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Dependence of sea ice yield-curve shape on ice thickness

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Abstract

In this note, the authors discuss the contribution that frictional sliding of ice floes (or floe aggregates) past each other and pressure ridging make to the plastic yield curve of sea ice. Using results from a previous study that explicitly modeled the amount of sliding and ridging that occurs for a given global strain rate, it is noted that the relative contribution of sliding and ridging to ice stress depends upon ice thickness. The implication is that the shape and size of the plastic yield curve is dependent upon ice thickness. The yield-curve shape dependence is in addition to plastic hardening/weakening that relates the size of the yield curve to ice thickness. In most sea ice dynamics models the yield-curve shape is taken to be independent of ice thickness. The authors show that the change of the yield curve due to a change in the ice thickness can be taken into account by a weighted sum of two thickness-independent rheologies describing ridging and sliding effects separately. It would be straightforward to implement the thickness-dependent yield-curve shape described here into sea ice models used for global or regional ice prediction. © 2004 American Meteorological Society.