Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01162, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01162
EGU General Assembly 2008

Oceanic impacts on tropical cyclone intensity changes

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Recent severe tropical cyclones underscore the inherent importance of warm background ocean flows and the interactions with the atmospheric boundary layer. Central to this question of heat and moisture fluxes from the ocean to the atmosphere, the amount of heat available to the tropical cyclone is essentially dictated by the level of entrainment mixing across the base of the oceanic mixed layer. In oceanic regimes where oceans mixed layers are thin, shear-induced mixing cools the upper ocean (and sea surface temperatures) quickly, which reduces the air-sea fluxes. This is an example of negative feedback from the ocean to the atmosphere. In regimes where the ocean mixed layers are deep (usually along the western part of the gyres), warm water advection by the nearly steady currents reduces the levels of turbulent mixing by shear instabilities. As strong wind driven current shears are arrested, less sea surface temperature cooling is observed which implies there is more heat is available through the surface. In this context, when tropical cyclones move into favorable or neutral atmospheric conditions (low vertical shear, anticyclonic circulation aloft), tropical cyclones have a tendency to rapidly intensify as observed over the Gulf of Mexico during Katrina and Rita in 2005, and in Dean and Felix in 2007 in the Caribbean Sea. To predict these tropical cyclone deepening (as well as weakening) cycles, coupled models must have ocean models with realistic initial ocean conditions and accurate air-sea and vertical mixing parameterizations. That is, the influence of the ocean on tropical cyclones is more than just a sea surface temperature.