Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11542, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11542
EGU General Assembly 2008

A two hundred year simulation of sea-ice from Pre-Industrial to Present

W. D. Hibler (1), J. Hutchings(1), S. Vavrus(2) and R. Kwok(3)

(1) University of Alaska Fairbanks, (2) University of Wisconsin,(3) Jet Propulsion Laboratory, Pasadena

While widely overlooked in most coupled global climate models, non-linear sea ice mechanics together with the constrained nature of Arctic pack ice provides the potential for multiple equilibrium states of Arctic sea-ice (Hibler and Hutchings, 2003). To examine how this transition from a low flow state, which likely applied up to around 1960, we utilize here preindustrial (circa 1700) and current atmospheric simulations coupled to thermodynamic sea ice to provide consistent forcing over a 200 year period to test the low to high flow transition hypothesis and determine the appropriate time scales. The pre-industrial model derived thermodynamic forcing is merged smoothly into the 1960's observed forcing. Analysis of the pre-industrial forcing shows when used with the orginal Hibler(79) viscous plastic model and implicit solution technique a high flow state is possible. Comparisons with faster but less precise other numerical techniques shows such a state is not tyically possible in many such models.

Beginning with a low flow state this reconstructed thermodynamic forcing field is used together with a fixed wind field to examine the transition and time scales for the transition to a high flow state. This simulation is compared to a simulation, which from 1960 on uses both observed thermodynamics and wind forcing. Comparisons to sea ice outflow and ice drift (especially the wind regression coefficients) are also made. The results demonstrate that the transition to a high flow state accounts for the preponderance of the loss of summer ice extent and ice thickness rather than wind shifts and thermodynamic warming that are currently used in many publications to explain such recent reductions.