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Sea ice mass balance in the Antarctic during austral spring

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In Sept-Oct 2007, a sea ice drift station, Ice Station Belgica, was established in the Bellingshausen Sea. Over twenty-seven days, we examined the snow cover and sea ice thickness changes on new ice, thin (0.6m), and medium thick (1.1m) first year ice and older, second year ice of greater than 2m mean thickness. Snow cover depth varied from zero cm over the new ice to >0.8m on the second year ice. Except for the new ice without a snow cover, all other ice types underwent bottom melting. Ocean heat fluxes were estimated of the order of 10W/m2. The largest changes observed were in near surface flooding. Storms redistributed the snow cover and with changes in wind direction, large drift accumulations occurred. particularly over the thicker deformed ice. The protruding ice blocks acted as snow fences for the building of the drift accumulations. The redistribution of the snow cover did not increase the mean snow depth, but resulted in increased flooding at the snow-ice interface. The area of flooded ice in the deformed ice area increased from 60% to nearly 80% and increased depths of flooded snow of 25cm at previously flooded areas. In contrast the level thin ice which lacked deformation features, showed accumulation of only a few cm of snow, and relatively little (<10%) surface flooding. While the amount of flooded areas radically changed and generally increased by snow redistribution, the relatively thick snow cover (0.8m) insulated the flooded areas, preventing their refreezing during cold periods and resulted in little mass addition by snow ice conversion. While the thinner ice also had thinner snow allowing a freezing front to penetrate into the ice , less areal flooding fraction resulted in only a small amount of snow ice conversion. The development of new ice in leads of a few tens of cms over small areas of leads opening and closing was therefore probably in near balance with the net ablation by bottom melting over the larger ice-covered area.