The decade-long global Greenhouse gas (GHG) observation by Greenhouse gas Observing SATellite (GOSAT) toward the Global Stocktake

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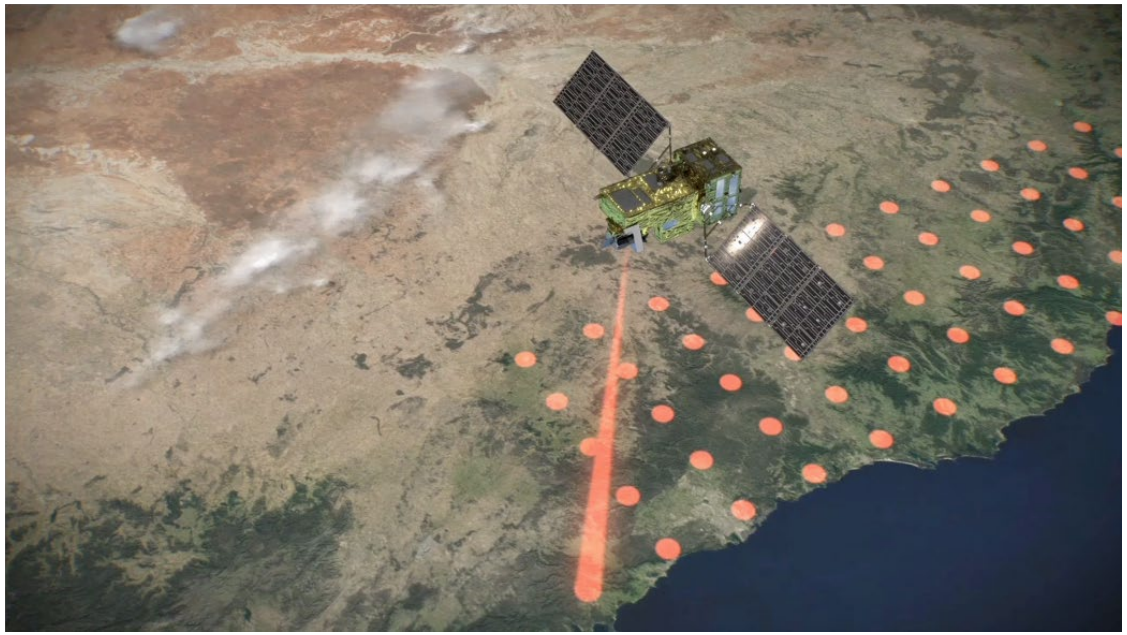
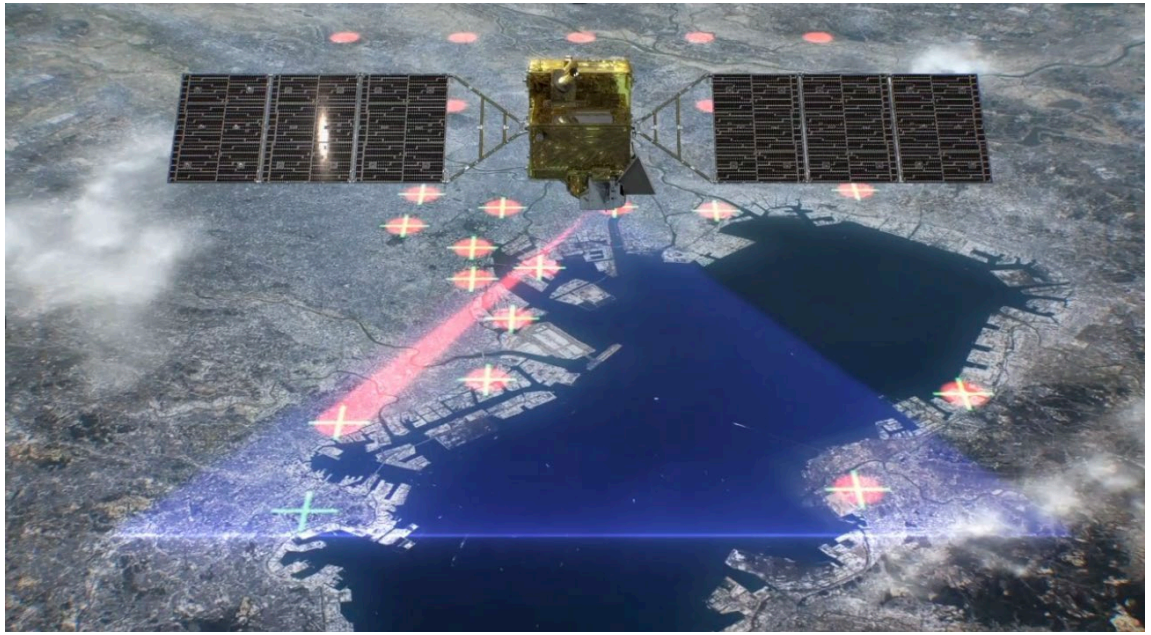
GOSAT – Japan's first GHG dedicated satellite

- TANSO (Thermal And Near-infrared Sensor for carbon Observation) on GOSAT equipped the Fourier transform spectrometer both SWIR and TIR bands to observe CO_2 and CH_4.
- GOSAT accommodated two observation modes: grid mode and target mode with the 2-axis agile pointing system for intense target observations over megacities.
- Cities are responsible for more than 70% of the global total GHG emissions.
- Intense target observations over world megacities have been continuously performed since 2015.



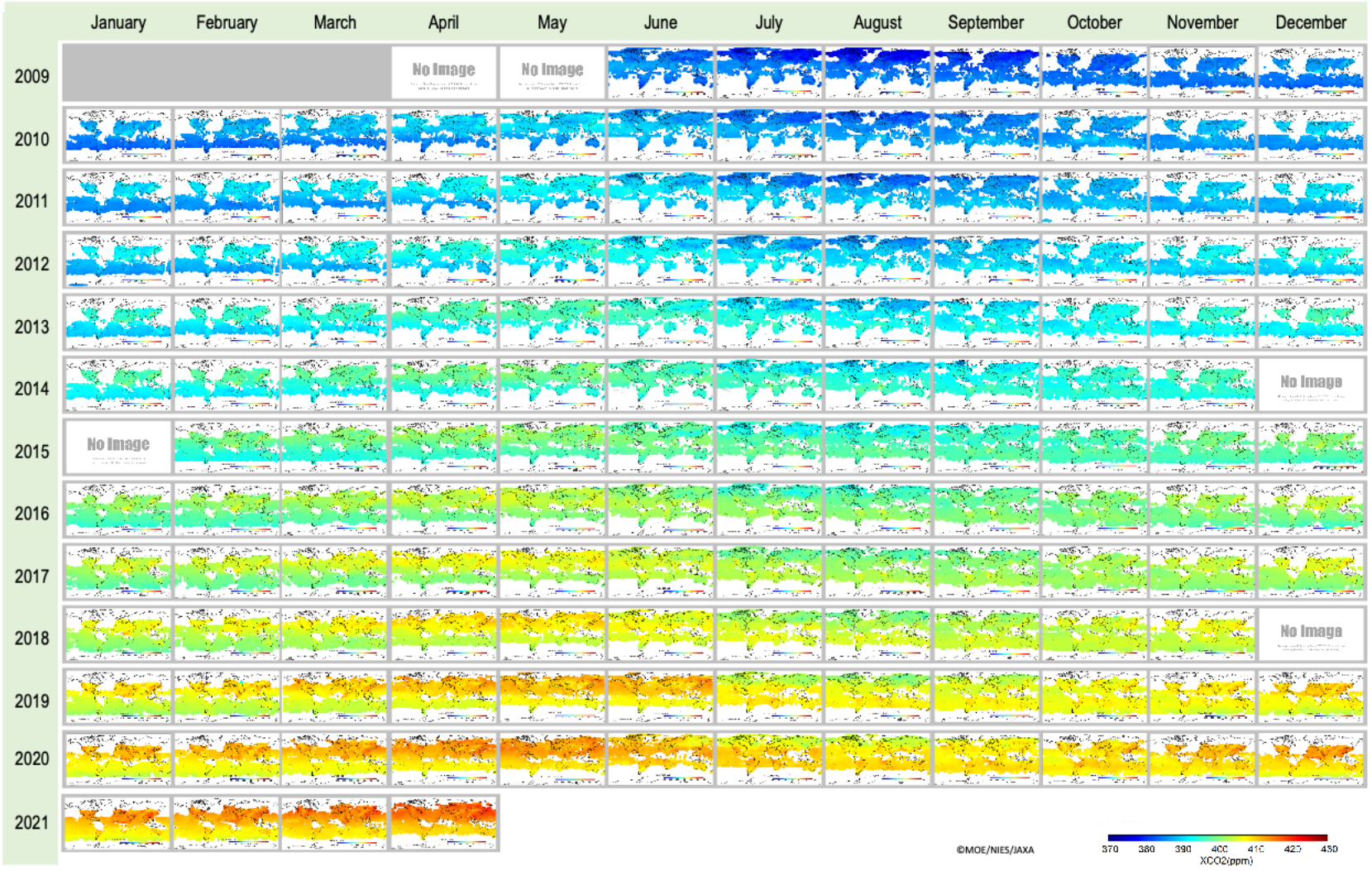
Grid observation (nominal)



Target observation

The longest satellite CO_2 record

- Japanese Greenhouse gases Observing SATellite (GOSAT) in orbit since 23 January 2009.
- GOSAT can monitor the global CO_2 distribution every 3 days, and continuously provide the CO_2 concentration changes more than 12.5 years.



GOSAT data clearly presents the global and local CO_2 density is increasing year by year.

JAXA/EORC patrial column GHG products

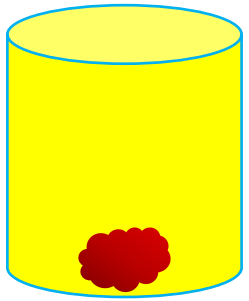
EORC: Earth observation research center

- Utilizing both solar reflected light and thermal emissions observed by GOSAT.
- New algorithm to derive the partial column information for emission studies.

Upper troposphere:
Represent Background CO_2 concertation.
Lower troposphere:
Represent City level CO_2 concentration changes.
Enhancement= lower CO_2 – averaged(upper CO_2)

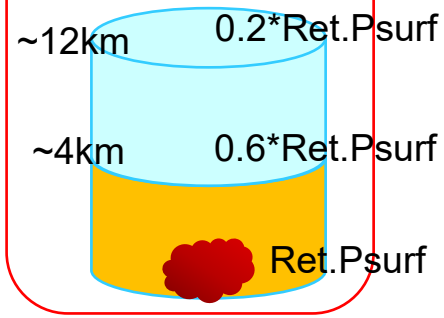
Conventional Method

Use only solar reflected light

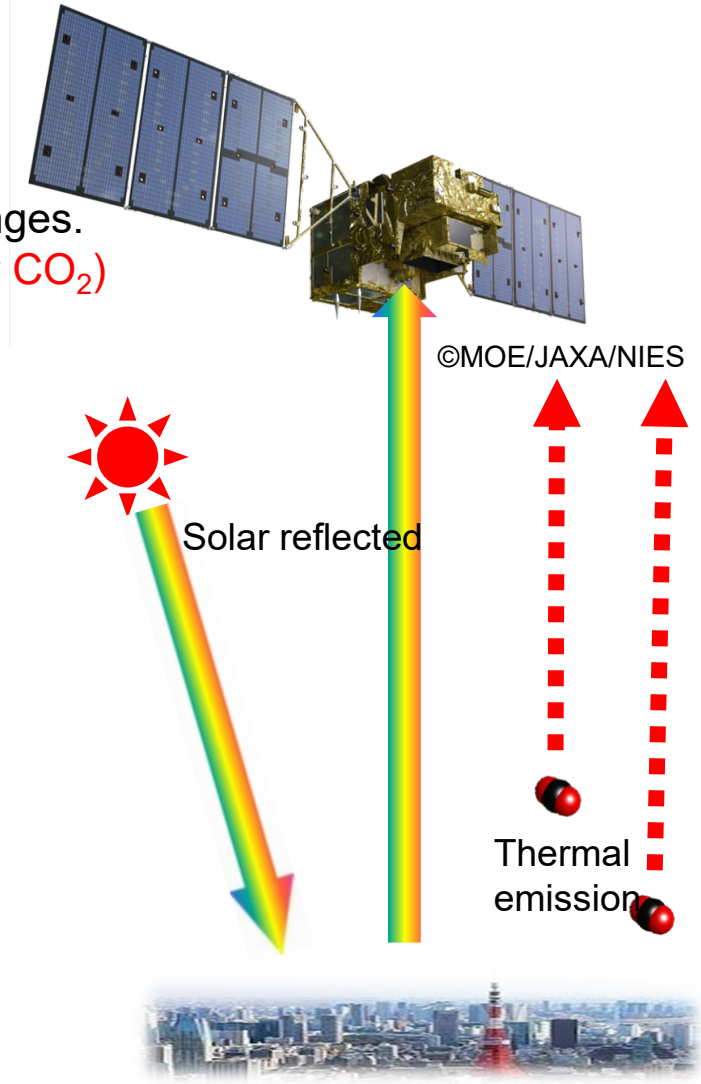


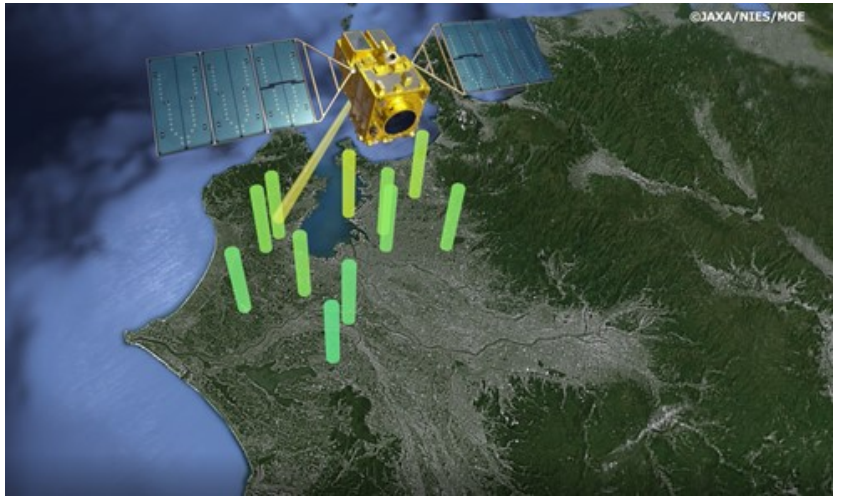
JAXA/EORC new Method

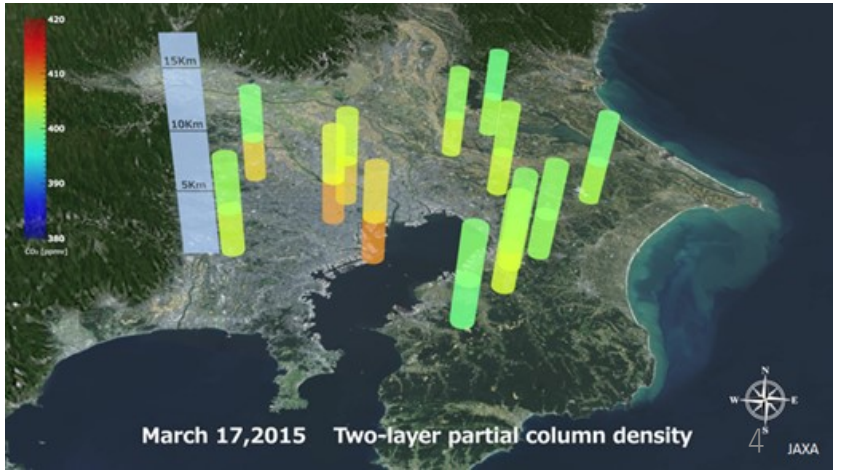
Use both solar reflected light & thermal



CO_2 emission and enhanced density of the lower troposphere

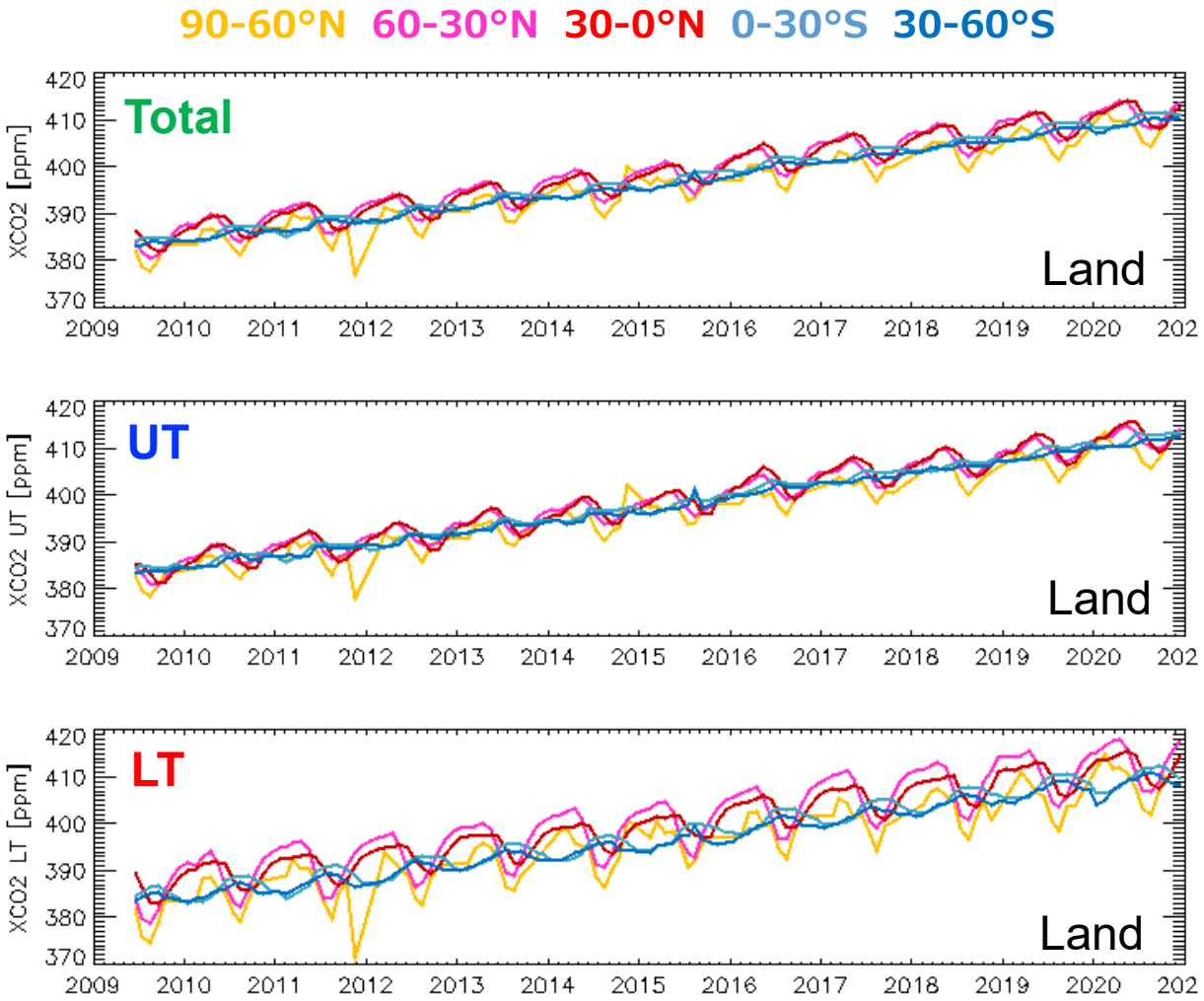


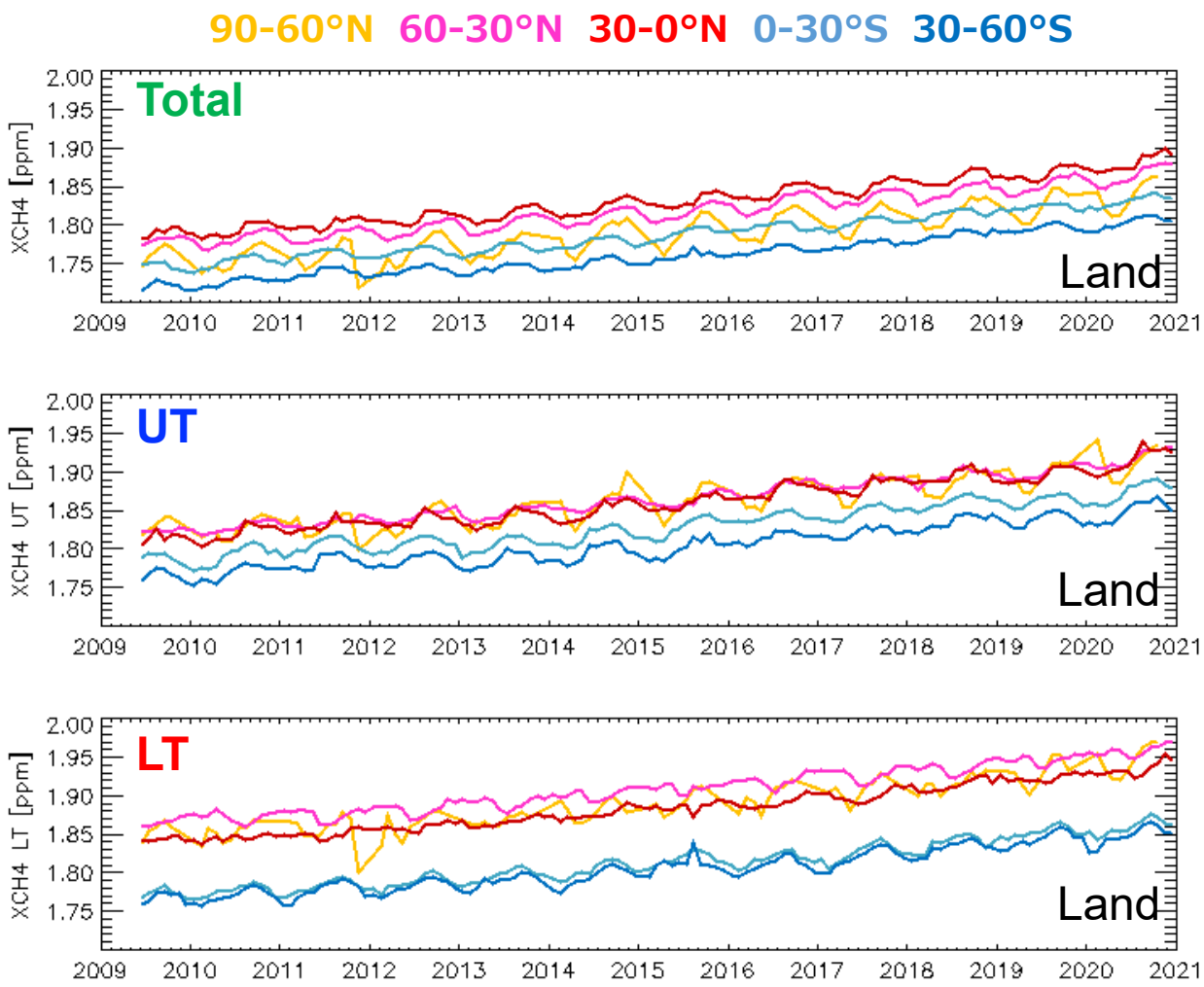




Seasonal CO_2 and CH_4 changes at different latitude bands

Seasonal and latitudinal variations are clearly observed in LT (lower troposphere) better than total column density.





Kikuchi et al, in prep.

CO_2

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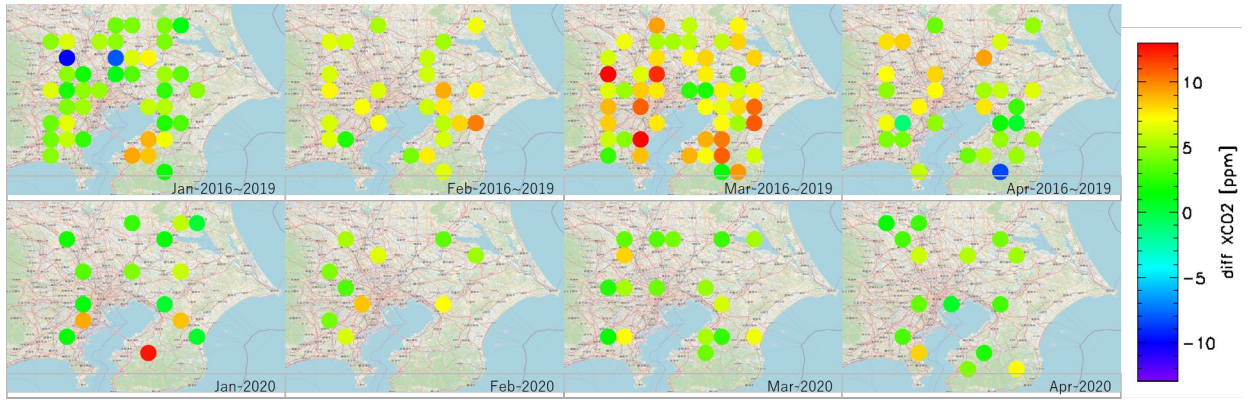
CH_4

CO_2 changes over Large Urban areas

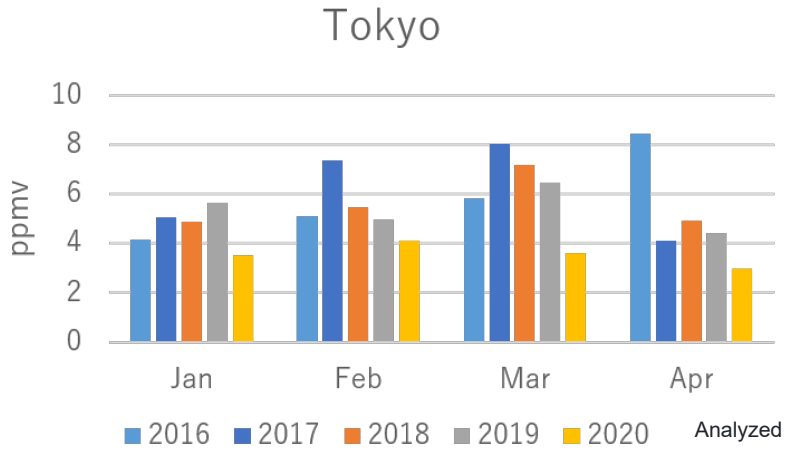
CO_2 enhancement = Partial column of lower troposphere (0-4 km) – Monthly-Area averaged upper troposphere (4-12 km)

Tokyo
2016-2019

2020



Analyzed by JAXA/EORC

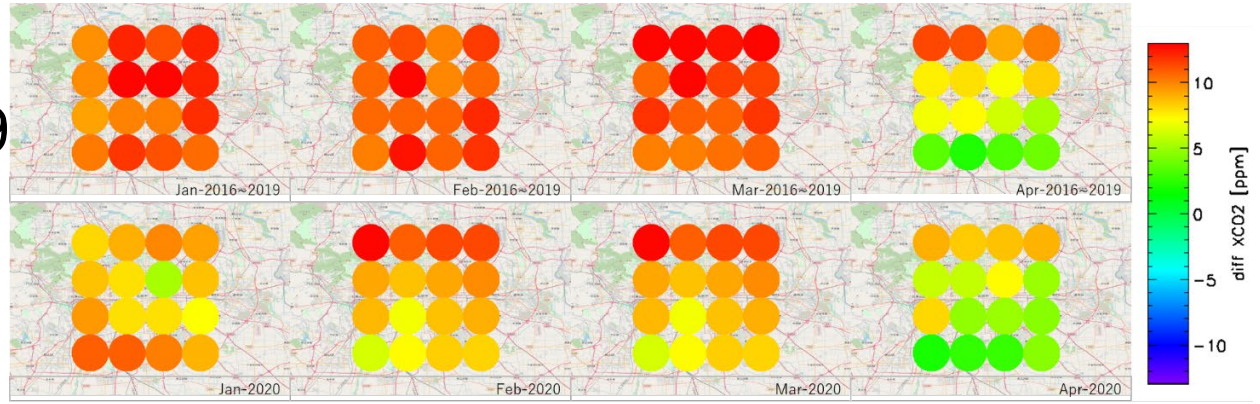


Analyzed by JAXA/EORC

Jan Feb Mar Apr

Beijing
2016-2019

2020



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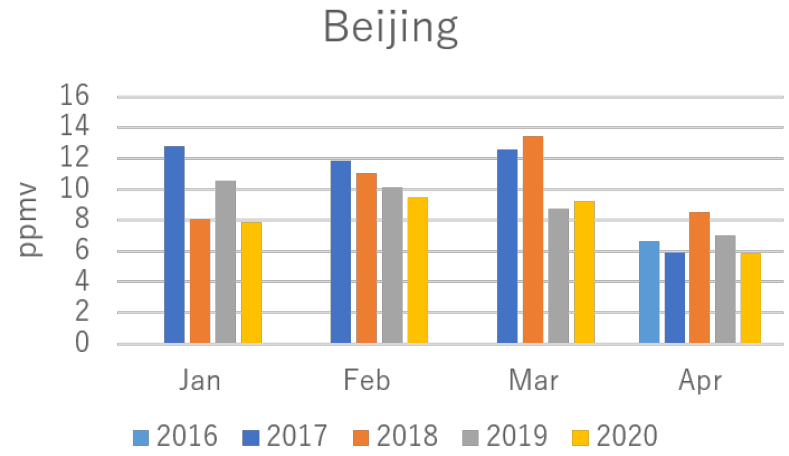
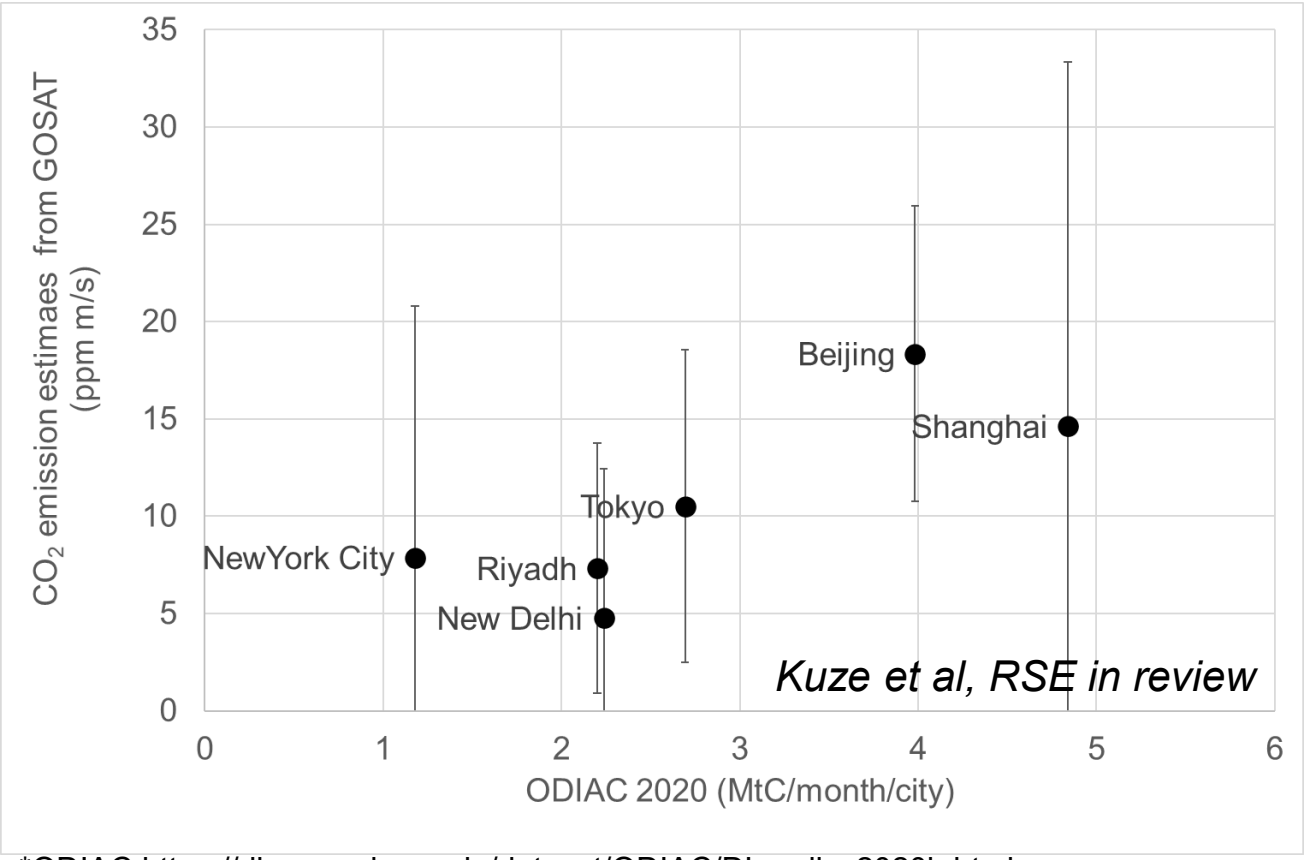


Analyzed by JAXA/EORC

Results for January through April of 2020 are compared to corresponding results from the 2016-2019 climatology.
All months in 2020 show reduced CO_2 enhancements relative to prior years.

Toward the global stocktake



*ODIAC:https://db.cger.nies.go.jp/dataset/ODIAC/DL_odiac2020b.html

The comparision between megacity CO_2 enhancement and the city-wide ODIAC* inventory estimates.

- The megacity CO_2 enhancements estimated using the partial column density retrieval are overall consistent with the ODIAC inventory.

- JAXA will release the start-of-the-art partial column products in public as a contribution to global community for improving the understanding of the carbon cycle toward the global stocktake.