Geophysical Research Abstracts,
Vol. 11, EGU2009-11657, 2009
EGU General Assembly 2009

On developing an imbedded ice-ocean tidal circulation model

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Because sea ice is floating in the ocean, convergence of sea ice can significantly affect ekmann fluxes of water equivalent and hence ocean circulation. In addition the fact that ice is floating causes the effective stresses driving the circulation of an ice covered ocean to differ significantly from the water drag on the underside of the sea ice. This is especially true when tidal effects are included as significant short term variability in deformation then occurs. In order to examine such features an imbedded ice ocean circulation model including tides is required in which changes in the water column pressures due to all fluid and floating ice terms are considered. To begin this development a barotropic z-level ice ocean circulation model is developed and numerically investigated in which the upper layer contains a variable thickness of sea ice with the non-linear sea ice dynamics solved simultaneously with the external mode of the ocean. Employing a regional ice ocean model with $\sim$14km resolution, several seasonal simulations are carried out to assess the effects of tidal and inertial variability on the ice mass balance; and the effects of floating sea ice on both these characteristics. Depending on the progress of the development, multi-year diagnostic simulations with temperature and salinity relaxed to observations may also be examined. We note that in most current ice-ocean models used to study global change the Archimedes effects of ice floating in the ocean are not explicitly considered.