

MODEL DERIVED DYNAMICS, BASAL MELT AND TIME EVOLUTION OF THE MERTZ GLACIER TONGUE, EAST ANTARCTICA

J P Court², R Warner³

¹University of Tasmania, Hobart, Tasmania, Australia, ²Institute of Antarctic and Southern Ocean Studies, Hobart, Tasmania, Australia, ³Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart, Tasmania, Australia, ⁴Australian Antarctic Division, Hobart, Tasmania, Australia

Recent research indicates extensive basal melting near the deep grounding lines of major Antarctic outlet glaciers. Further, observed glacier accelerations in the Antarctic Peninsula after the collapse of Larsen B ice shelf suggest continental ice discharge may be sensitive to buttressing effects of floating ice. These points suggest ocean climate change may have a major influence on Antarctica.

The Mertz Glacier in East Antarctica (67°40'S, 144°30'E) terminates in a floating tongue approximately 140km from grounding line to tip, with the first 65km flowing through the constraint of an embayment while the final 75km extends as a free-floating (unconstrained) tongue. Using published observations of ice thickness and velocities the dynamics, basal melt and time evolution of the Mertz Glacier tongue were studied using a depth-integrated ice shelf model. Assuming the tongue is currently in steady-state, the pattern of basal-melting was calculated. The tongue was then time-evolved from an ice cliff at the grounding line until it reached its current length.

Our results show a high rate of melt adjacent to the grounding line (>40m/a) falling to zero after 16km. This is in good agreement with published observational estimates. The modelled system then exhibits a region of basal freeze before reverting to melt under the free-floating extension.

Various researchers have suggested basal melt-rate ocean climate sensitivities of around 10 m/a/K. We devised a melt-rate prescription to study the effect of a 1°C increase in water temperature over 50 years and modelled the glacier tongue evolution to a new steady-state. While ice thickness near the grounding line is significantly reduced, the most dramatic change is a major reduction in the length of the free-floating extension. Since the glacier tongue forms part of a barrier to sea-ice transport by the East Wind drift and is implicated in the existence of the Mertz Polynya, an important formation site for Antarctic Bottom Water, climate change impacts on the Mertz glacier tongue may have global consequences.