Geophysical Research Abstracts,
Vol. 10, EGU2008-A-00126, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-00126
EGU General Assembly 2008


# Carbon dioxide fluxes and carbonate chemistry dynamics in the Arctic Siberian seas

**I. Semiletov** (1,2), I. Pipko (2), I. Repina (3), D. Kosmach (2) and N. Shakhova (1,2),

(1) International Arctic Research Center/University Alaska Fairbanks, Alaska, USA, (2) V.I. Il'ychov Pacific Oceanological Institute/Far-Eastern Branch of Russian Academy of Sciences, Russia, (3) Obukhov Institute of Atmospheric Physics/Russian Academy of Sciences (igorsm@iarc.uaf.edu)

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 paper we present some results obtained from different moving platforms (vessels, helicopter, drifting station, moorings) during the IPY field campaign-2007 and before (1999-2006). We show that the Arctic Siberian seas (and the Arctic basin) represent a mosaic structure composed from the $CO_2$sources 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 and Barents seas' 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) newest direct twelve months measurements (2007-2006) show a drastic $pCO_2$ oscillations over the East-Siberian shelf slope which reflects a complicated interaction of local shelf waters (Siberian Halocline Water) with the Atlantic Intermediate Water; 5) $pCO_2$decrease from 410 $\mu$atm to 288 $\mu$atm, which was recorded in February-March beneath the fast ice near Barrow may reflect increased photosynthetic activity beneath sea-ice just after polar sunrise; 6) measurements made in May-August 2005 beneath the sea ice in the Central Basin show relatively high values of $pCO_2$ ranging between 425 $\mu$atm and 475 $\mu$atm values, while in fall-winter time the $pCO_2$ values went down by unknown reasons; 7) vertical helicopter profiles (up to 2,000m height) made near the Lena River Delta show that the Laptev sea surface is a strong source of carbon dioxide, methane, and water vapor into the atmosphere; 8) chamber flux measurements made across the highly eroded Muostakh Island in the Laptev Sea show that a significant portion of terrestrial eroded carbon is escaped into the atmosphere in $CO_2$ form (because of high rates of aerobic oxidation) and never reached the sea.