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Carbon dioxide fluxes across the atmosphere-ice-water interfaces in the Siberian and Alaskan shelf seas.

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Climatic changes in the Northern Hemisphere have led to remarkable environmental changes in the Arctic Ocean, which is surrounded by permafrost. These changes include significant shrinking of sea-ice cover in summer, increased time between sea-ice break-up and freeze-up, and Arctic surface water freshening and warming associated with melting sea-ice, thawing onshore and offshore permafrost, and increased runoff. The air-land-shelf interaction in the Arctic has a substantial impact on the composition of the overlying atmosphere; as the permafrost thaws, a significant amount of old terrestrial carbon becomes available for biogeochemical cycling and oxidation to CO_2. The Arctic Ocean's role in determining regional CO_2 balance has been ignored, because of its small size (only $\sim$4% of the world ocean area) and because its continuous sea-ice cover is considered to impede gaseous exchange with the atmosphere so efficiently that no global climate models include CO_2 exchange over sea-ice. In this report we present some results obtained from different moving platforms (vessels, helicopter, drifting station) in 1999-2006. We show that the Arctic seas (and the Arctic basin) represent a mosaic structure composed from the CO_2sources and sinks : 1) the arctic shelf seas (the Laptev and East-Siberian seas) are a strong source of atmospheric CO_2 because of oxidation of bio-available eroded terrestrial carbon and river transport; 2) the Chukchi Sea shelf exhibits the strong uptake of atmospheric CO_2; 3) the sea-ice melt ponds and open brine channels form an important spring/summer air CO_2 sink that also must be included in any Arctic regional CO_2 budget. 4) direct measurements beneath the sea ice show a drastic pCO_2 decrease from 410 μatm to 288 μatm, which was recorded in February-March beneath the fast ice near Barrow may

reflect increased photosynthetic activity beneath sea-ice just after polar sunrise. New measurements made in May-August 2005 beneath the sea ice in the Central Basin show relatively high values of pCO_2 ranging between 425 μatm and 475 μatm values, while in fall-winter time the pCO_2 values went down by unknown reasons