



Sea Ice within CESM2

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CICE5

The LANL Sea Ice Model

- Currently incorporated into CESM simulations and being used for all test runs
- Has a number of new options relative to CICE4+, which was used in CESM1
- Have explored the impact of several new options and a final configuration has been chosen for CESM2
- No additional ice developments are planned for CESM2



Ice dynamics (no change)

- Solves sea-ice momentum equation for u and v components of velocity
 - Air stress, ocean stress, sea surface tilt, coriolis force, internal stress
- Continues to use the Elastic-viscous-plastic rheology (Hunke and Dukowicz, 1997)
- Uses incremental remapping advection (Lipscomb and Hunke, 2004)
 - Conservative, second-order accurate, monotone, efficient



Ice thickness distribution (no change)

- Subgridscale representation of sea ice spatial heterogeneity
- Use 5 subgridscale ice thickness categories
- Ice-atmosphere exchange is category dependent
- Mechanical redistribution
 - Convergence/shear of sea ice results in ridging of thin ice to thicker ice categories



Parameterizations (no change)

- Radiation. Delta-Eddington (Briegleb and Light, 2007)
 - Multiple scattering transfer using inherent optical properties of ice
- Aerosols – dust and black carbon deposition and cycling (Holland et al., 2012)



New developments



Thermodynamics

- “Mushy physics” (Turner et al., 2013)
 - Treats ice as a 2-phase (solid and brine) mushy layer
 - Includes simulation of
 - vertical temperature profiles
 - bulk salinity profiles,
 - gravity drainage,
 - flushing,
 - More realistic snow-ice formation



New parameterizations

- Melt ponds. New level ponds (Hunke et al 2013)
 - Preferential ponds over level ice as observed
 - Ponds drain through ice and affect salinity
 - Ponds “show through” snow cover

