Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

ACG031-P03 Room: Convention Hall Time: May 27 17:15-18:45

Greenhouse gas fluxes in relation to vegetation coverage on a glacier foreland in the high Arctic, Ny-Alesund

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The general circulation models predict that future global climate change will have highest impact in the polar region. Carbon cycle in the Arctic terrestrial ecosystem is limited largely by temperature and therefore, most likely to be sensitive to the climate warming. The net effect of climate change on the carbon balance will depend on the balance of net primary production and decomposition, which is likely to vary with vegetation situation such as vegetation type and biomass. As part of the study on ecosystem carbon cycle in the high Arctic, we examined the exchange of greenhouse gas fluxes from a Salix polaris-moss community in relation to the coverage of Salix polaris(a vascular plant).

The study area was situated in Ny-Alesund, Svalbard, Norway (79oN). We selected 12 points with different coverage of Salix(bare soil, 5-20% (small), 30-55% (middle)) to set up the soil chambers (20 cm inside diameter, 15 cm height, insert 5 cm in to ground). The ecosystem respiration (CO_2 flux), $CH_4$and N_2O fluxes were determined using closed-chamber method from July 23 to August 3 in 2009. The soil temperature and moisture were monitoring at the same time.

The mean CO_2flux (mg $CO_2m^{-2}$of overall investigated period varied widely from 30.68 (SD4.91) for the bare soil, 46.01 (SD6.58) and 63.54 (SD22.41) for the small and middle coverage of Salix, respectively. In this study, the CO_2flux estimated as ecosystem respiration, which is the sum of total plant respiration (above- and below-ground) and microbial respiration. Since the emission of $CO_2$from bare soil is due to microbial respiration, the contribution of total plant respiration to ecosystem respiration were estimated as 33% to 51%. The ecosystem respiration was positively correlated to the coverage of Salixsignificantly ($r=0.789$, $p<0.01$, $n=12$). On the other hand, the temporal variation of CO_2flux was determined by soil moisture rather than soil temperature during the investigating period. That is, CO_2flux was significantly negative correlation to soil moisture where soil covered with Salixless than 20% ($p<0.05$), while CO_2flux was significantly positive correlation to soil moisture where soil covered with Salixby 30-55% ($p<0.05$).

Keywords: Arctic tundra, Ecosystem respiration, Soil microbial respiration, Greenhouse gases, Salix polaris-moss community, Carbon cycle