Modeling of multi-scale coupling between atmosphere and ocean

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Atmospheric and oceanic perturbations couples at various temporal and spatial scales. Small-scale oceanic surface gravity waves with periods of 1-10 s and wavelengths of 10-100 m, so called swells, radiate atmospheric acoustic waves, so called microbaroms [*Arendt and Fritts, 2000*]. Large-scale oceanic surface gravity waves with periods of thousands of seconds and wavelengths of hundreds of kilometers, so called tsunami, radiate atmospheric gravity waves [*Peltier and Hines, 1976*]. Oceanic surface displacements as sources of tsunamis radiate atmospheric acoustic and gravity waves [*Matsumura et al., 2011*], and boundary waves so called Lamb waves [*Arai et al., 2011*]. The acoustic and gravity waves related to tsunamis and their sources propagate to the ionosphere to disturb plasmas [*Occhipinti et al., 2006*; *Saito et al., 2011; Tsugawa et al., 2011*]. Since the propagation and the amplitude of these atmospheric waves are sensitive to the temperature and wind structure of the atmosphere [*Hedlin et al., 2012; Hickey et al., 2009; Walterscheid et al., 2000; 2003*], they can be used as a probe of the atmosphere. They can also used as a probe of oceanic wave heights because the oceanic waves are their sources. The atmospheric structure and oceanic wave heights would vary with the climate change, so we could estimate the climate change by monitoring their variation. However, so far we cannot easily analyze both effects of atmospheric structure and oceanic wave heights because they are complexly combined. For the analysis, modeling technique is quite useful. We are developing coupled atmosphere and ocean models, which are both three-dimensional non-hydrostatic fluid. In this presentation, we will introduce the results of the most recent model calculations.

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