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Relationship between ice cover and water temperature during summertime Arctic revealed by a trans-Arctic cruise

J. Inoue (1). T. Kikuchi (1) and D.K. Perovich (2)

(1) Japan Agency for Marine-Earth Science and Technology, (2) Cold Regions Research and Engneering Laboratory (Email: jun.inoue@jamstec.go.jp; Fax: +81-46-867-9455)

To observe the recent sea ice and ocean condition during summertime Arctic, the first trans-Arctic cruise in the 21st century has been conducted by the USCGC ice breaker 'Healy' from 5 August to 30 September 2005. The relationship between ice concentration obtained by ice watch on board and temperature above freezing point calculated by XCTD observation showed a negative correlation (CT-relation), suggesting that the local heat balance has been satisfied in the ice-ocean coupling system. To investigate the CT-relation in detail, a simplified ice-ocean coupled model, which is based on the heat balance among the heat input from atmosphere, lateral and bottom melting of sea ice, and heat storage in the ocean mixed layer, was applied. The calculated CT-relation converged with time, which agrees with observed CT-plots whenever a different initial ice concentration was employed, while the curve significantly varied when the initial floe size was changed. This means that lateral melting accelerates the decrease in ice concentration as the initial floe size decreases. The importance of floe size on the recent abrupt decay of ice cover in summertime Arctic will be discussed.