Geophysical Research Abstracts
Vol. 14, EGU2012-6883-1, 2012
EGU General Assembly 2012

Mechanical power input to the oceans from buoyancy and wind

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Mechanical power input from buoyancy and wind forcing at the ocean surface affects the global circulation on different length and time scales. We explore how mechanisms associated with buoyancy and wind stress enter the mechanical energy budget and convert energy between its kinetic and potential forms. The steady-state, volume-integrated conversion between kinetic and potential energy is found to easily mask the range of mechanisms and scales that affect the circulation. Using idealized numerical simulations, we find that the rate of generation of mechanical energy associated with buoyancy forcing at the ocean surface, and the rate of conversion from potential energy to kinetic energy are comparable to the rate of generation (of kinetic energy) by wind work. We find also that power input from buoyancy forcing and from wind stress have positive feedbacks on each other.