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Ocean Science Discussions

Interactive comment on "Results from the implementation of the elastic viscous plastic sea ice rheology in HadCM3" *by* W. Connolley et al.

Anonymous Referee #1

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This paper successful achieves what it aims to do, discuss the implantations of the EVP rheology and the various tunings mostly on the ice to ocean heat flux to allow an improved simulation of the ice concentration in both hemispheres. I believe it should be published in Ocean Science with minor changes.

On page 4 the Connolley et al 2004 reference is not included in the list and the Turner et al reference appeared in 2006.

Page 5 the increase in the ice ocean heat flux proportional to ice fraction. Is this proportionality linear with ice concentration or with open water percentage? As the open water increases you would expect more heat to be available to melt the ice, laterally as well as from the underside of the ice.

Page 6 and 8 can you write P* as 2.7x10^4 or as 27K as you did later.

Page 7, 2nd Paragraph. Improvements in Ross Sea and Weddell gyre, are these changes really due to the rheology or that the ice is not responding to the wind forcing?

End of Paragraph Why would you expect ice to be thinner with EVP, or is it just that the 4m cut-off ice thickness is so incorrect that anything even free drift would improve it?

You comment that the thermodynamic parameterization had been developed to work with the ocean ice drift in HADCM3. Not as far as I understood from many conversations on sea ice in Hadley/Met office models going back 2 decades. The thermodynamics and choice of kappa was set back in the 80's and the ice moving at ocean drift came from GFDL.

Page 8. It would be interesting to see some of the changes in patterns of ice thickness resulting from the parameter tests. The detailed satellite based ice concentration observations make using that an easier data set to tune to but the ice will be come considerably thinner with some of these changes. End of section 5.2 you have used HadCM3+P_M_5 in figure but M_10 in text.

Top of page 9 why haven you used HADCM3+EVP as your control as it shows greater sensitivity to the ice strength changes.

Page 10, errors in sea ice model. Any discussion on how well the EVP scheme coped with the pole in the Arctic does the ice move as a solid body north of a certain point as seen in cavitating fluid case. The authors have concentrated more on performance aground Antarctica where the rheology term is small, so a little more emphasis on the Arctic ice thickness even with the winter high pressure leading to poor wind stress performance is understood.

Figure 7. The shades of green are two close to distinguish the parameter cases.

Interactive comment on Ocean Sci. Discuss., 3, 777, 2006.