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Asian summer monsoon signatures observed by the CONTRAIL commercial airliner measurements

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CONTRAIL Comprehensive Observation Network for Trace gases by Airliner
http://www.cger.nies.go.jp/contrail/

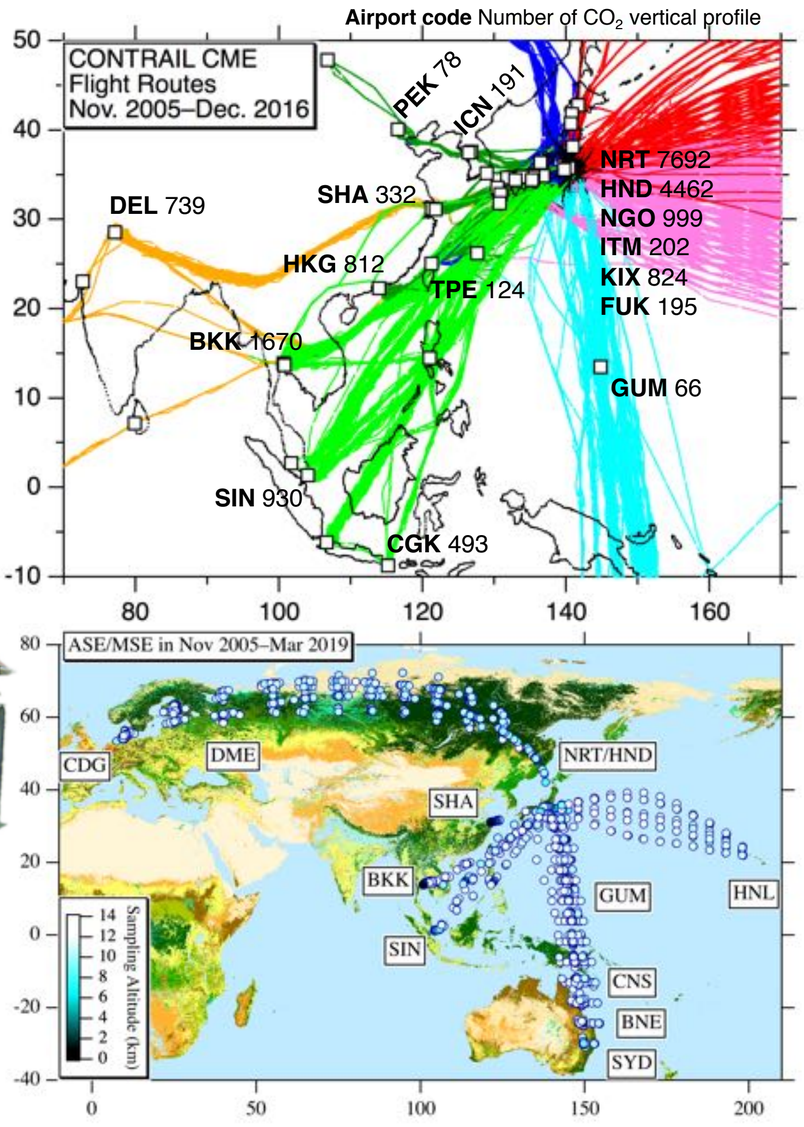
CONTRAIL
(Comprehensive Observation Network for TRace gases by AIrLiner)

CONTRAIL is an ongoing project for atmospheric trace gas measurements onboard commercial airliners of Japan Airlines (JAL). Our measurements started in 2005 with 2 instruments (ASE and CME) with major focus on greenhouse gas and related species. Currently JAL's B777-200ER and -300ER are certified for ASE and CME installation. CONTRAIL CME CO_2 data are available at doi.org/10.17595/20180208.001 and ASE data upon request.

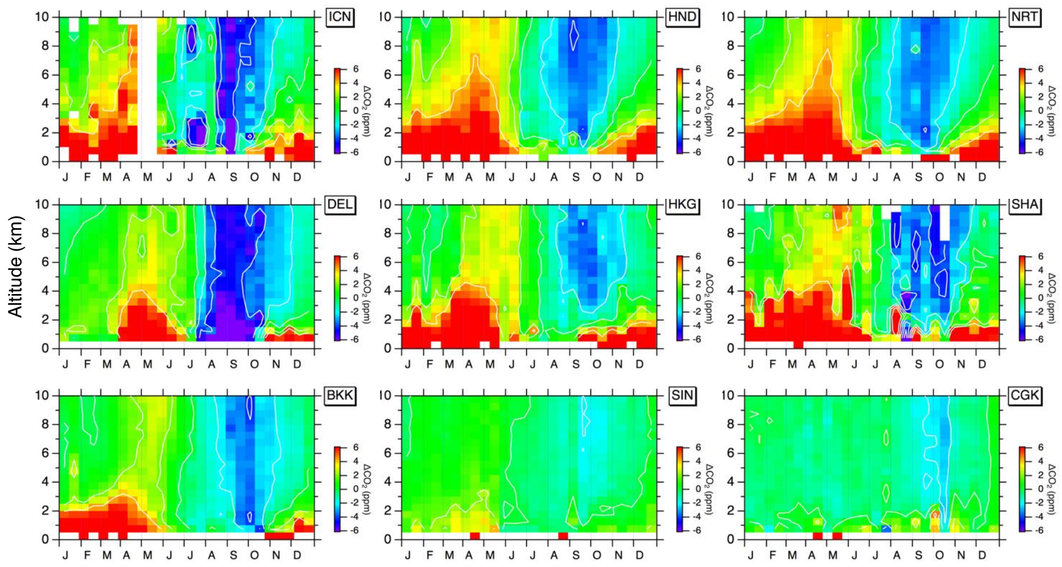
CME, ASE & Flight Statistics

Continuous CO_2 Measuring Equipment (CME)

Automatic air Sampling Equipment (ASE) for laboratory trace gas measurements

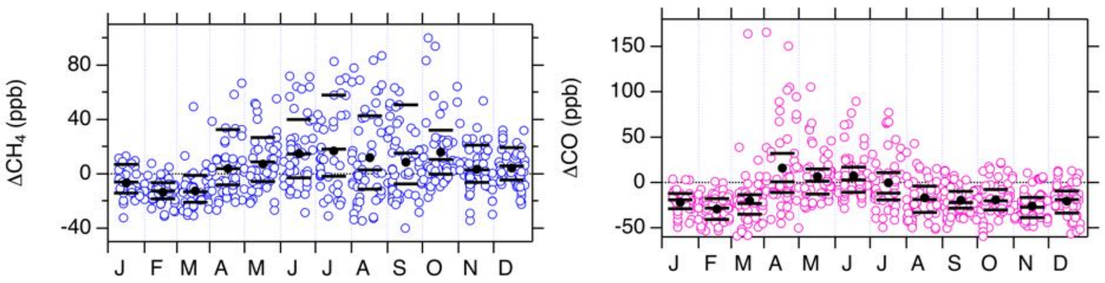


Vertical Profiles of CO_2



Seasonal variations of vertical profile of ΔCO_2 over airports in Asia. ΔCO_2 is defined as ΔCO_2 (lat, lon, alt, t) = CO_2 (lat, lon, alt, t) − Trend CO_2 at MLO (t). The MLO (Mauna Loa) data is from NOAA/GMD. Figures are from Umezawa et al. (2018, Atmos. Chem. Phys., doi.org/10.5194/acp-18-14851-2018).

Outflow to the Western Pacific



Seasonal variations (left) CH_4 and (right) CO in the upper troposphere (> 8 km) over the northwestern Pacific (20-40˚N, 140–160˚E from the flights to Australia). All the data are corrected for the long-term trend calculated from the MLO data. Black dots and thick horizontal lines indicate monthly averages and medians, 25 and 75% percentiles, respectively.
Interestingly, high CH_4 values were frequently observed in summer in the upper troposphere over the northwestern Pacific. Tagged tracer simulations indicated that such high CH_4 were South Asian and East Asian origins (Umezawa et al. 2012, Atmos. Chem. Phys., doi.org/10.5194/acp-12-8095-2012).

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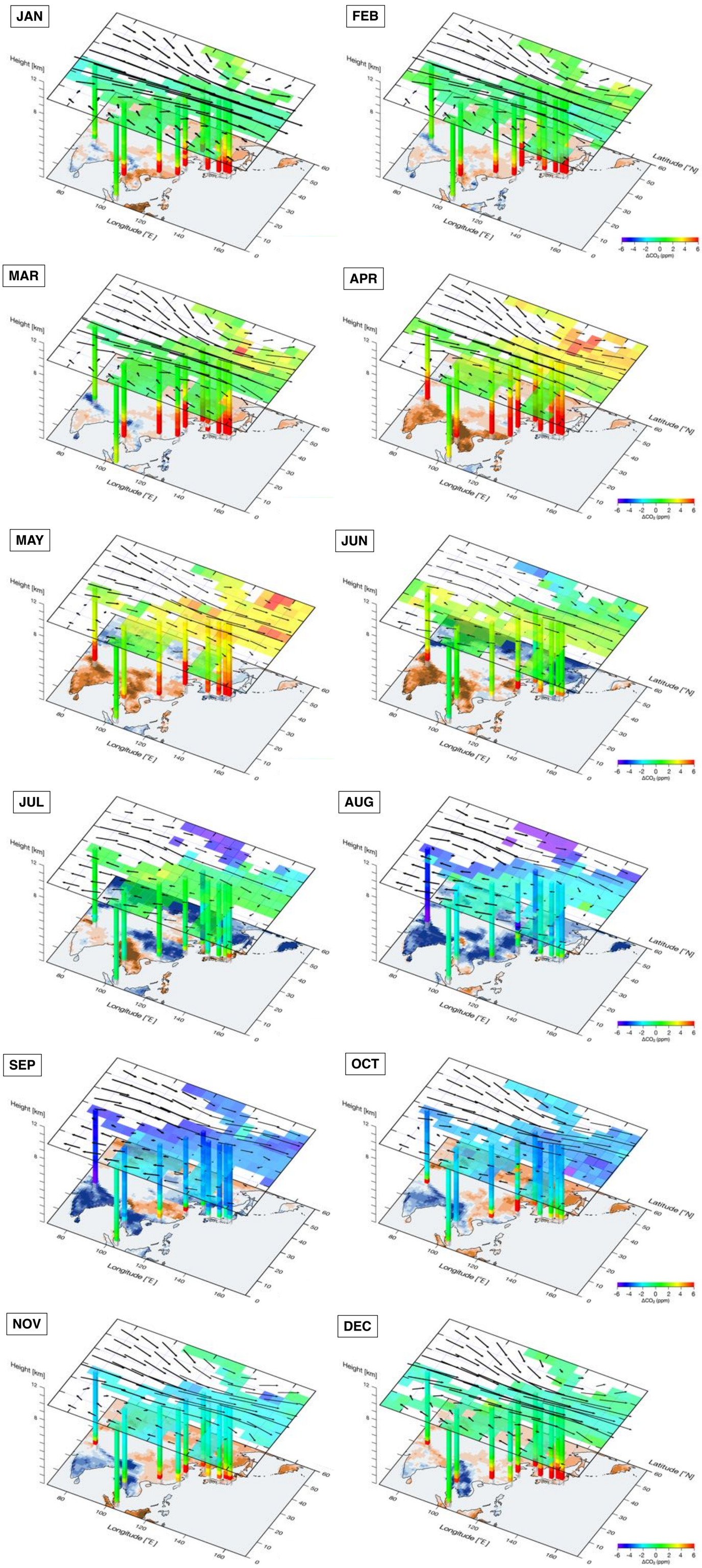
Monthly Climatological CO_2 Distributions over Asia



Monthly climatological distribution of ΔCO_2 over the Asia-Pacific region calculated from cruising (the upper panels) and ascent/descent flight data over airports (pillars). The lower panels show monthly biospheric CO_2 flux optimized in the NICAM-TM model inversion (Niwa et al. 2012, J. Geophys. Res., doi.org/10.1029/2012JD017474).