A look at two disparate limits of the climate system: oceanic sub-mesoscales and global energy balance\textsuperscript{1}

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A common theme underlying this journey across scales is that of energy balance. The first topic considers scales from a few tens of meters to a few tens of kilometers and grapples with a fundamental question that concerns energetics of ocean circulation: how does ocean circulation equilibrate in the presence of continuous large-scale forcing and a tendency of geostrophic turbulence to confine energy to large and intermediate scales. In particular, interior instabilities are shown to provide an energy pathway between the largely-balanced, energetic oceanic mesoscales and smaller unbalanced scales (J. Fluid Mech. (2014), vol. 756, pp. 965-1006; doi:10.1017/jfm.2014.464). The second topic zooms out to the global scale and considers global warming from an energy balance perspective. With the global ocean sequestering in excess of 90\% of the recent warming due to energy imbalance at the top of the atmosphere, sensitivity of warming and depth of penetration of warming are characterized in a probabilistic fashion.

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