covariance structure used to construct the merged, multi-altimeter SSH dataset may leave its imprint on the gridded spectra. This in turn suggests that a refined procedure might be developed that would retain additional information at high frequencies and wavenumbers, which might then be used for further analysis of mesoscale dynamics.