Aerospace Information Research Institute(AIR)
Chinese Academy of Sciences(CAS)

Difference of detecting anthropogenic CO2 emission by GOSAT and OCO-2 observations in China

Reporter: Mengya Sheng
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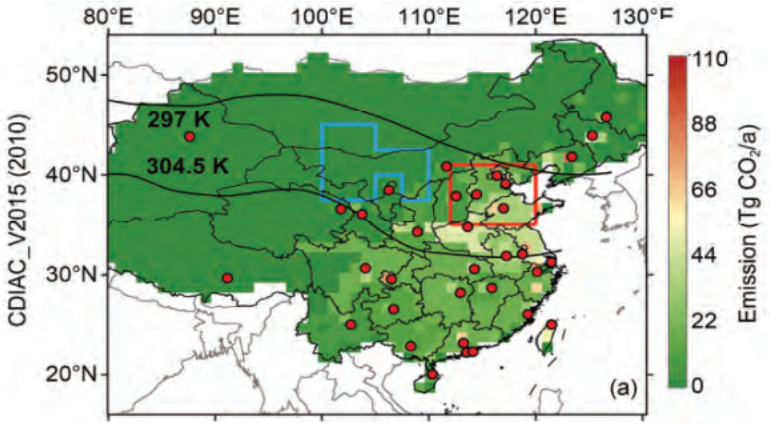
Outline

- Background
- Studying area and method
- Difference of satellite retrievals for detecting anthropogenic emission
- Discussion

Background

- GOSAT (Lei L P,et al. Chin Sci Bull, 2017)

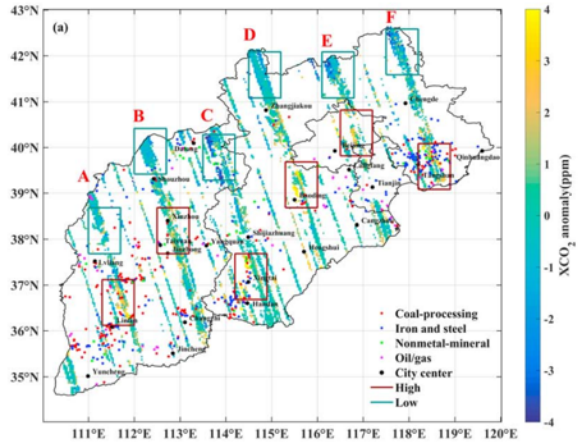


Background region

Emission region

Regionally elevated CO_2 originating from anthropogenic emissions in urban intensive areas, about **1.8 ppm**, can be detected by GOSAT from 2010 to 2014.

- OCO-2 (Wang,S.,et al. *Journal of Geophysical Research: Atmospheres*, 2018.



High-emission areas with industrial plants are detectable by CO2 anomalies compared to natural background area and the average enhancement is about **1.3-2.3 ppm**.

Different observing geometries

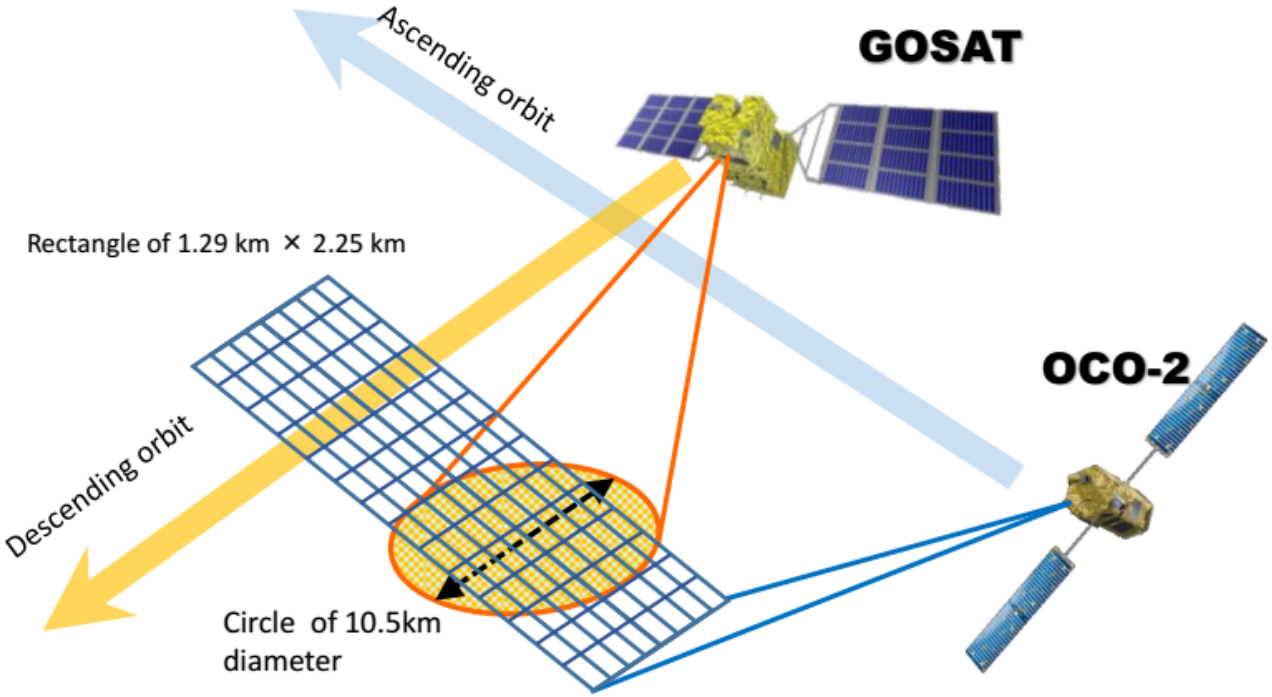
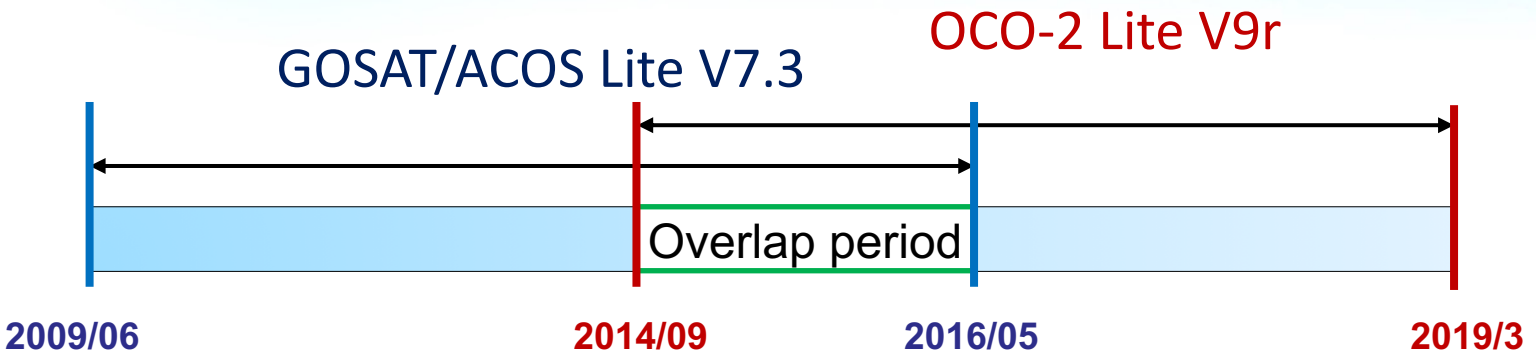


Figure 1. GOSAT and OCO-2 orbit direction and observation strategy.

(Kataoka,et al.,remote sensing,2017)

The column-averaged CO2 dry air mole fraction (XCO2) retrieved from the two satellites observation could be different due to different sensors, viewing geometries, and repeat cycles for regional analysis of CO2.

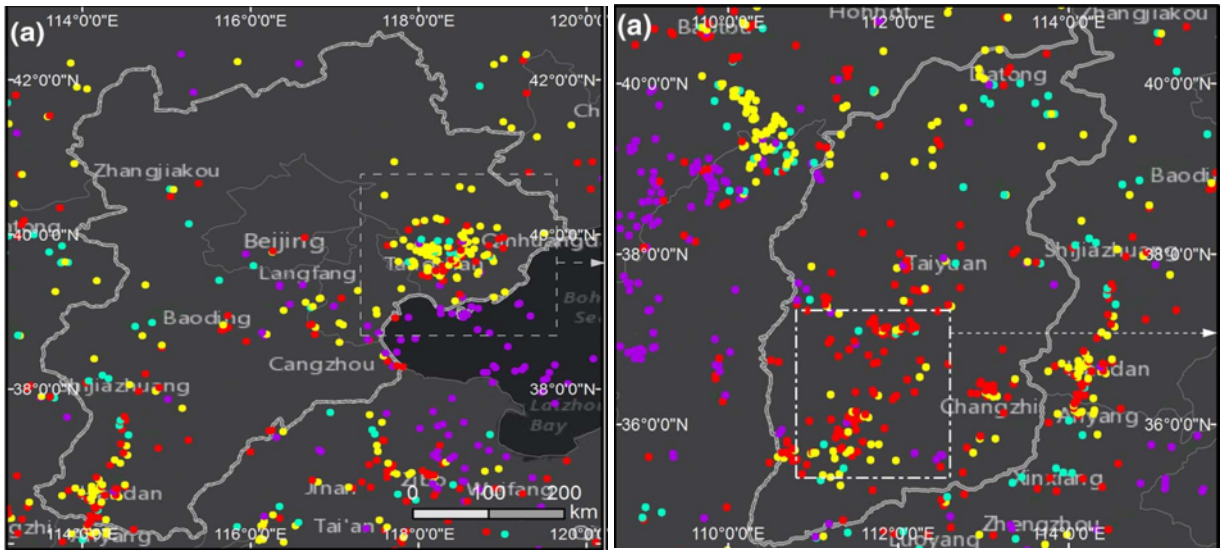
XCO2 datasets



Industrial heat sources derived from VIIRS Nightfire product

(Yongxue Liu et al.,2017)

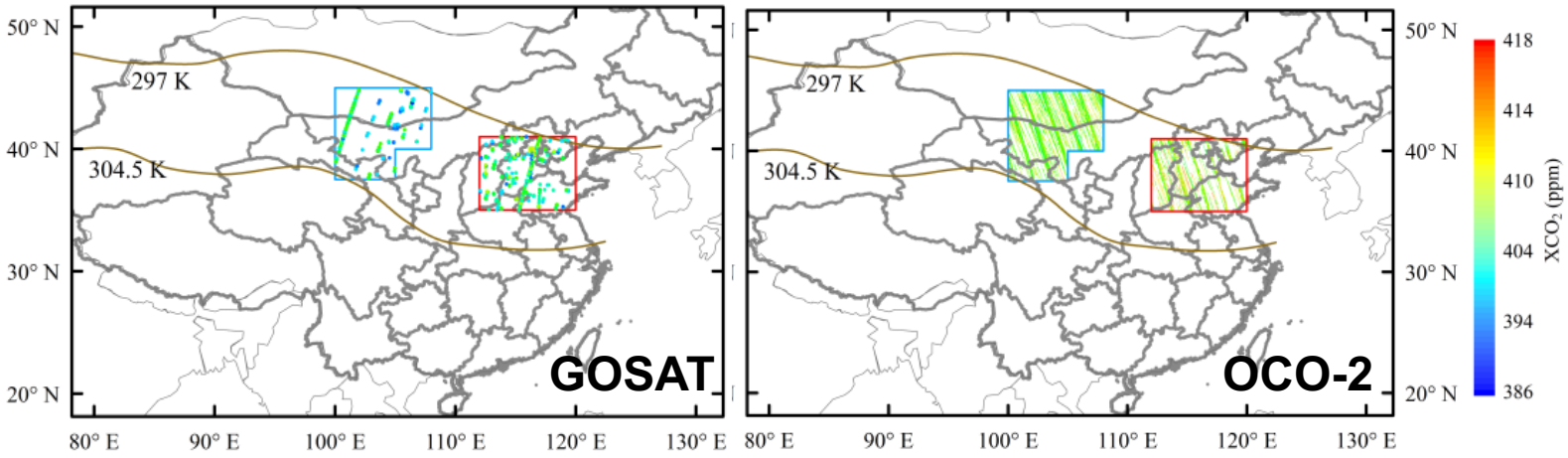
The overall accuracy
BeijingTianjin-Hebei:80%
Shanxi Province: 84%



Studying area and method

CO_2 observations of GOSAT and OCO-2

The spatial resolution is 0.02°×0.02°.



- Two regions are settled under the same meteorological conditions

Background region
Inner Mongolia grasslands

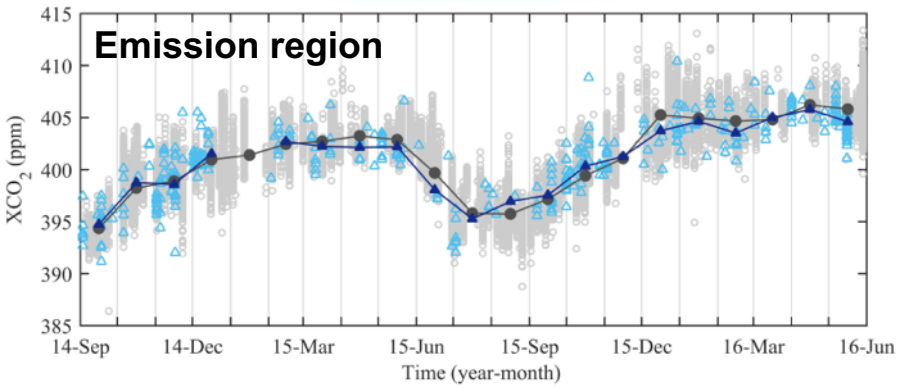
Emission region
Beijing-Tianjin-Hebei
area in northern China

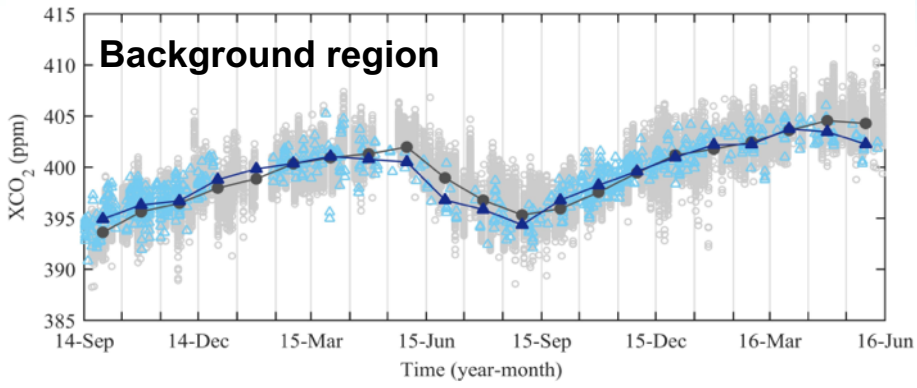
- Calculating CO_2 enhancements between emission and background region.

Enhancement：$enXCO2=XCO2_{Emission}-XCO2_{Background}$

- Comparing CO_2 enhancements from GOSAT and OCO-2.

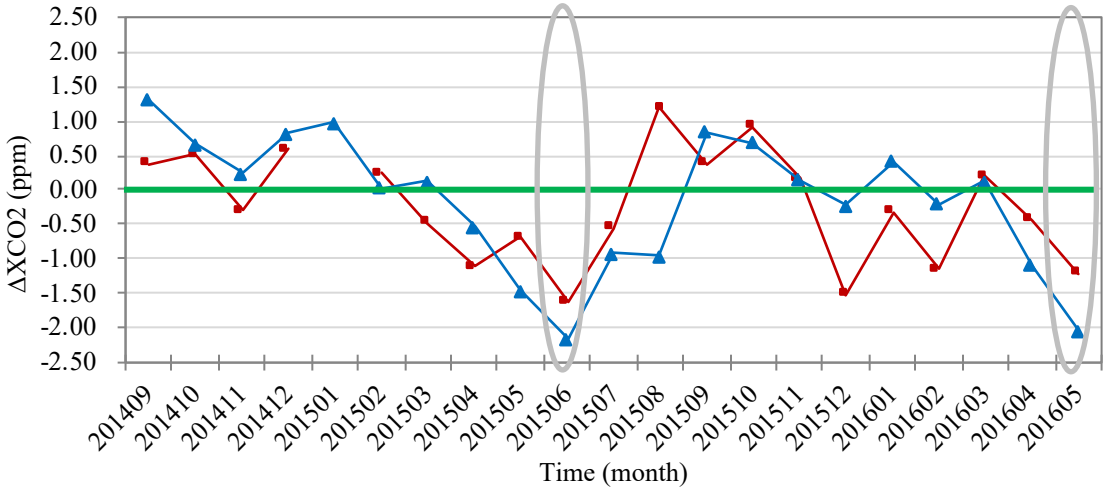
Regional averaged XCO2 from GOSAT and OCO-2





GOSAT observation
OCO-2 observation
GOSAT monthly averaged
OCO-2 monthly averaged

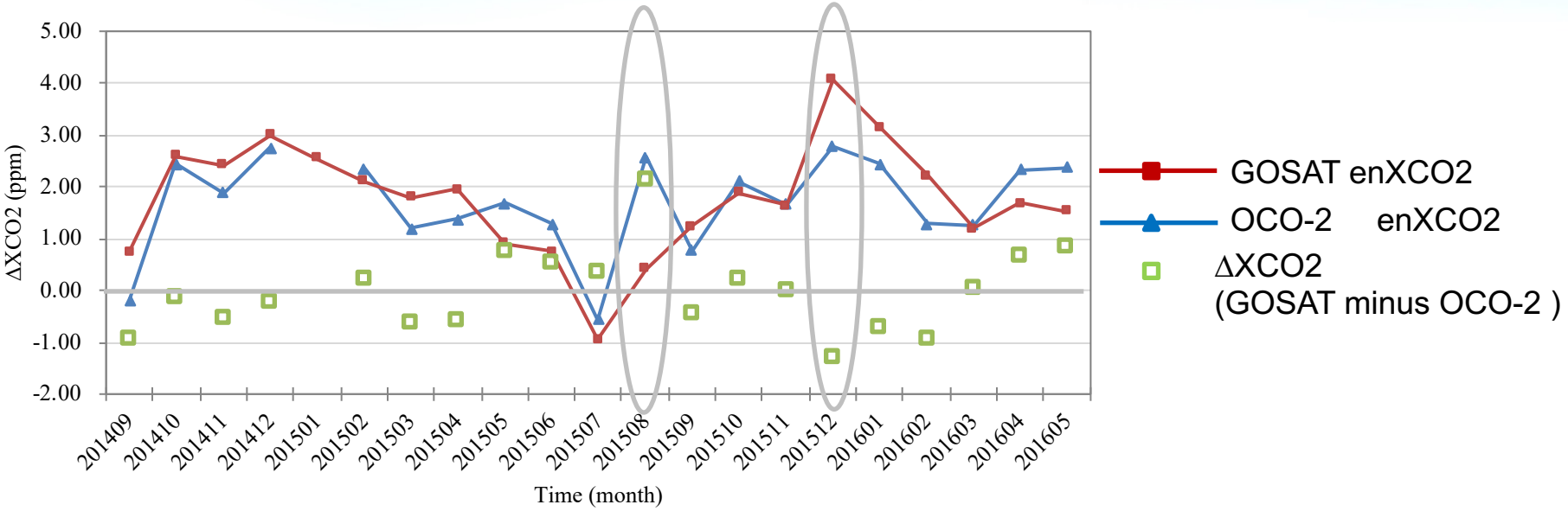
GOSAT XCO2 minus OCO-2 XCO2



Emission region
Background region

XCO2 difference	GOSAT minus OCO-2
Emission region	-1.62 to 1.20 ppm
Background region	-2.16 to 1.30 ppm

XCO2 enhancement from GOSAT and OCO-2

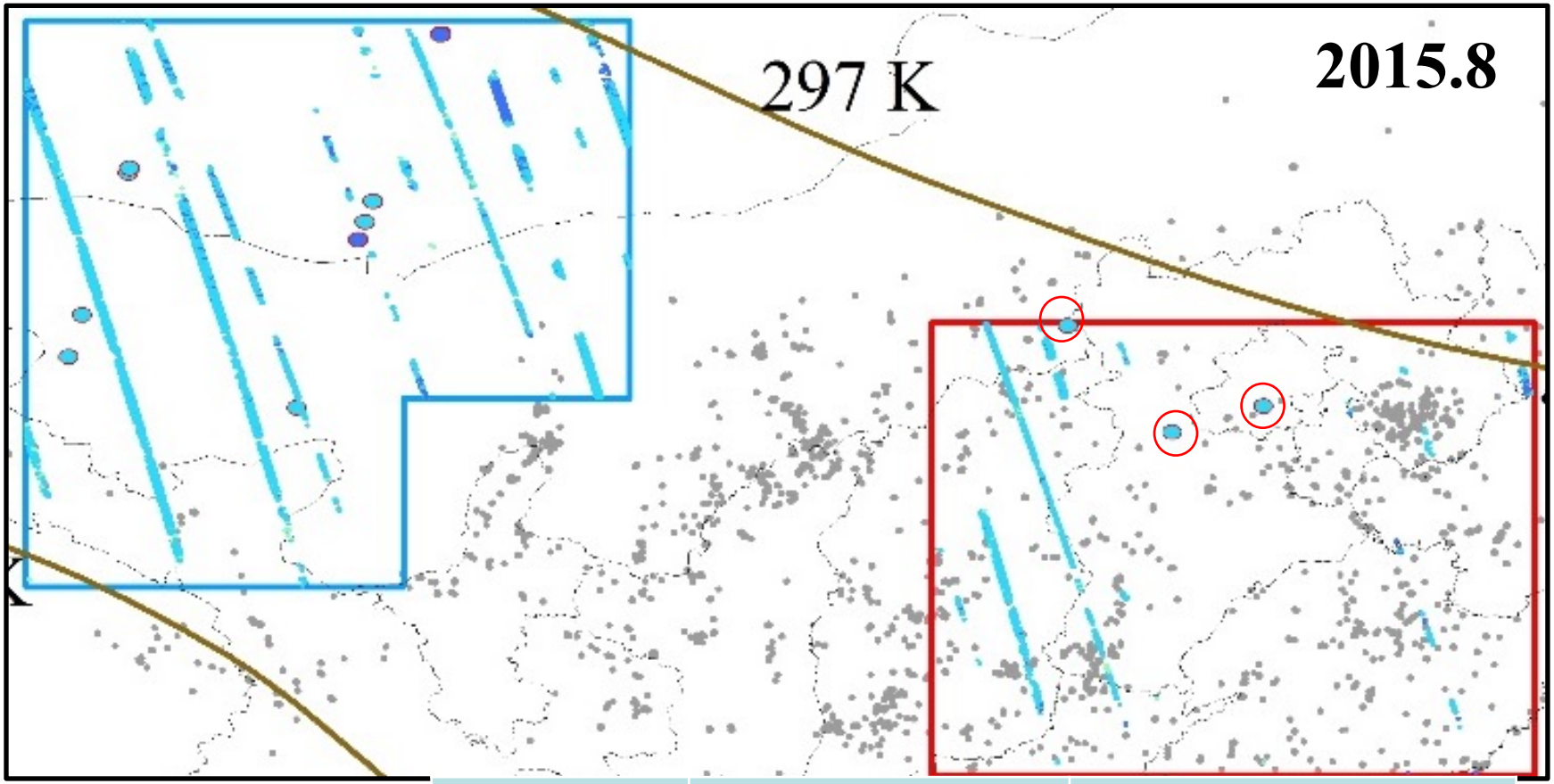


Overlap period
2014.9-2016.5

	GOSAT	OCO-2
Averaged XCO2 Enhancement	1.69 ppm	1.72 ppm

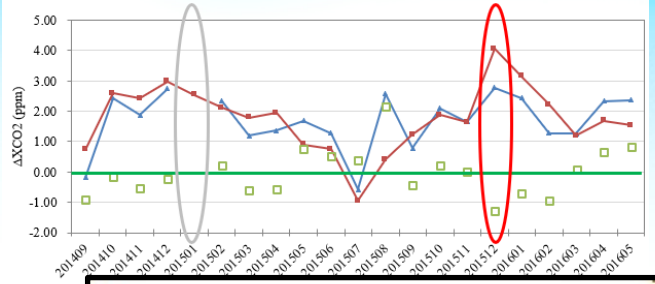
Their differences are generally less than 1 ppm excluding 2.16 ppm in August 2015 and -1.28 ppm in December 2015.

Distribution of observing points in **August 2015**

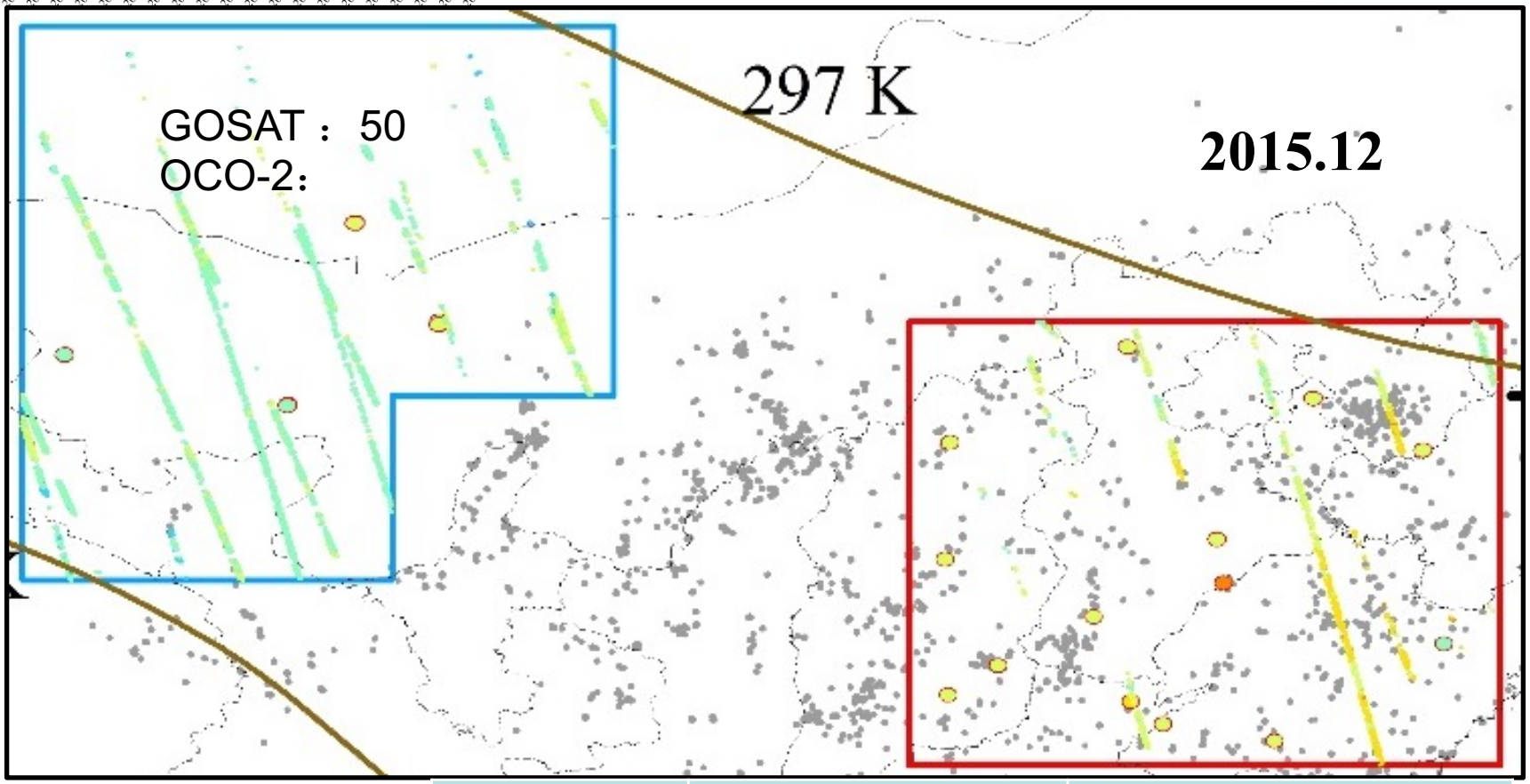


GOSAT 10.5km
OCO-2 3km
Heat sources

	Emission region	Background region
GOSAT	3	25
OCO-2	2433	6460



Distribution of observing points in **December 2015**



GOSAT 10.5km
OCO-2 3km
Heat sources

	Emission region	Background region
GOSAT	18	50
OCO-2	1204	4294

Conclusions

- Regional CO_2 enhancement derived from GOSAT and OCO-2 are approximately similar. XCO_2 enhancements of 1.7 ppm in the emission region can be detected by GOSAT and OCO-2.

- Regional CO_2 enhancement detected by contrast between emission region and background region with OCO-2 and GOSAT should consider about the distribution of satellite observations.

Thank you！

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