

ATMOSPHERIC CO₂ MEASUREMENT NETWORK ON TOWERS IN WEST SIBERIA

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ABSTRACT

To know regional-to-continental scale CO₂ fluxes between atmosphere and terrestrial biosphere using an inverse model, the CO₂ measurements on plural towers situated in a thousand square kilometer area of West Siberia have been carried out since 2002. The CO₂ concentrations at 80m of the tower during daytime afternoon well represents those of PBL with its difference in ± 3 ppm, and 90% of them in ± 2 ppm, in clear sky day, when no strong inversion is occurred in winter. The tower observation expands to five sites to date, and additional four sites will be established in a year.

INTRODUCTION

To quantify the global CO₂ distribution and variation accurately, observations near CO₂ sink and source is indispensable. Terrestrial biosphere in northern hemisphere plays an important role in global carbon cycle [Tans *et al.*, 1990], and only limited atmospheric CO₂ observations over the forest area in Siberia have been done [Nakazawa *et al.*, 1997; Lloyd *et al.*, 2002]. To clarify the atmospheric CO₂ variation in the planetary boundary layer (PBL) in western Siberian forest, in situ atmospheric CO₂ measurement network on tower is effective.

EXPERIMENTAL

Atmospheric CO₂ concentration is measured at 80, 40, 20 and 5m height of the tower in the west Siberian forest, Berezhovka (BRZ : 56.17° N, 84.33° E) since February 2002. Locations of the observation sites are shown in fig. 1. Ambient air is taken from the inlet attached to the tower and introduced into the NDIR (LI-7000, Li-Cor) with its flow rate of 35 ml min⁻¹ after dehumidification by a Nafion dryer and a chemical desiccant (Mg(ClO₄)₂). Data are obtained every 30 minutes, and the concentration is determined based on NIES standard gas scale. Additional tower measurements in West Siberia were started after 2004.

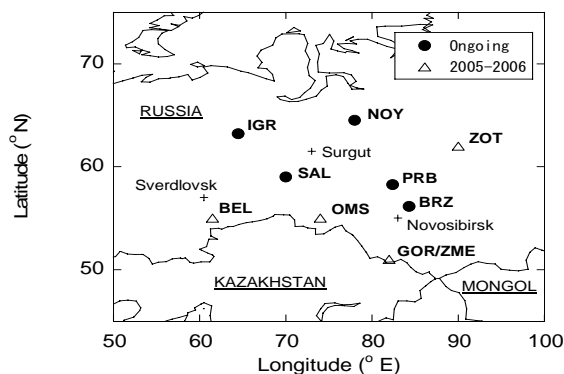


Fig. 1 Location of the observation sites

RESULTS AND DISCUSSION

The CO₂ concentrations at 80m of the tower during daytime afternoon shows clear seasonal variation with its amplitude of 30 ± 1 ppm, which is about 15 ppm higher than the value of reference marine boundary layer at 55° N shown by NOAA/CMDL [Conway *et al.*, 1994]. The simultaneous aircraft measurements over the tower on clear sky weather in daytime afternoon [Machida *et al.*, this issue] reveal that the CO₂ variation at 80m of the tower well represents the concentration of PBL with its difference in ± 3 ppm, and 90% of them in ± 2 ppm, when no strong inversion is occurred in winter (fig. 2).

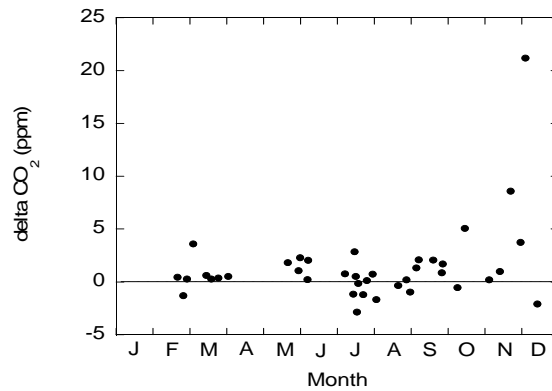


Fig. 2 The CO₂ differences between the value at 80m of the tower and the averaged value of PBL obtained by aircraft.

At Parabel (PRB : 58.25° N, 82.40° E) located about 330km northwest of Berezorechka, CO₂ is measured at 67 and 35m of the tower since June 2004. Igrim (IGR : 63.20° N, 64.48° E) is situated about 1400km northwest of Berezorechka, and the measurement was started on September 2004 at 47 and 24m of the tower. The variations observed in fall of 2004 at BRZ, PRB and IGR are shown in fig. 3. The temporal variations of daytime CO₂ observed at PRB and IGR show similar seasonal variation as those observed at BRZ, but their differences are sometimes over 10ppm in cloudy and rainy days. The measurements at Noyabrsk (NOY : 63.17° N, 75.40° E) and Salym (SAL : 60.07° N, 71.47° E) are also executed recently. Other four sites (Zotino : ZOT, Beloretsk : BEL, Omsk : OMS, and Gornyak : GOR or Zmeinogorsk: ZME) will be settled in 2005-2006.

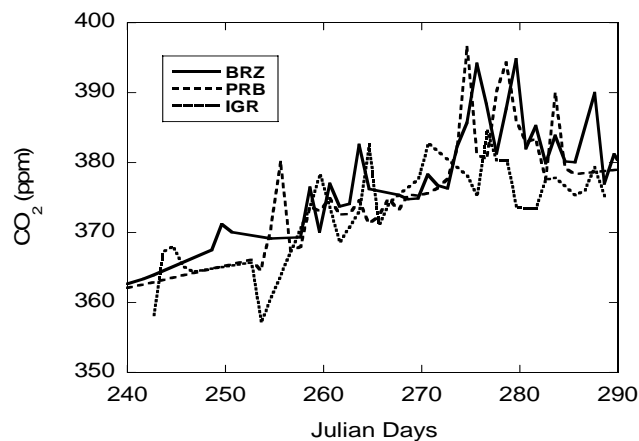


Fig. 3 The CO₂ variations observed at BRZ, PRB and IGR in fall of 2004.

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