11th GEOSS Asia Pacific Symposium

WG3: THE GEO CARBON AND GHG INITIATIVE

TanSat mission achievement and Chinese CO_2 fluxes inversion from satellite observations

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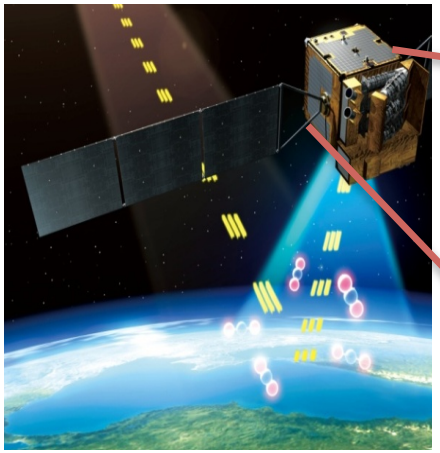
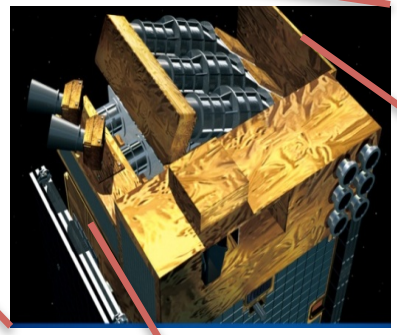
Outline

- **1 TanSat mission achievement**
- **2 Chinese CO_2 fluxes inversion from satellite observations**
- **3 Validation observation of profile**
- **4 Prospective and future plan**

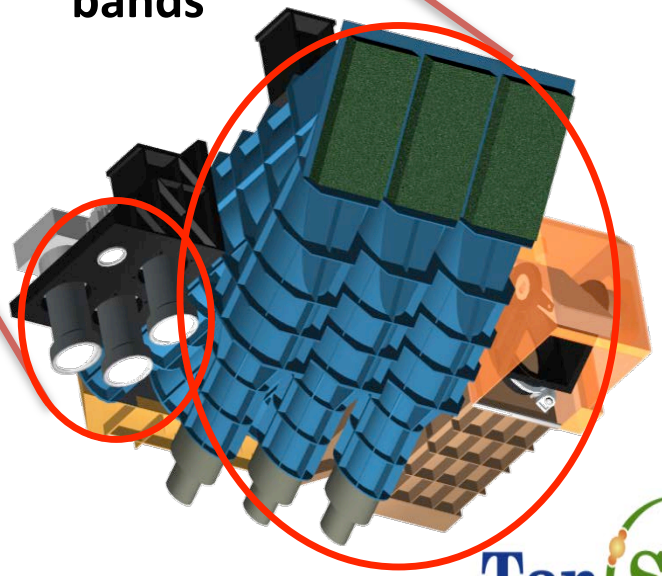
Instrument onboard TanSat





Atmospheric Carbon dioxide Grating Spectrometer-ACGS

- 0.76 μm, O2 A-band
- 1.61 and 2.06 μm, CO2 bands



Cloud and Aerosol Polarization Imager - CAPI

- A wide field of view moderate resolution imaging spectrometer with polarization channel
- Ultraviolet: 0.38μm
- Visible: 0.67μm
- Near infrared: 0.87, 1.375 and 1.64μm
- Polarization: 0.67 & 1.64 μm

中国·GEO

TanSat

Algorithm development

IAPCAS algorithm and application

Institute of Atmospheric Physics, Chinese Academy of Sciences

IAP Carbon Dioxide Retrieval Algorithm for Satellite Observation – IAPCAS

Application

TanSat algorithm

Other observation → OCO-2

Similar observation characters

aTanGO
Application of TanSat algorithm on GOSAT Observation

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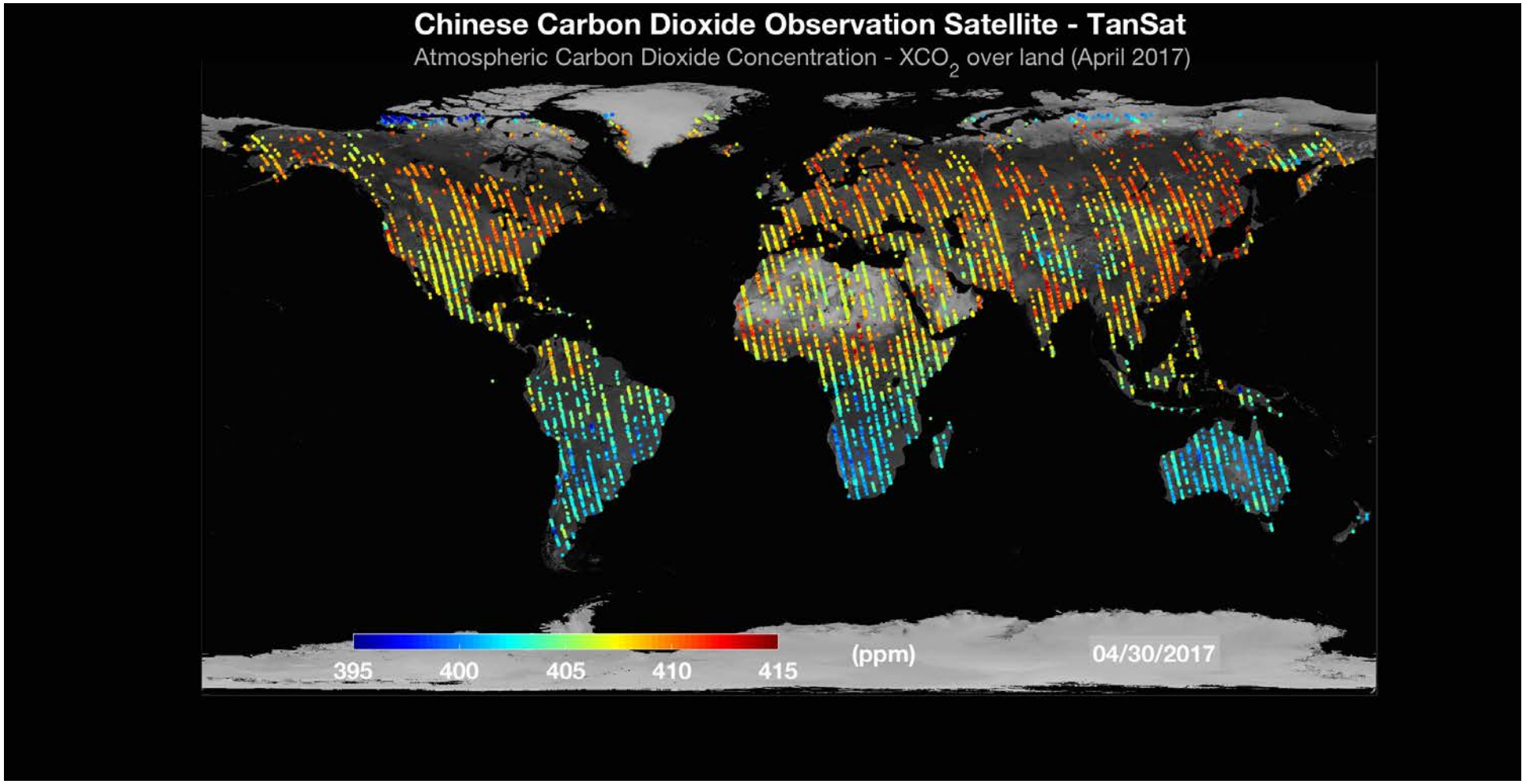
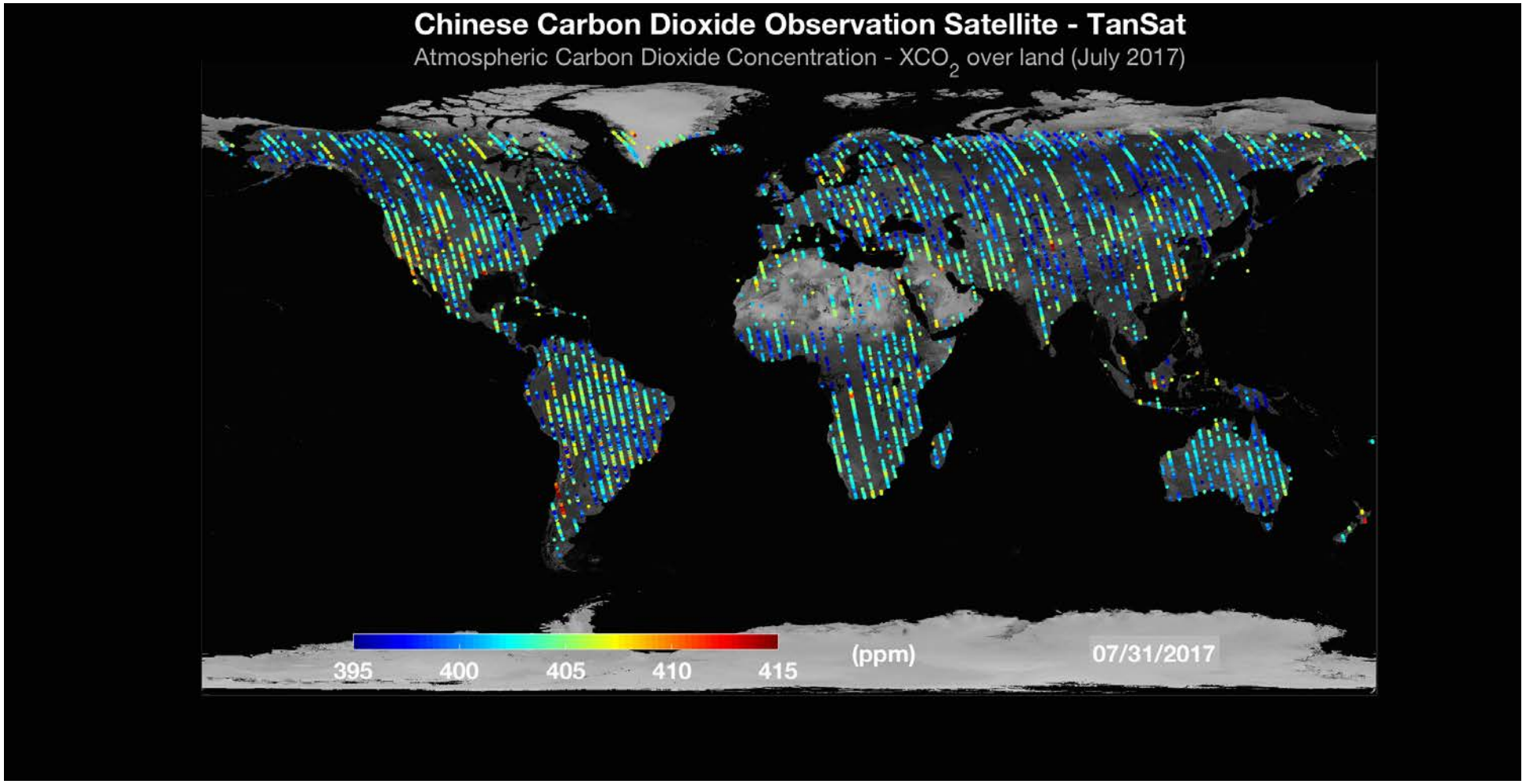
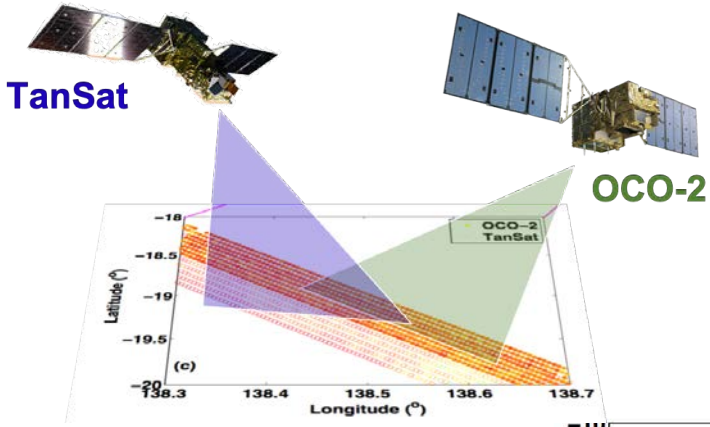
Global distribution of XCO2 on April 2017 --TanSat



Global distribution of XCO2 on July 2017 --TanSat

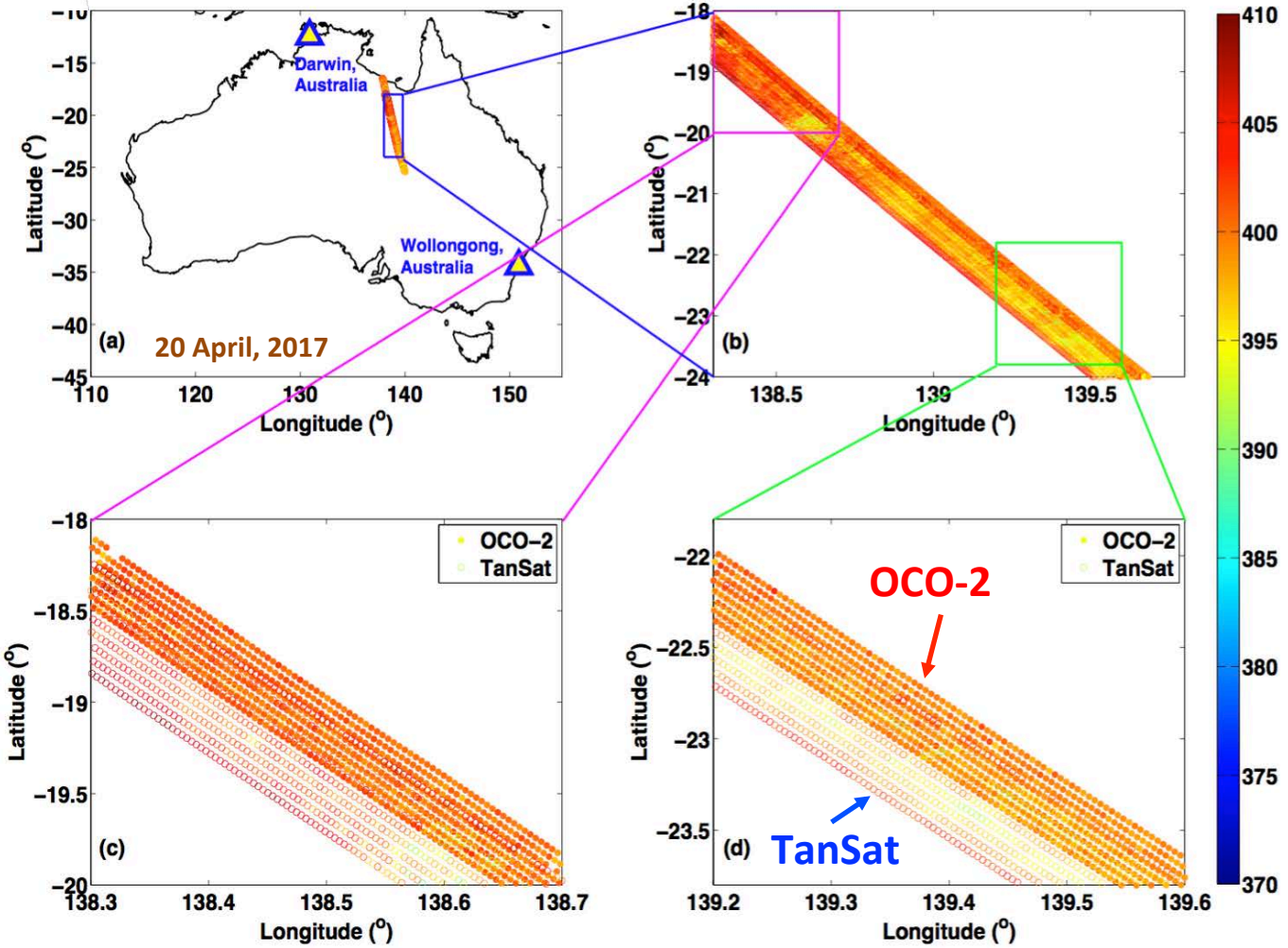




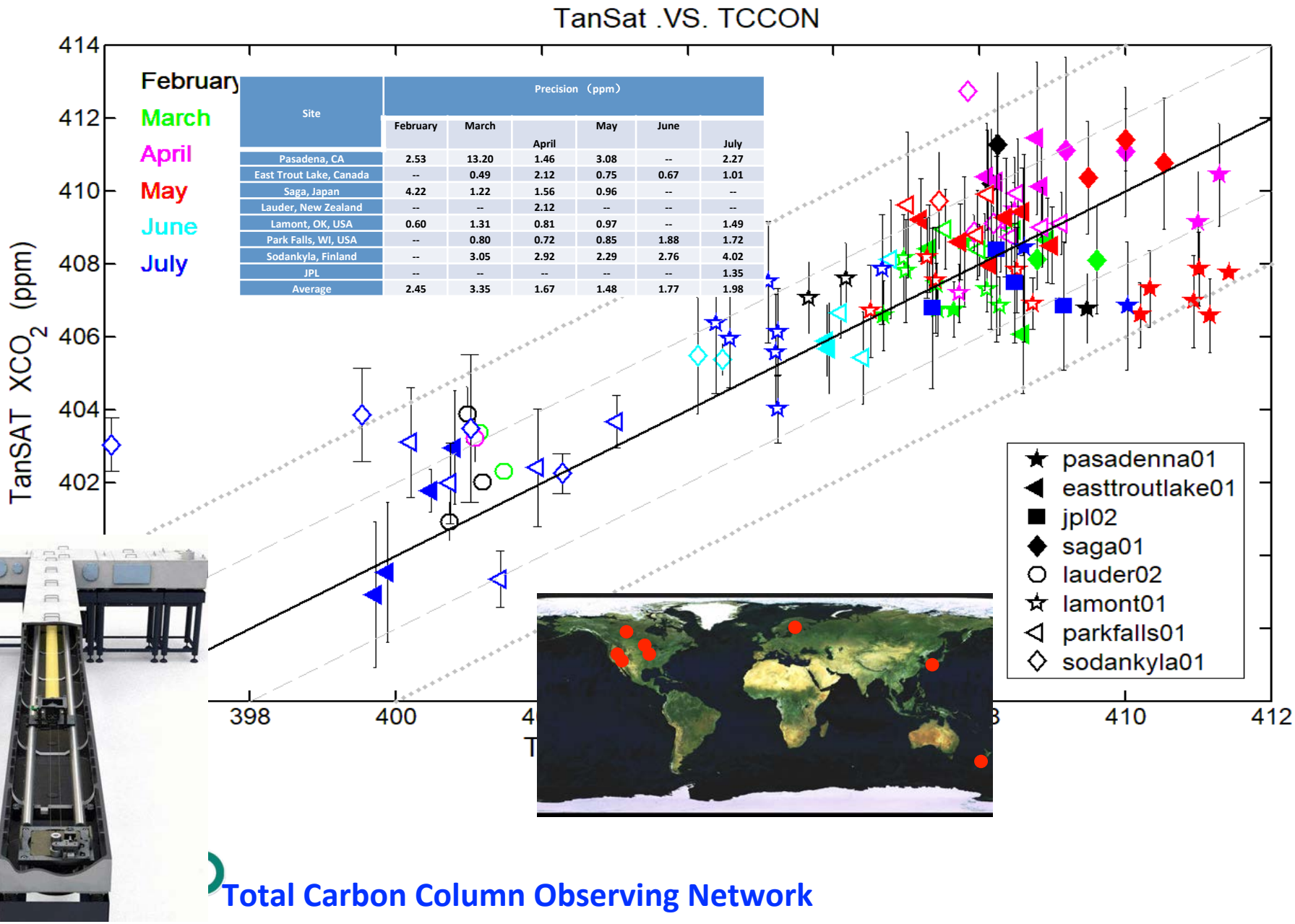
Inter-comparison with OCO-2

Overlap measuring with OCO-2 in Australia on 20 April, 2017

Inter-comparing with spectrum and XCO_2



TanSat XCO_2 validation against TCCON



Site	Precision （ppm）					
	February	March	April	May	June	July
Pasadena, CA	2.53	13.20	1.46	3.08	--	2.27
East Trout Lake, Canada	--	0.49	2.12	0.75	0.67	1.01
Saga, Japan	4.22	1.22	1.56	0.96	--	--
Lauder, New Zealand	--	--	2.12	--	--	--
Lamont, OK, USA	0.60	1.31	0.81	0.97	--	1.49
Park Falls, WI, USA	--	0.80	0.72	0.85	1.88	1.72
Sodankyla, Finland	--	3.05	2.92	2.29	2.76	4.02
JPL	--	--	--	--	--	1.35
Average	2.45	3.35	1.67	1.48	1.77	1.98

Total Carbon Column Observing Network

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Flux inversions

CTM:

Version: GEOS-Chem v9.02

Resolution : 4 (Lat) X 5 (Lon)/47 levels

Met Fields: ***GEOS-FP***

Prior fluxes:

- ✓ODIAC Fossil fuel emissions.
- ✓3-hourly biospheric fluxes (CASA till 2015.12);
- ✓Monthly oceanic surface fluxes (Takahashi)
- ✓Weekly biomass burning emissions (GFED)

Time period:

2009.01 to 2016.01

Observations:

Insitu: In-situ observations (ObsPack: 2009-2015)

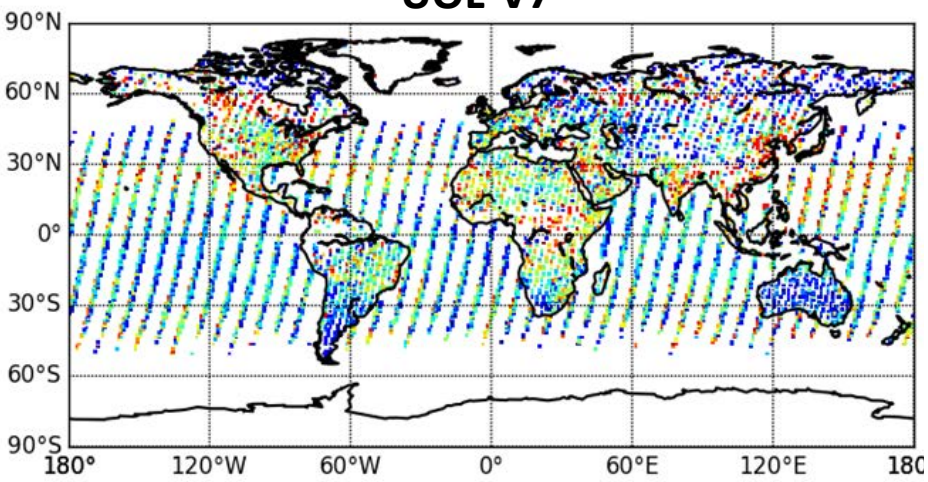
OCO-2: Land **nadir** 10s XCO2 retrievals of v7 by JPL

ACOS-B7: GOSAT XCO2 retrievals (2009-2015) by JPL (O'Dell el al.)

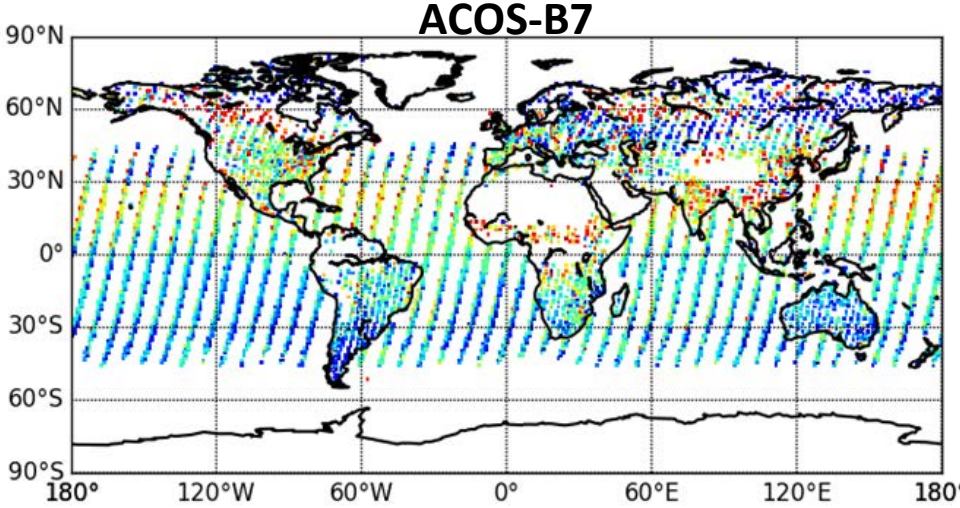
UOL-V7: GOSAT XCO2 retrievals by UoL (Parker et al.)

Observation coverage

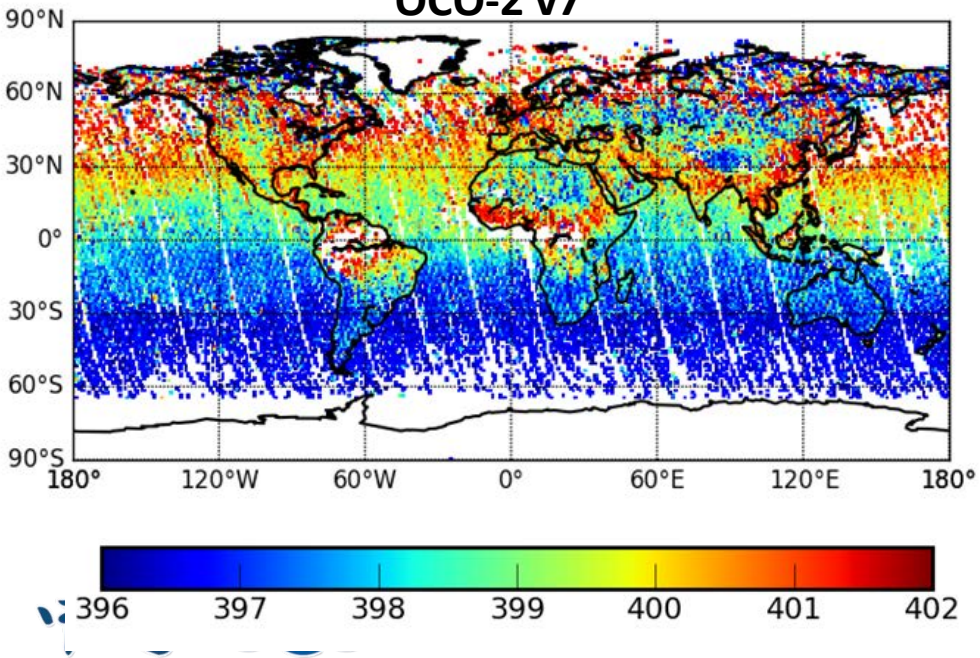
UOL-V7

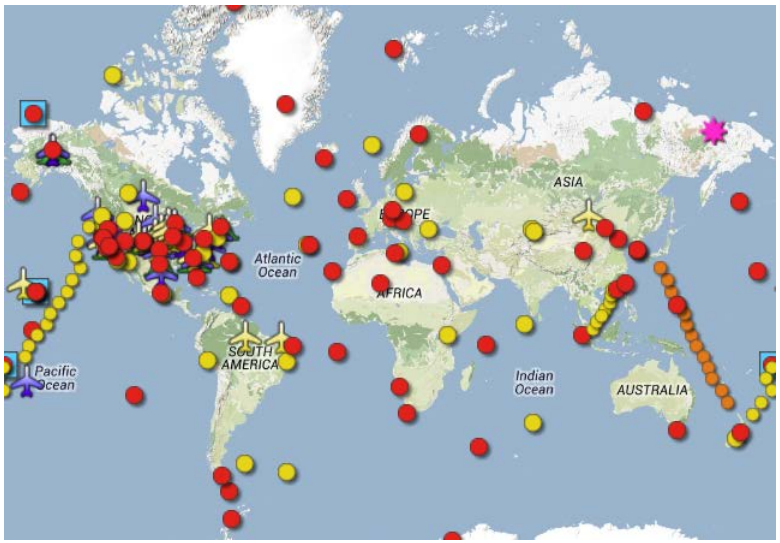


ACOS-B7



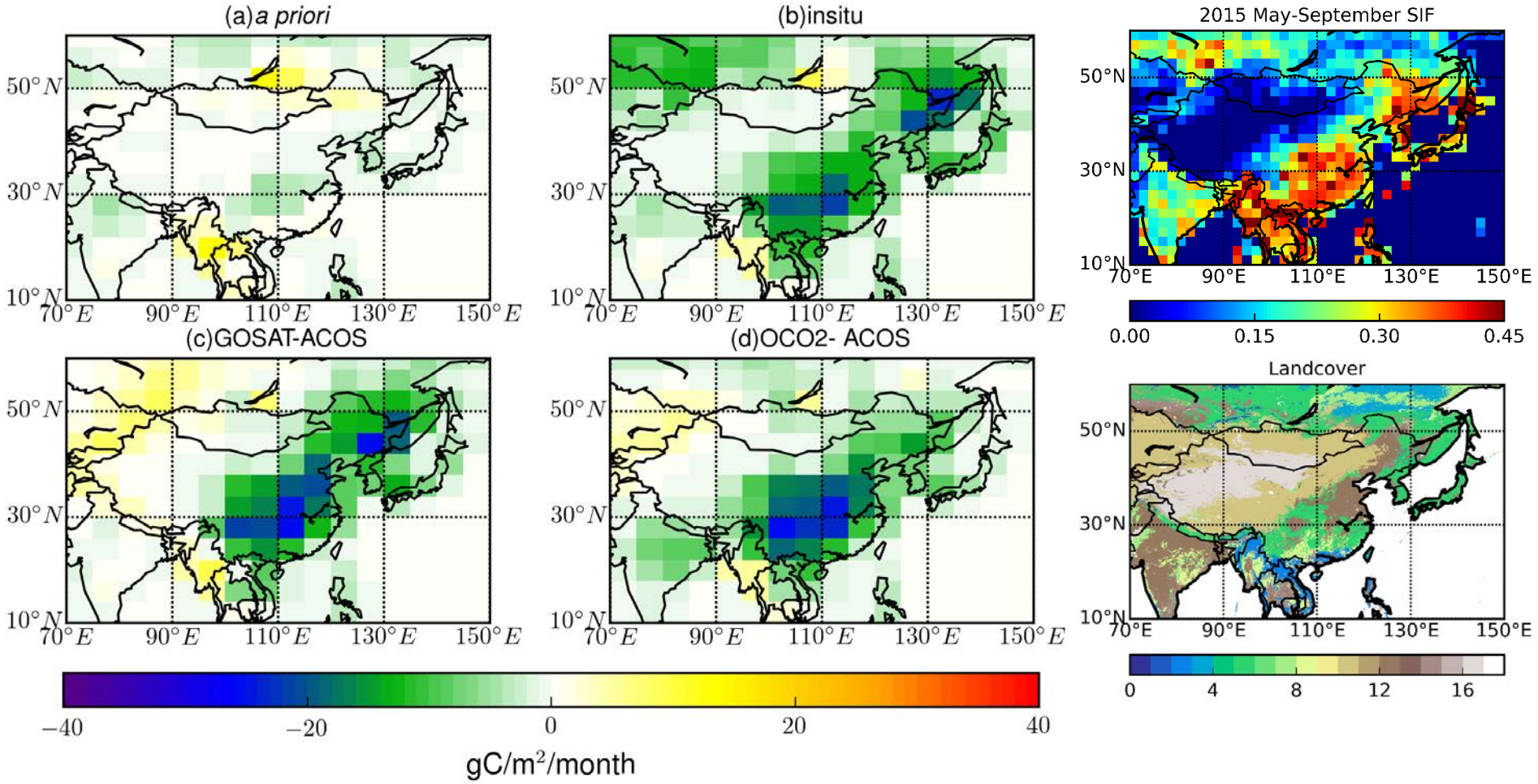
OCO-2 v7





In-situ Network (from NOAA website)

Inversion results-biosphere sink of 2015 over China

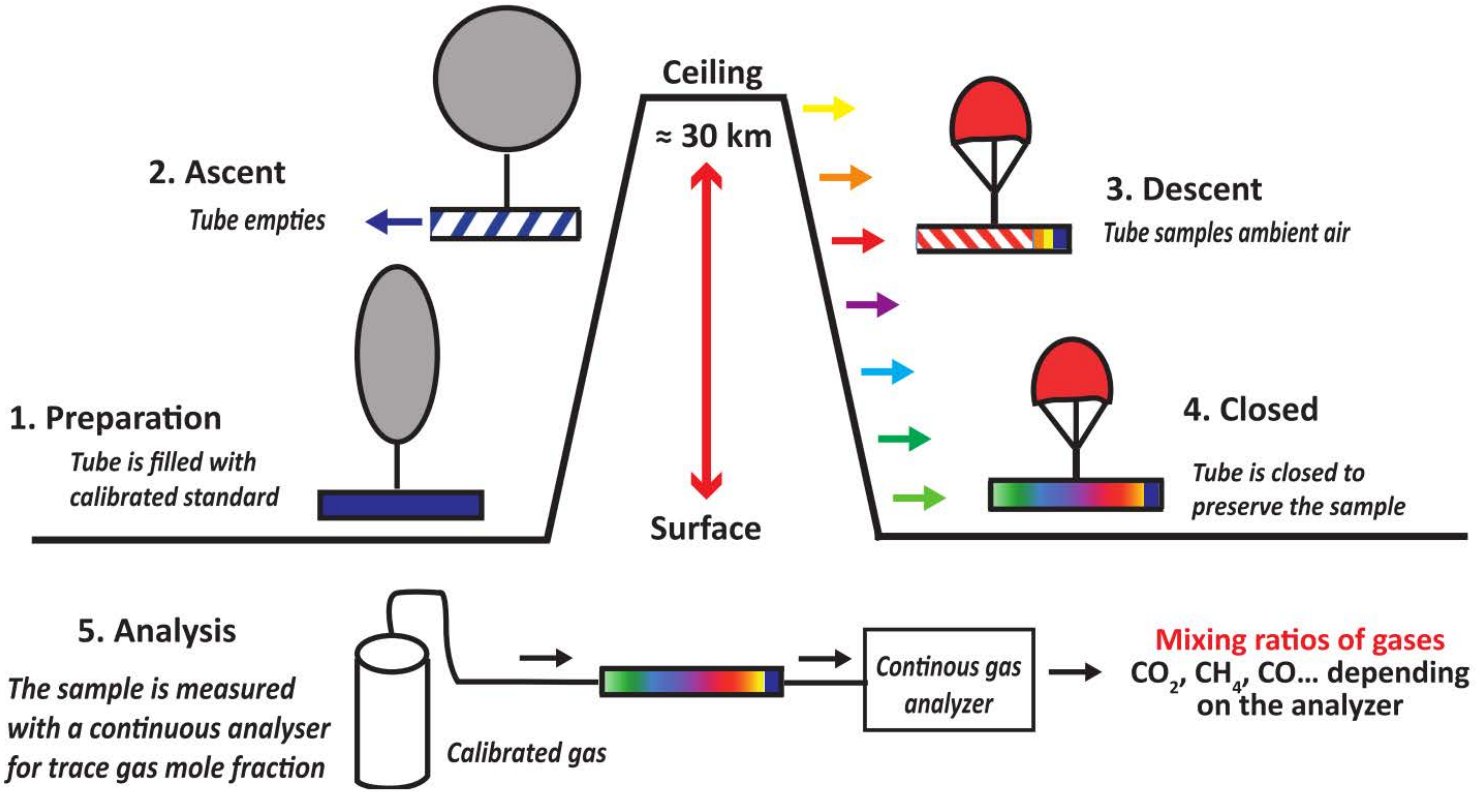


The distribution of the biosphere carbon sink is consistent with the SIF data and the vegetation distribution over China.

3 Validation observation of profile

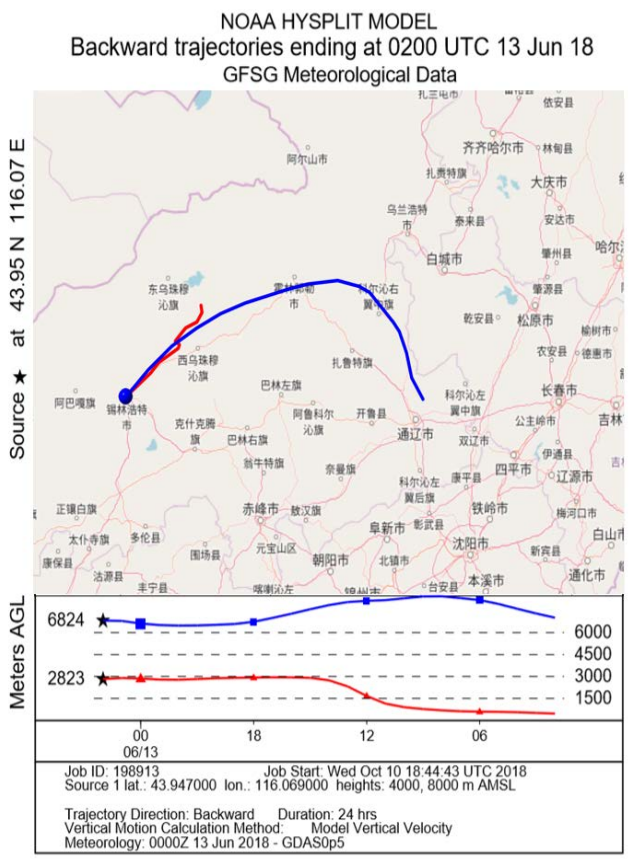
Aircore: An atmospheric sampling system to enhance the knowledge of vertical distribution of CO_2\CO\CH_4

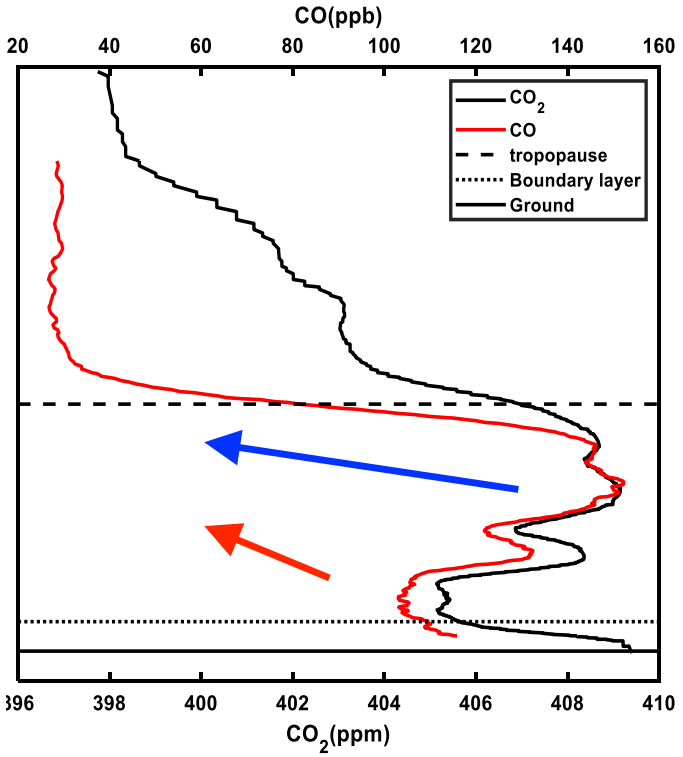
Sampling method

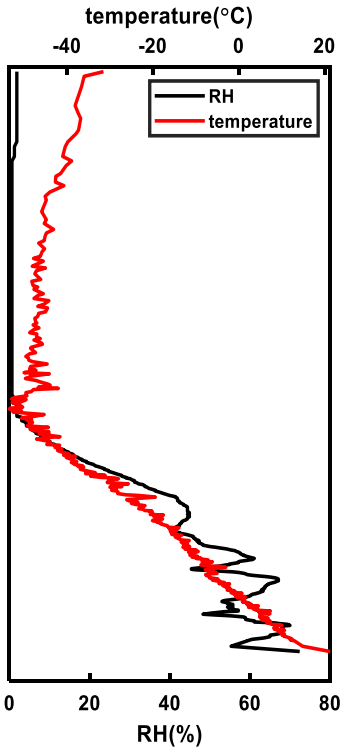


Profiles

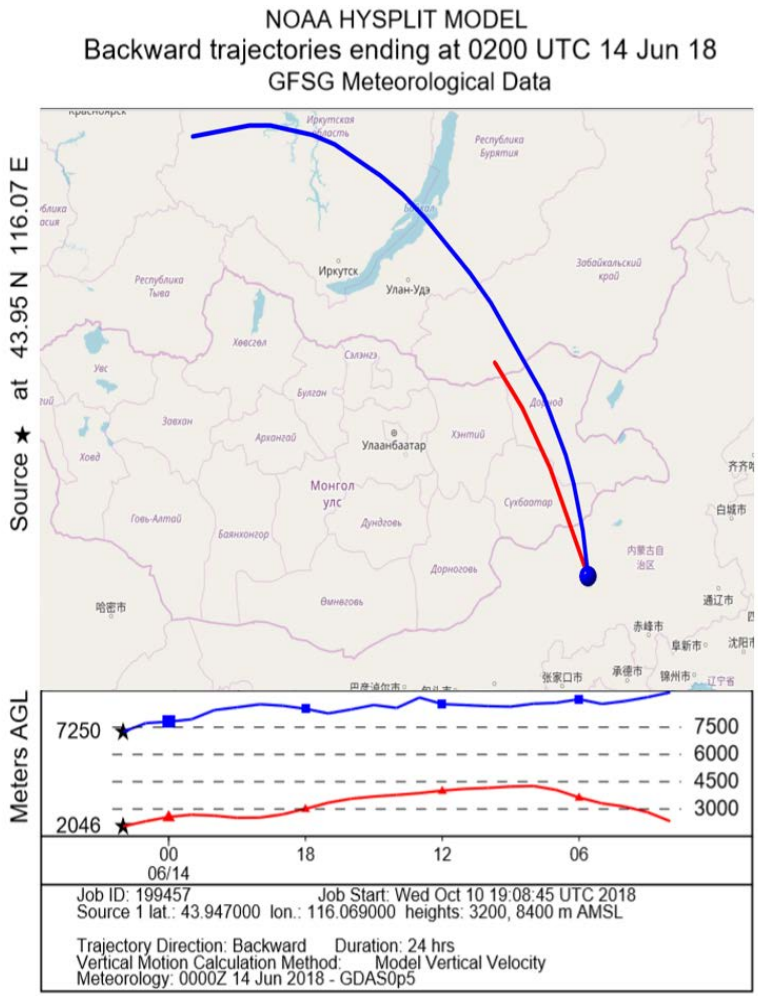
6.13



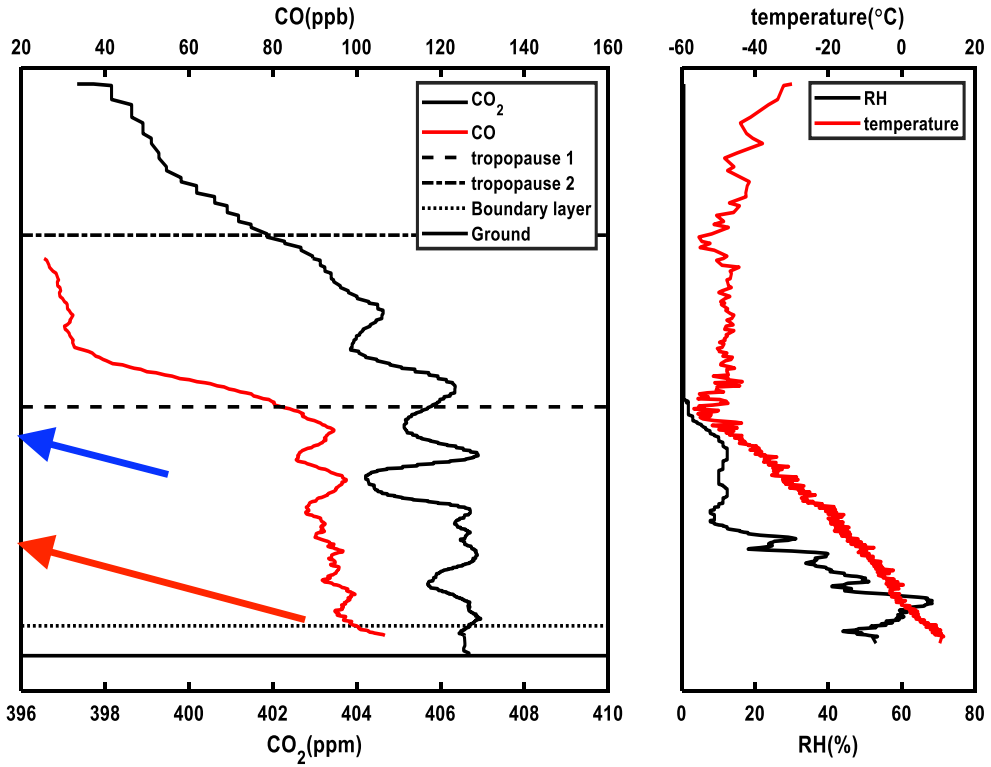




Profiles



6.14



XCO_2 of each layer

	Boundary	Free troposphere	1st tropopause – 2nd tropopause	Upper stratosphere	Total
6.13	408ppm	407ppm	403.8ppm	399.4ppm	407ppm
6.14	406.6ppm	406.2ppm	404.9ppm	399.9ppm	406.1ppm

XCO_2 of boundary and free troposphere on 6.13 is higher
XCO_2 of UTLS on 6.14 is higher

STE?

4. Perspective and Plan

1. After launched on December 22, TanSat has operated more than 20 months in “NOMINAL” states.
2. The L1b data has been released to different users in GEO website (http://chinageoss.org/tansat/index.html).
3. The L2 data have been retrieved by the research algorithm and the operational algorithm will be released.
4. Chinese GHGs flux has been estimated by assimilated with Satellite observations.
5. Validation measurement in China will be conducted and it will strengthen the international data sharing.

Thank You

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