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DETECTION OF TRENDS IN CO_2 VERTICAL PROFILES DUE TO BIOSPHERIC AND ANTHROPOGENIC FLUX CHANGE

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Large increase in emissions of CO_2 has been estimated from fossil fuel consumption statistics since the 1990 as per the CDIAC, IEA or EDGAR. Independent studies also propose that the terrestrial biospheric uptake must have been increased in order to balance the sources, sinks and atmospheric burden. However, the relative sources and sinks strengths still have large uncertainties due to lack of sufficient observations and uncertainties in modeling tools. Since the early 1990s, vertical profiles of atmospheric CO_2 are measured by the both NIES (in Siberia) and Tohoku University (over Japan) observational programs. We use these vertical profile observations and an AGCM-based chemistry transport model (JAMSTEC's ACTM) to decipher the signals from fossil fuel consumption, using measurements over Japan that samples the outflow of the continental emissions, and terrestrial biosphere of the arctic, which has supposedly ventilating greater amount of carbon due to increased surface temperature and CO_2 fertilization.

The ACTM simulation results, using the fluxes from a 84-region time-dependent inverse model and increasing fossil fuel emissions, suggest that the CO_2 vertical gradients should have become greater over Japan during the winter as the fossil fuel CO_2 signal from the continental Asia outflows isentropically near the surface. However, during the summer the continental outflow occur through the upper troposphere, resulting in weaker vertical gradient or even inverted vertical profile over Japan. The ACTM results over Surgut and Noboshibirisk (NIES sites in Siberia) suggest that the terrestrial biospheric uptake increase consists of detectable change in the gradients in CO_2 vertical profiles. These results, in comparison with measured vertical profiles using research aircrafts, will be presented.