GHG Monitoring Activities in CGER

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and
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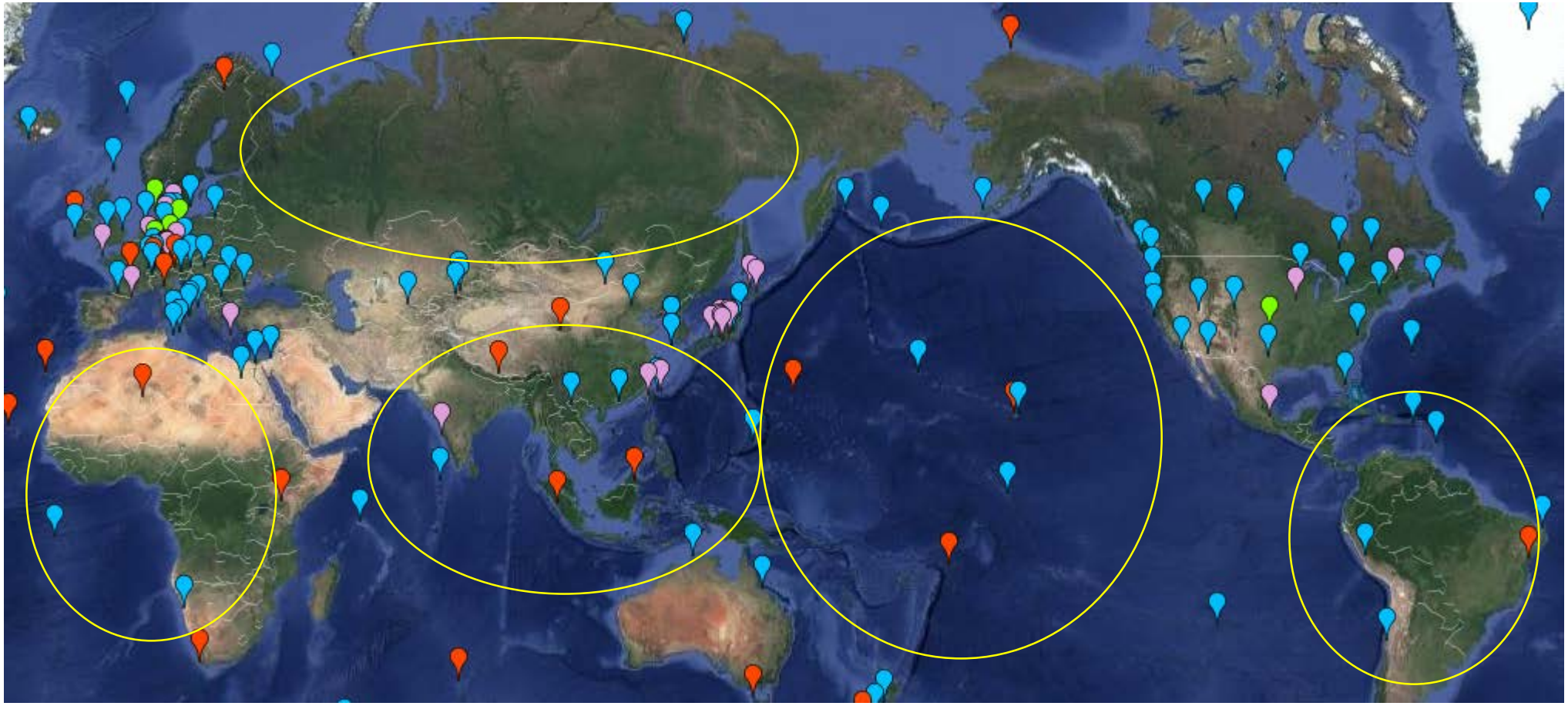
Y.Terao, H.Nara, Y.Tohjima, S.Nomura
other members in Center for Global
Environmental Research (CGER)

World observation sites for GHG



From WDCGG

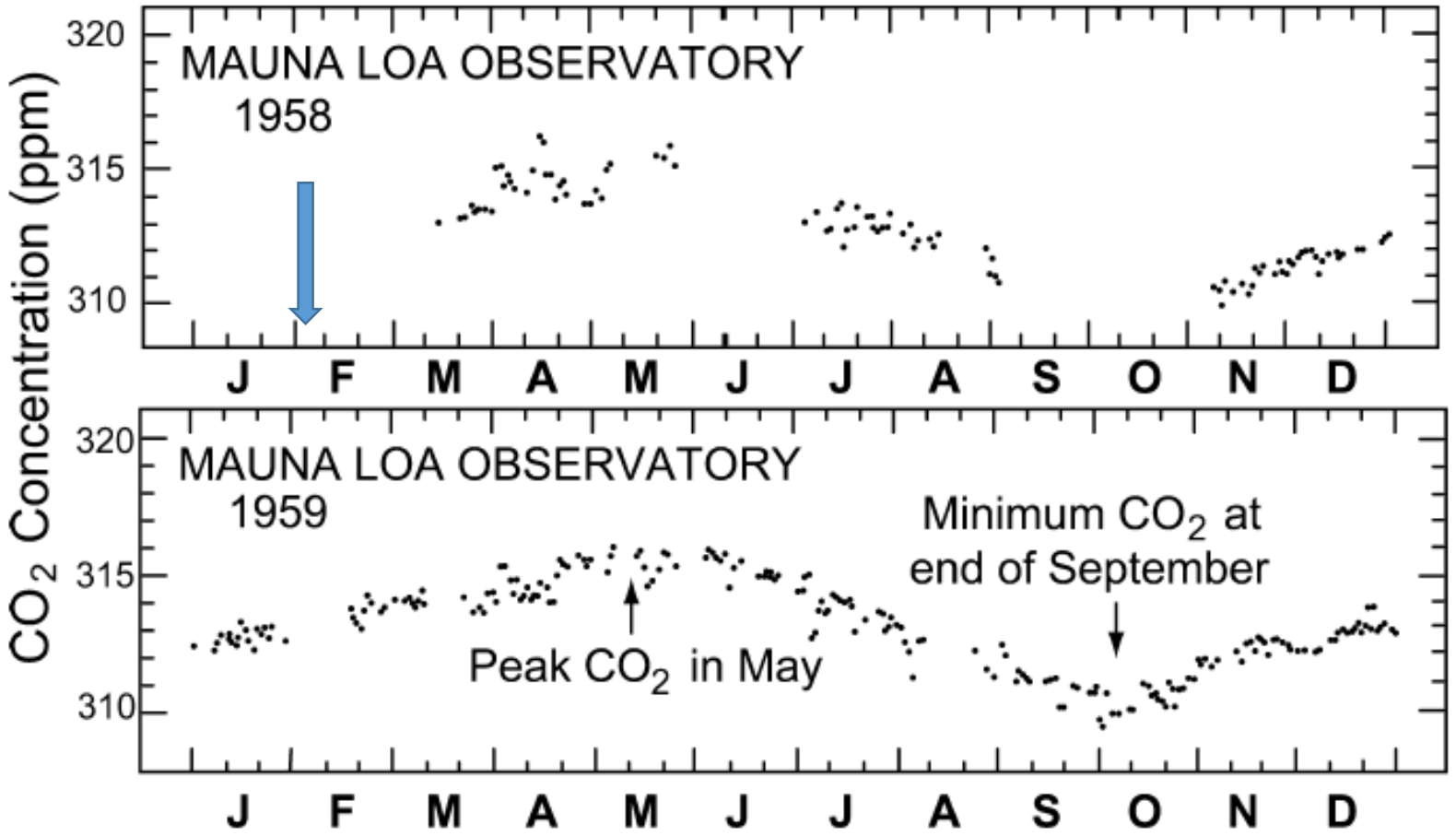
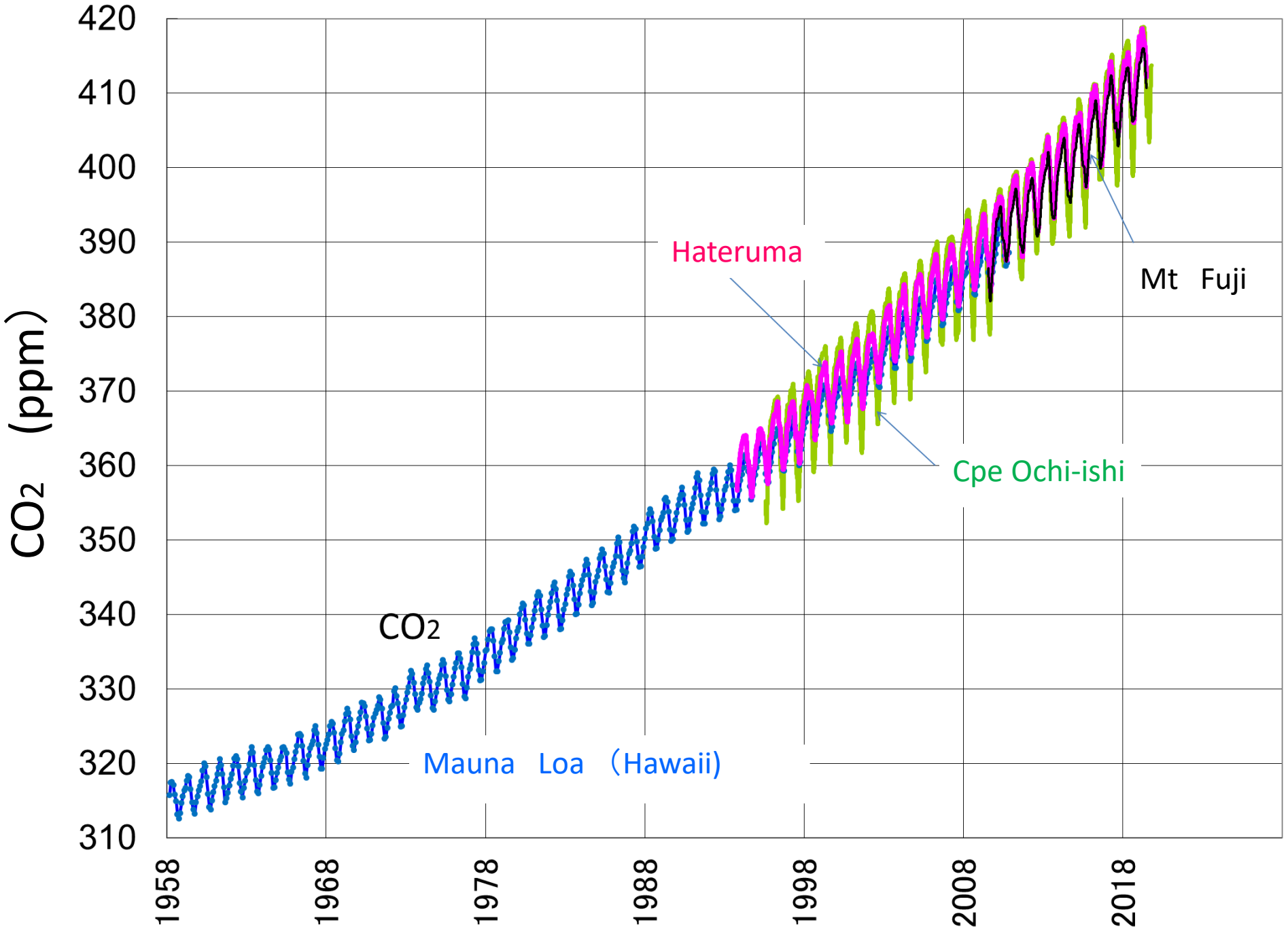
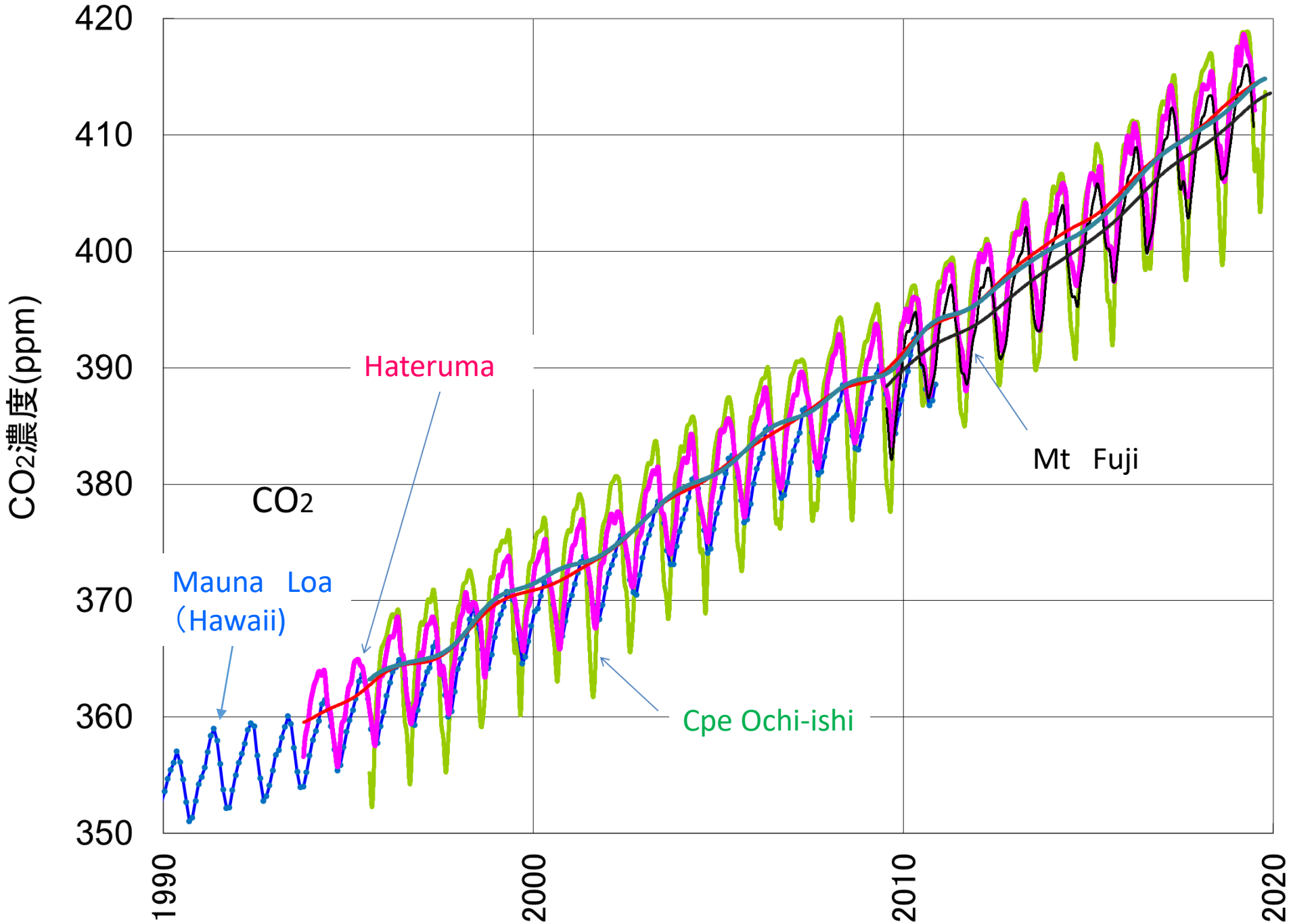


Figure 3. Daily CO_2 readings from the first two years of monitoring on Mauna Loa. Data from ref 3.

CGER Monitoring Activities for GHG and Flux

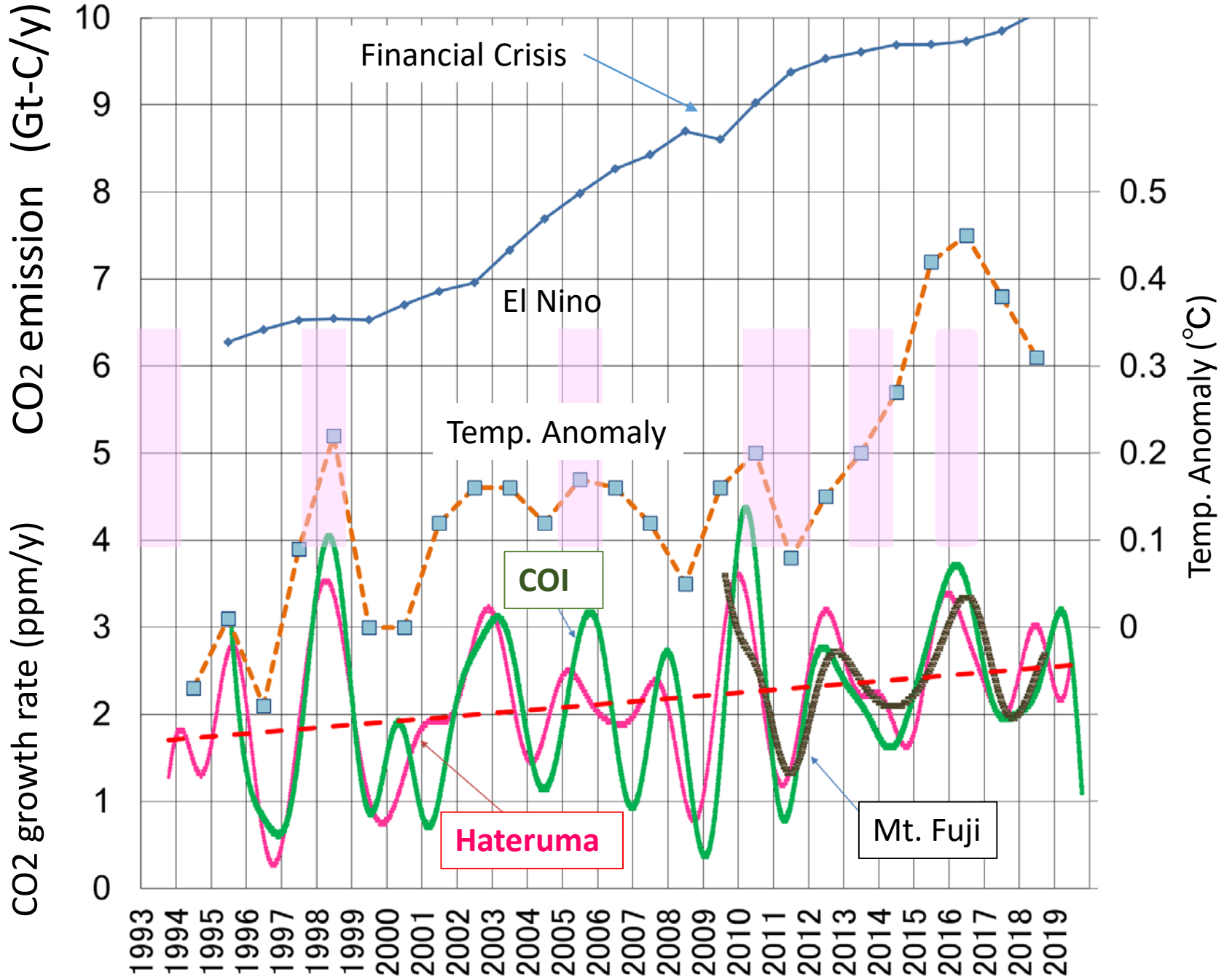

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Image IBCAO
Google Earth


420
410
400
390
380
370
360
350
340
330
320
310
CO2 (ppm)
1958
1968
1978
1988
1998
2008
2018
Hateruma
Mt Fuji
Cpe Ochi-ishi
CO2
Mauna Loa （Hawaii)


420
410
400
390
380
370
360
350
1990
2000
2010
2020
CO2濃度(ppm)
CO2
Hateruma
Mauna Loa
（Hawaii)
Cpe Ochi-ishi
Mt Fuji

30 years ago
Growth rate
1.5 ppm/y

Recently
2.5ppm/y

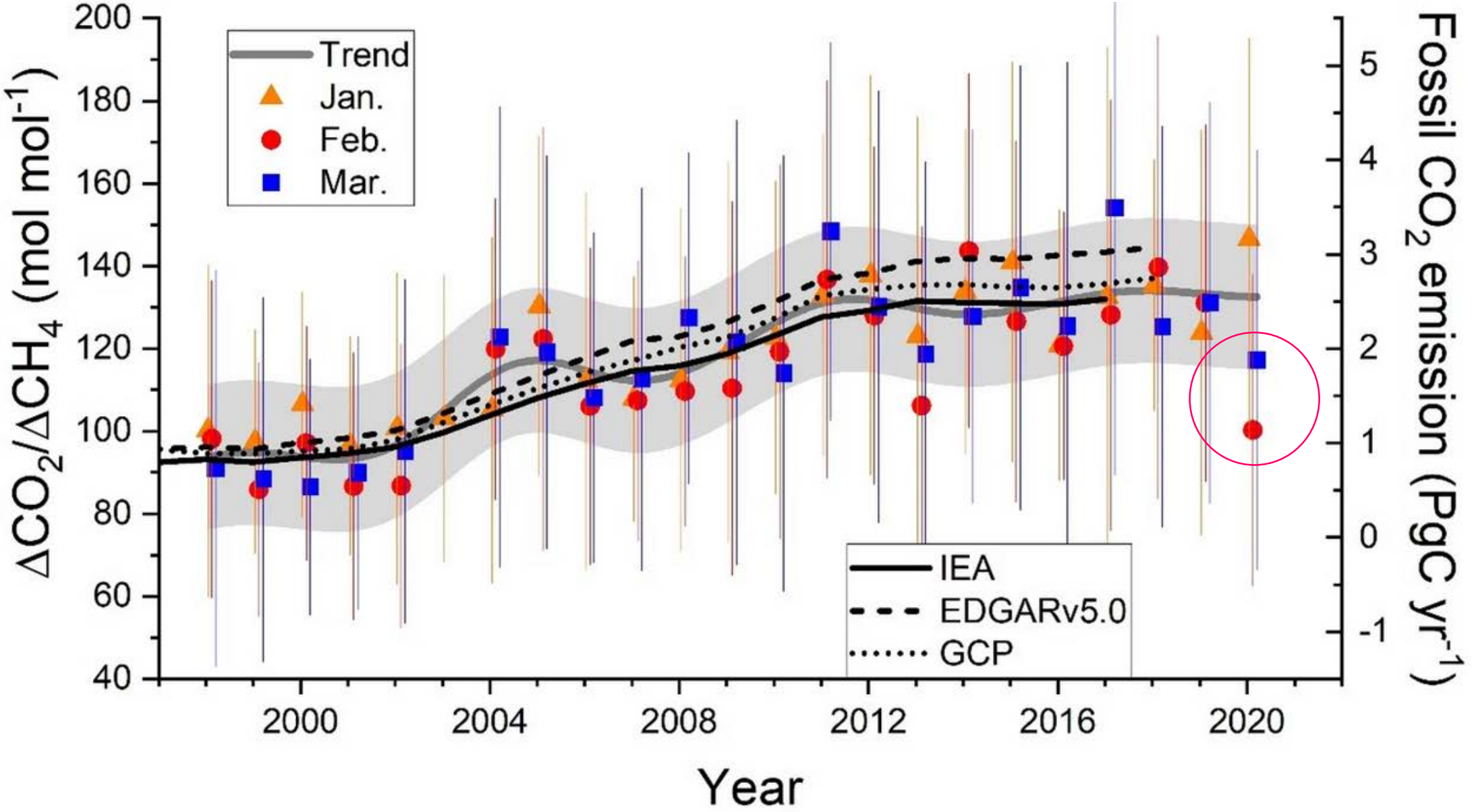


Detection of fossil-fuel CO_2 plummet in China due to COVID-19 by observation at Hateruma

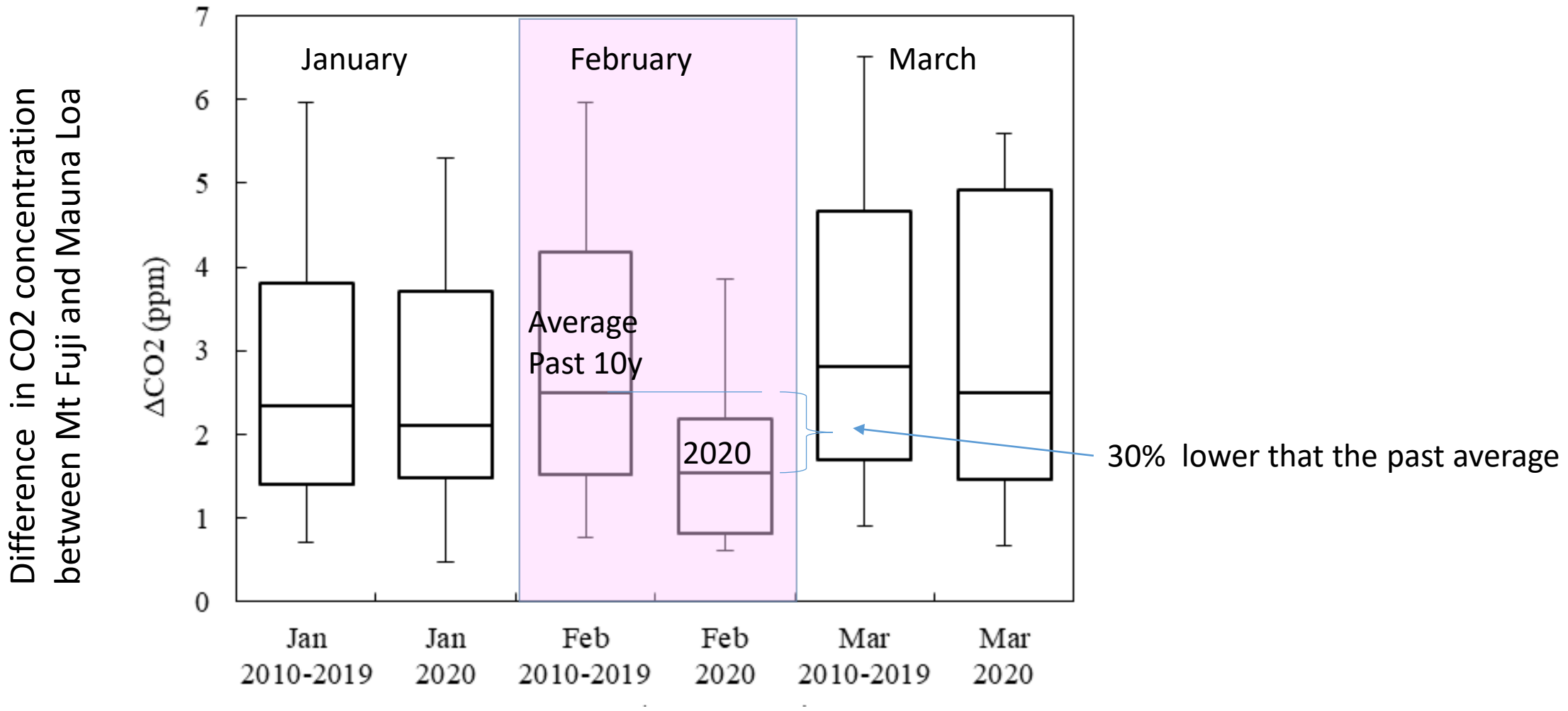
Yasunori Tohjima ✉, Prabir K. Patra, Yosuke Niwa, Hitoshi Mukai, Motoki Sasakawa & Toshinobu Machida

scientific reports

Published: 29 October 2020



Chinese Lockdown seemed to affect CO2 concentration at Mt Fuji



GLOBAL CARBON PROJECT

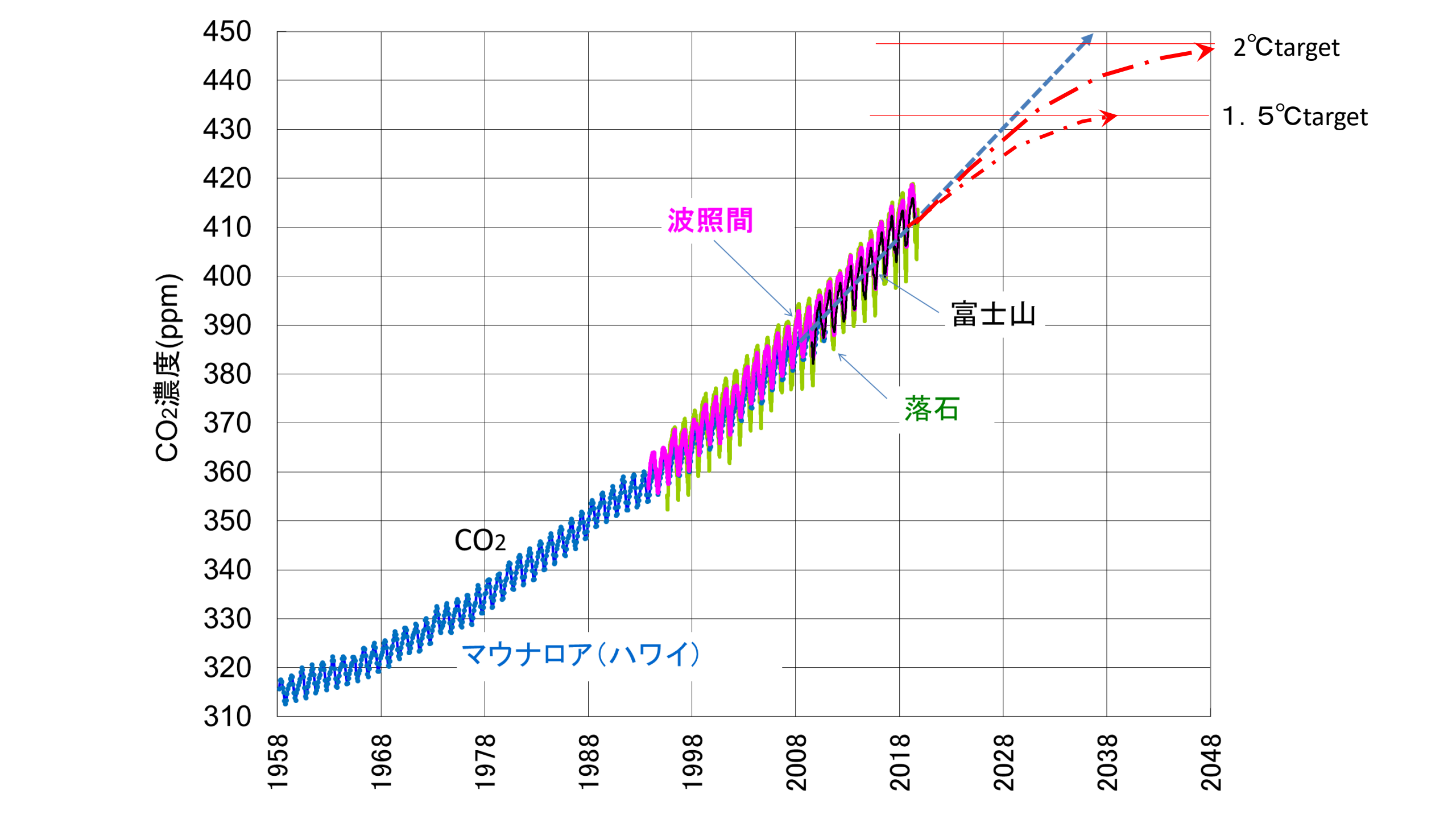
2020 Results Summary

Region / Country	2019 emissions (billion tonnes/yr)	2019 growth (percent)	2020 projected growth** (percent)	2020 projected emissions** (billion tonnes/yr)
China	10.2	2.2%	-1.7%	10.0
USA	5.3	-2.6%	-12.2%	4.7
EU27	2.9	-4.5%	-11.3%	2.6
India	2.6	1.0%	-9.1%	2.4
World (incl. bunkers*)	36.4	0.1%	-6.7%	34.1

*bunkers: Emissions from use of international aviation and maritime navigation bunker fuels are not usually included in national totals

**Median of the four studies

Source: Friedlingstein et al 2020; Global Carbon Budget 2020


450
440
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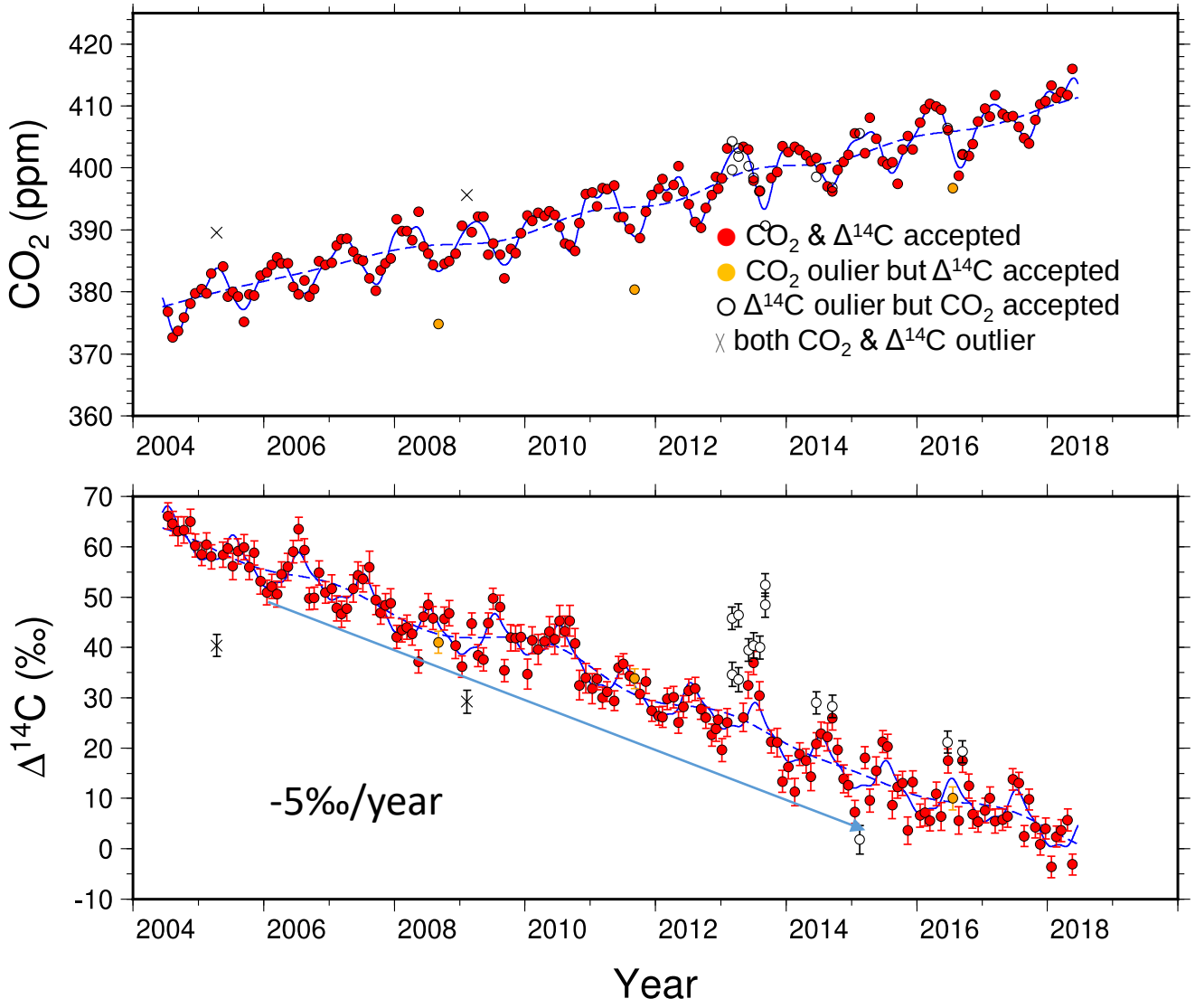
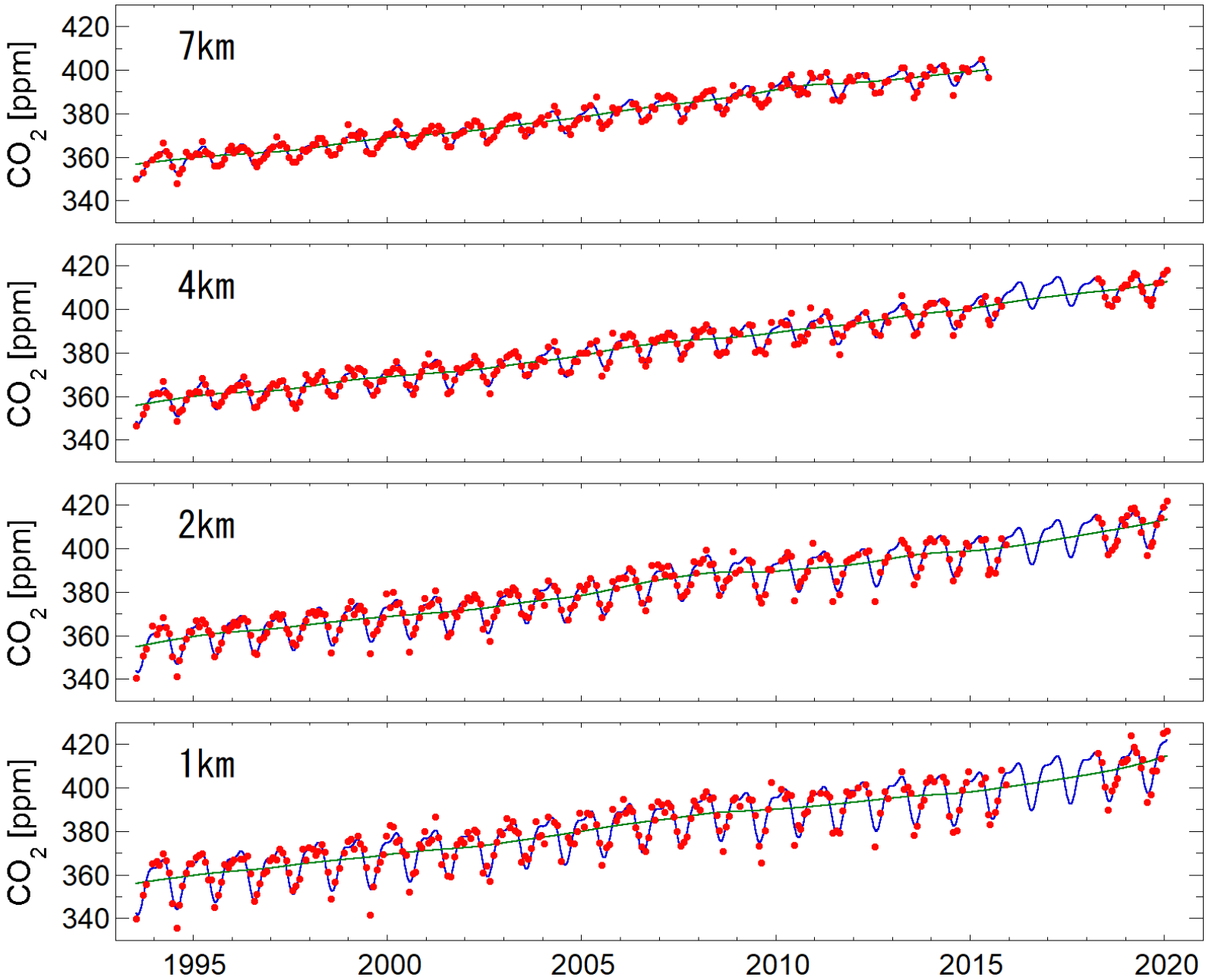
370
360
350
340
330
320
310
CO2濃度(ppm)
1958
1968
1978
1988
1998
2008
2018
2028
2038
2048
2℃target
1．5℃target
波照間
富士山
落石
CO2
マウナロア（ハワイ）

14C showed anthropogenic source CO2 accumulated in the atmosphere ,NOT natural phenomena



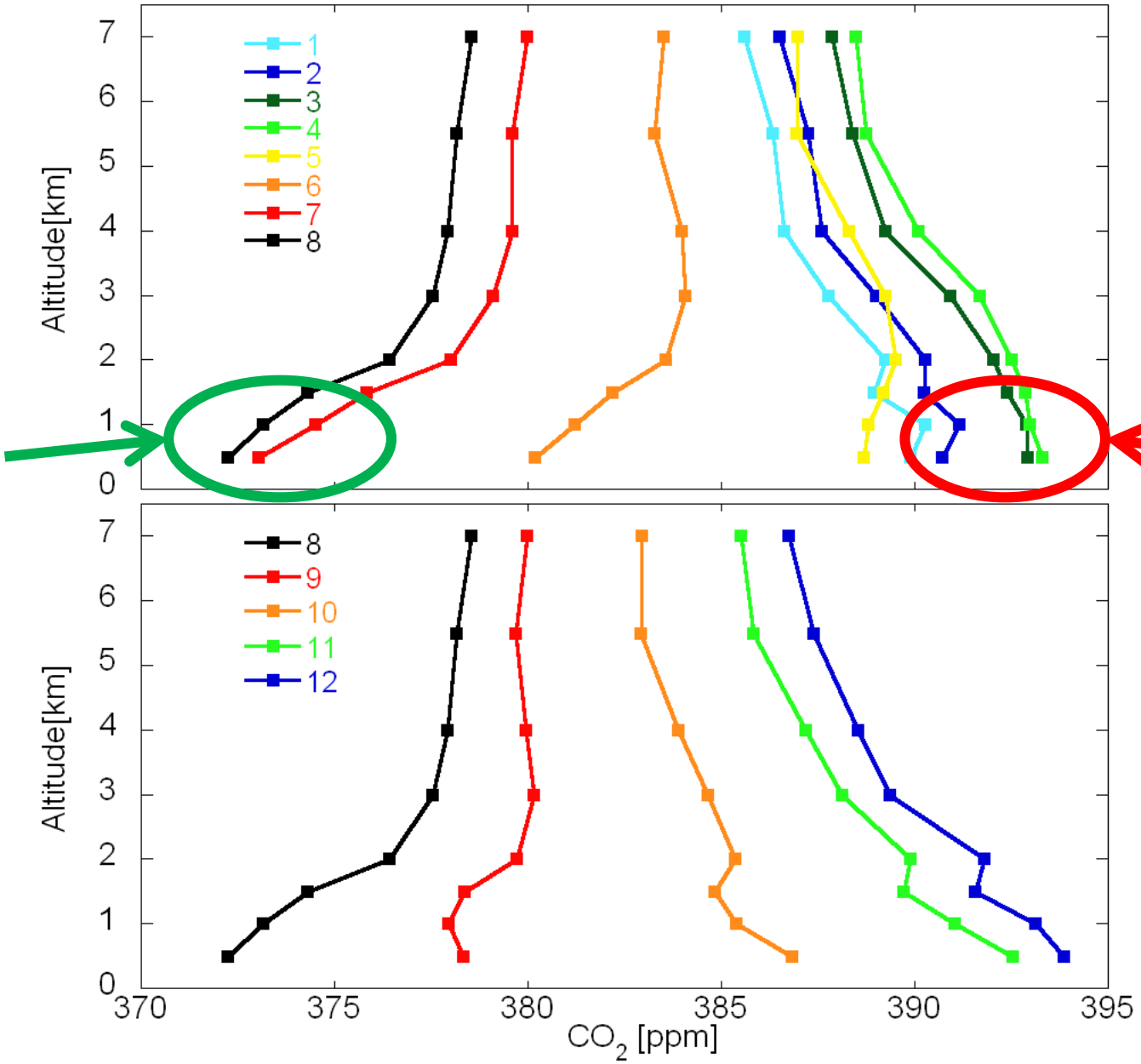

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Image IBCAO
Google Earth

CO2 continuously increased over Surgut



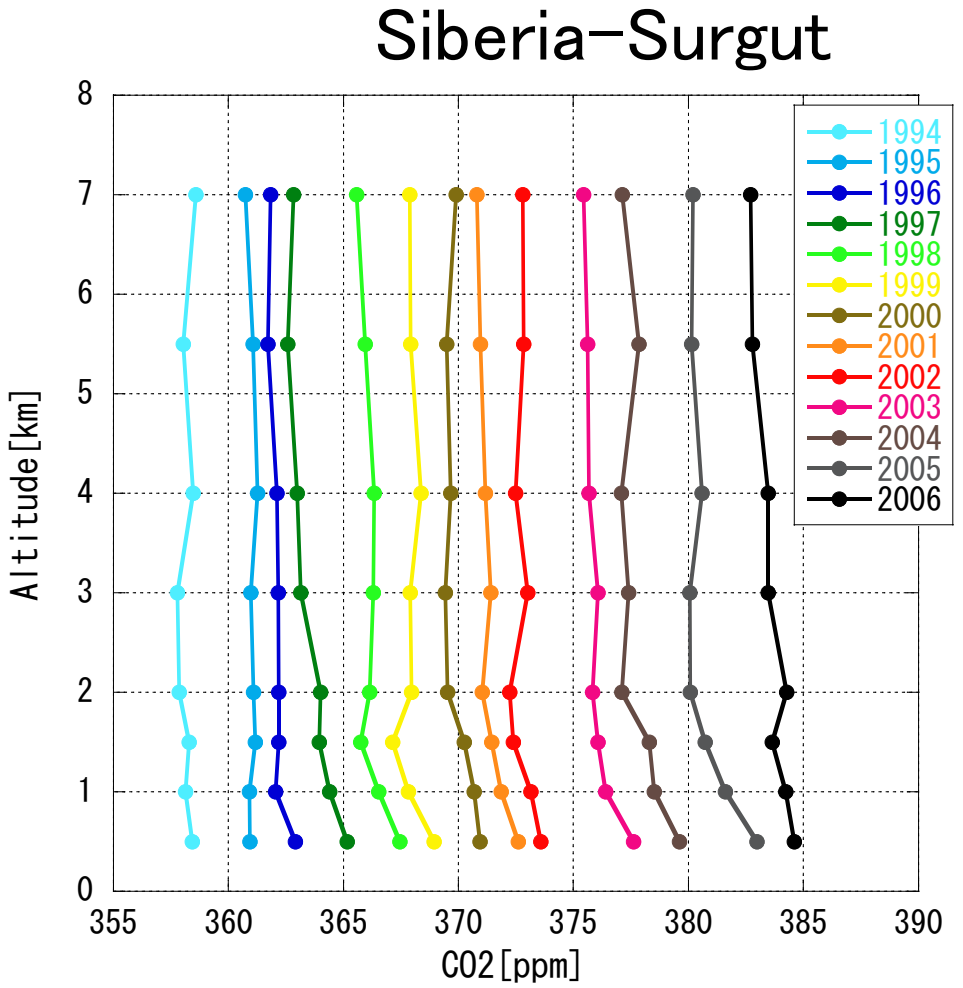
CO2 vertical distribution over Surgut

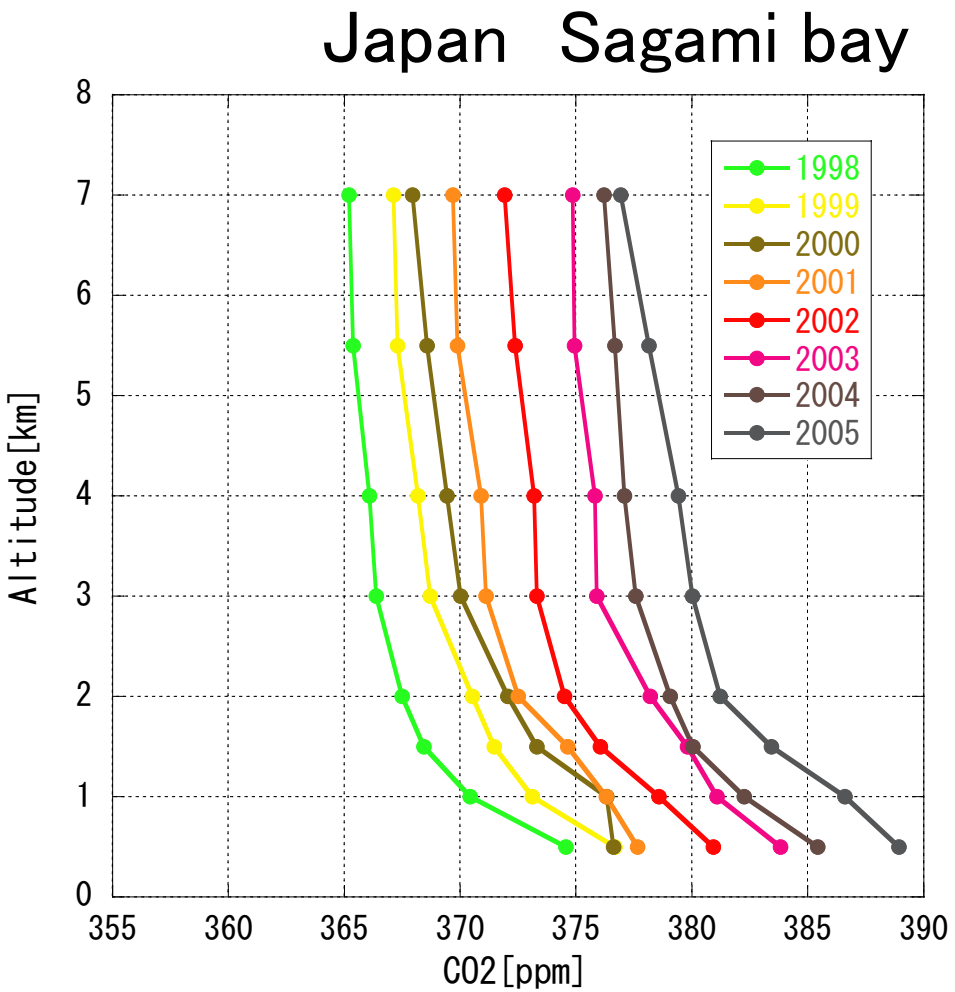
Summer photosynthesis absorbs CO2 near surface



Winter – Spring respiration emits CO2

Annual concentration over Siberia Comparison with Japan





Almost balanced in C budget in Siberia but ,,

Ocean observation using commercial cargo ships

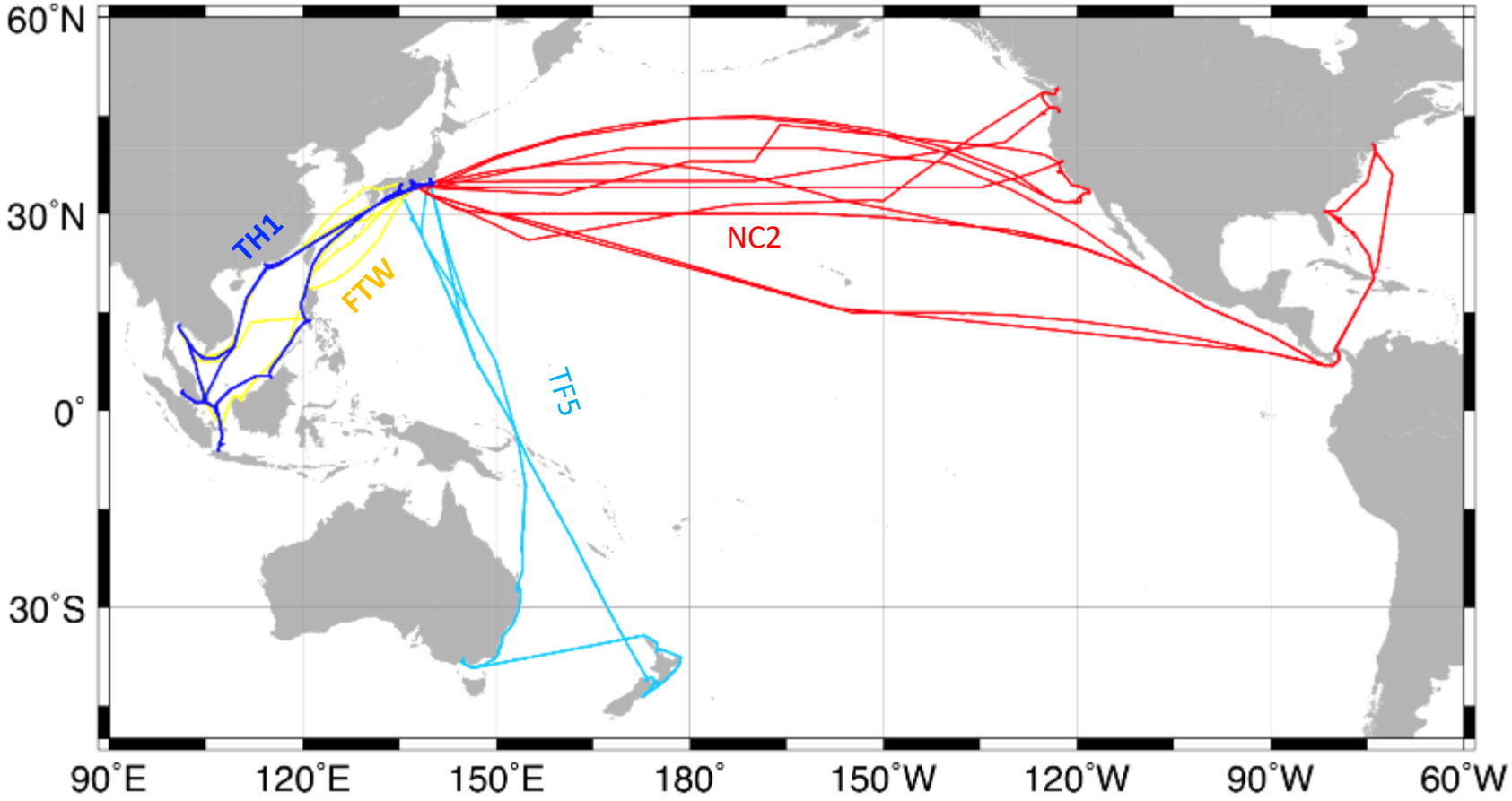
M/V New Century 2 (Car Carrier)
Japan – West/East Coast of the U.S.
4（west cst.）～8 weeks（east cst.）
Atms. GHG mes.： 2014/6 – present
Ocn. CO_2 mes.： 2014/4 – present

M/V Trans Future 5 (Multi-purpose Carrier)
Japan ― Oceania: 6 weeks
Atms. GHG mes.： 2005/11 – present
Ocn. CO_2 mes.： 2006/6 – present

M/V Trans Harmony 1 (Car Carrier)
Japan – Southeastern Asia : 4 weeks
Atms. GHG mes.： 2018/3 – 2019/5

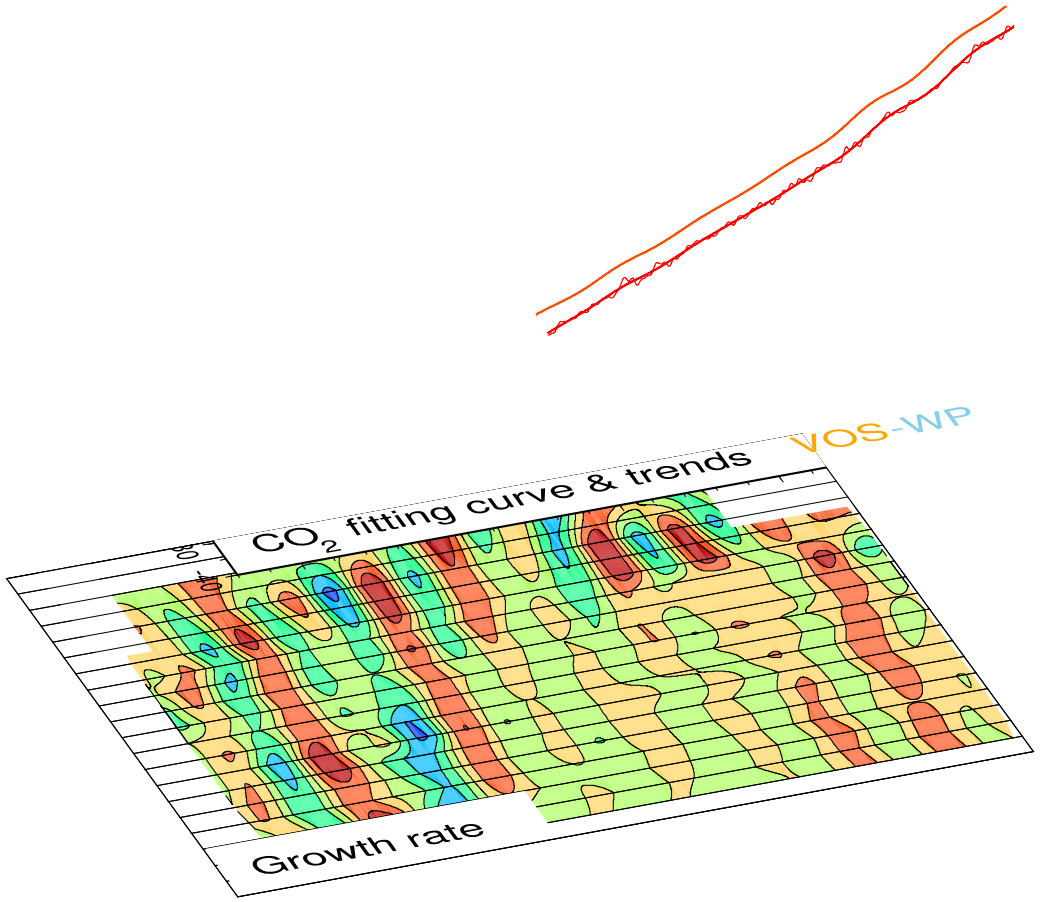
M/V Fujitrans World (Car Carrier)
Japan – Southeastern Asia : 4 weeks
Atms. GHG mes.： 2019/7 – present

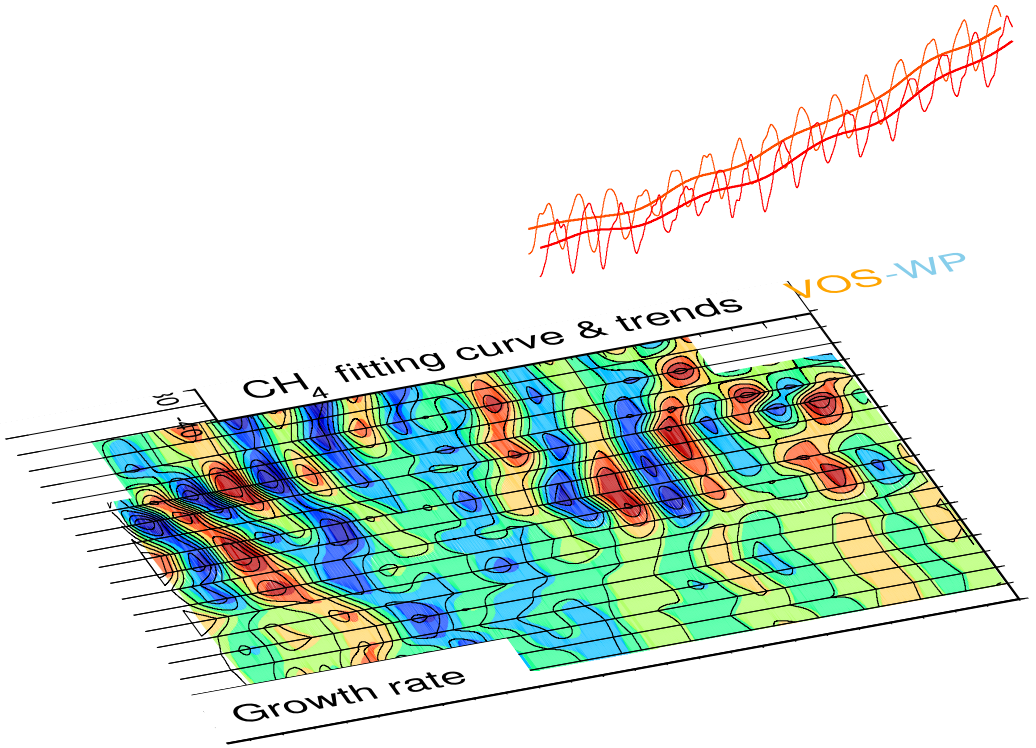
環境研によるVOS観測体制



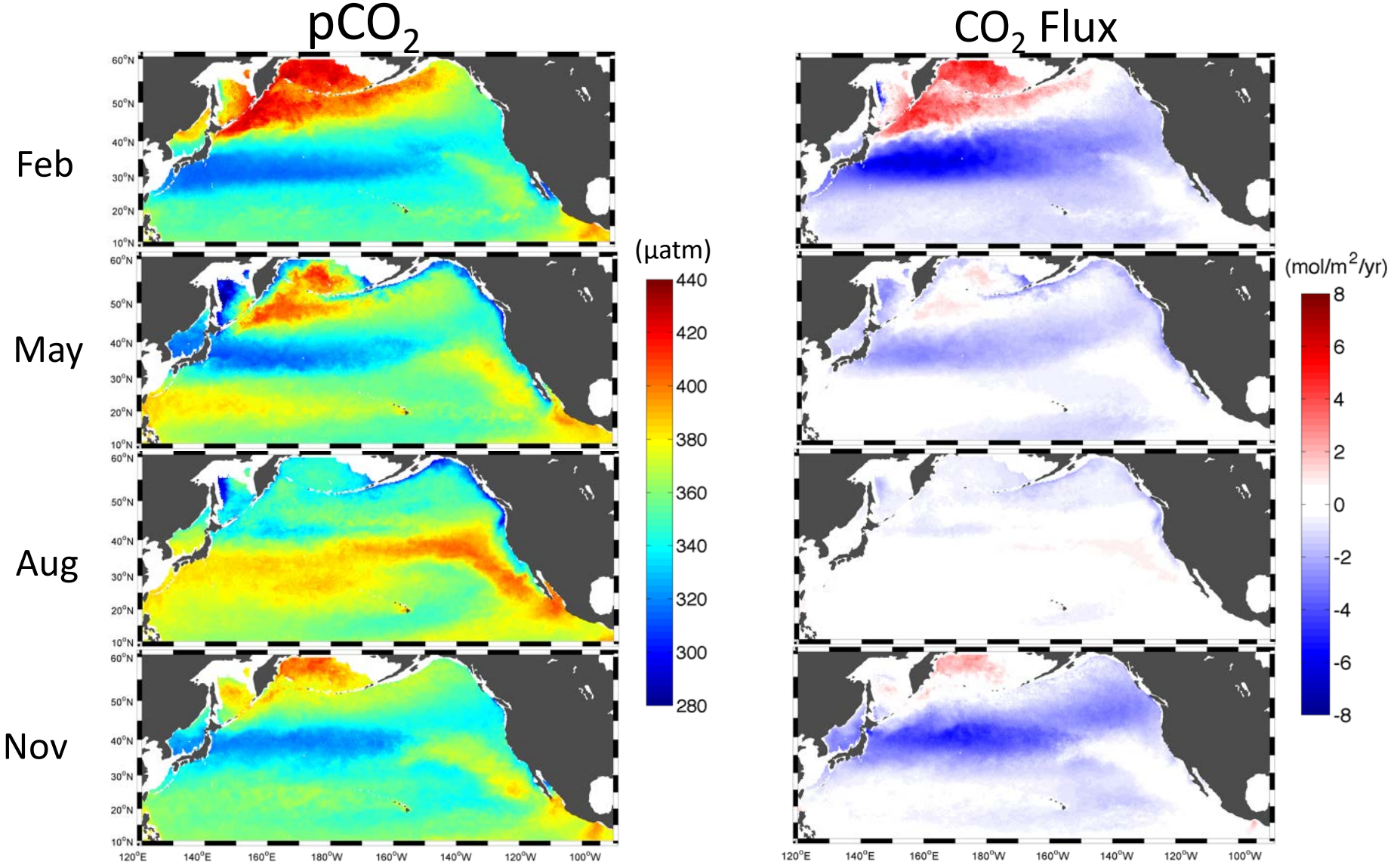
図：2019年の観測航路

オセアニア航路で観測された温室効果ガス濃度の緯度分布





pCO_2 and CO2 flux –averaged distribution-



Winter

- strong sink and source

→strong sink in total

Summer

- Weak sink and weak source

→weak CO_2 sink

North pacific was a sink ocean through a year

Providing data to SOCAT and GCP

- 2020 SOCAT database included NIES 756 cruse（about12% of total data）

Earth Syst. Sci. Data, 11, 1783–1838, 2019
https://doi.org/10.5194/essd-11-1783-2019

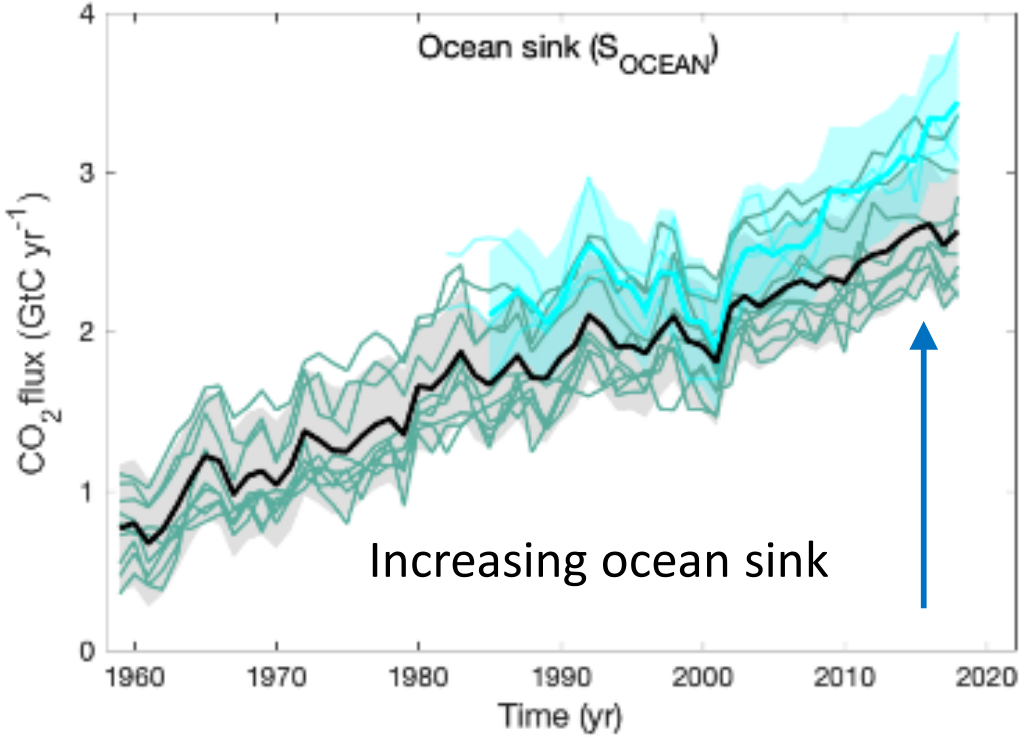
Open Access Earth System Science Data

Global Carbon Budget 2019

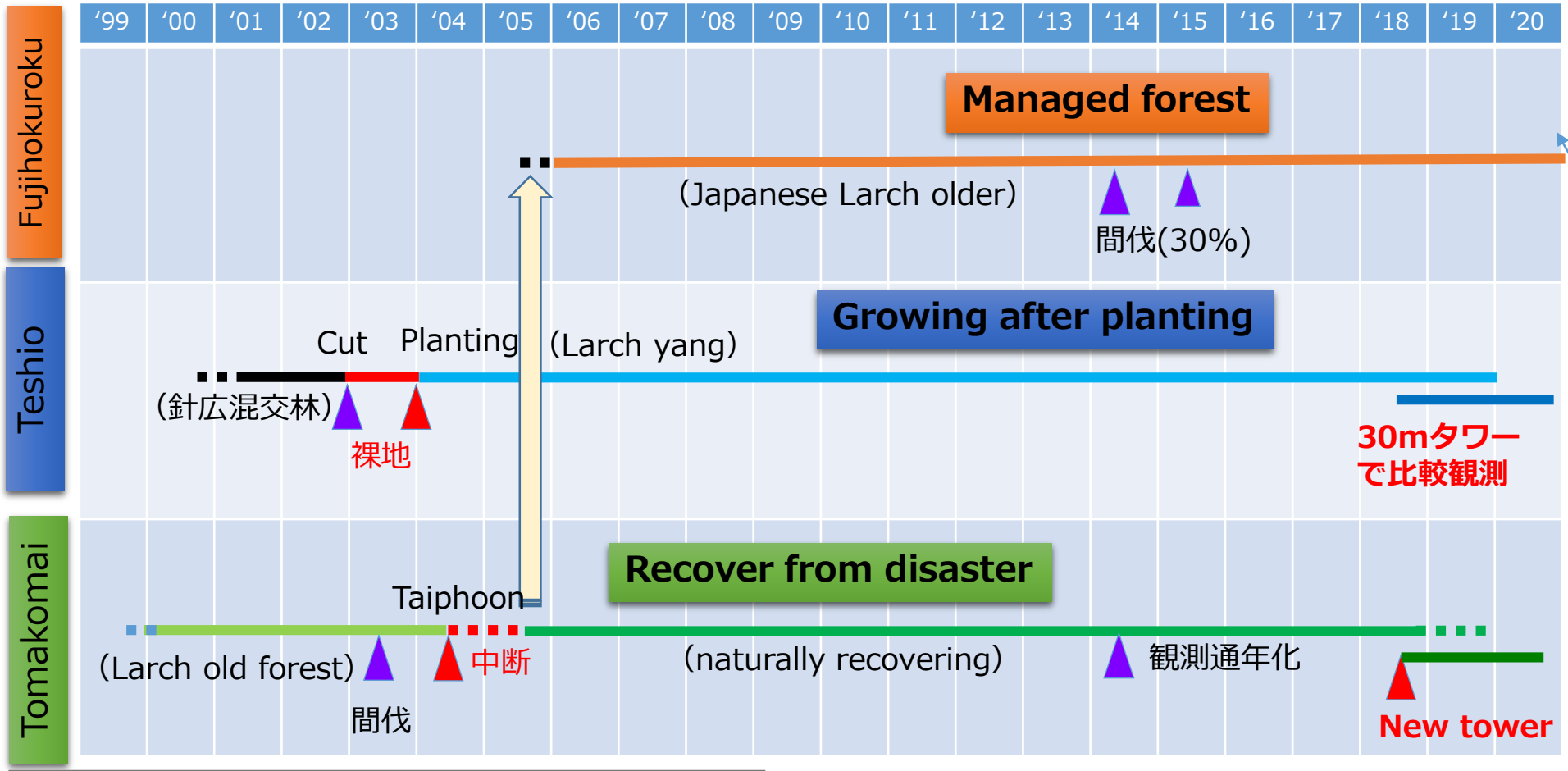
Pierre Friedlingstein[1,2], Matthew W. Jones[3], Michael O'Sullivan[1], Robbie M. Andrew[4], Judith Hauck[5], Glen P. Peters[4], Wouter Peters[6,7], Julia Pongratz[8,9], Stephen Sitch[10], Corinne Le Quéré[3], Dorothee C. E. Bakker[3], Josep G. Canadell[11], Philippe Ciais[12], Robert B. Jackson[13], Peter Anthoni[14], Leticia Barbero[15,16], Ana Bastos[8], Vladislav Bastrikov[12], Meike Becker[17,18], Laurent Bopp[2], Erik Buitenhuis[3], Naveen Chandra[19], Frédéric Chevallier[12], Louise P. Chini[20], Kim I. Currie[21], Richard A. Feely[22], Marion Gehlen[12], Dennis Gilfillan[23], Thanos Gkritzalis[24], Daniel S. Goll[25], Nicolas Gruber[26], Sören Gutekunst[27], Ian Harris[28], Vanessa Haverd[11], Richard A. Houghton[29], George Hurtt[20], Tatiana Ilyina[8], Atul K. Jain[30], Emilie Joetzjer[31], Jed O. Kaplan[32], Etsushi Kato[33], Kees Klein Goldewijk[34,35], Jan Ivar Korsbakken[4], Peter Landschützer[9], Siv K. Lauvset[36,18], Nathalie Lefèvre[37], Andrew Lenton[38,39], Sebastian Lienert[40], Danica Lombardozzi[41], Gregg Marland[23], Patrick C. McGuire[42], Joe R. Melton[43], Nicolas Metzl[27], David R. Munro[44], Julia E. M. S. Nabel[9], Shin-Ichiro Nakaoka[45], Craig Neill[46], Abdirahman M. Omar[36,18], Tsuneo Ono[46], Anna Peregon[12,47], Denis Pierrot[15,16], Benjamin Poulter[48], Gregor Rehder[49], Laure Resplandy[50], Eddy Robertson[51], Christian Rödenbeck[52], Roland Séférian[53], Jörg Schwinger[54,18], Naomi Smith[55,54], Pieter P. Tans[22], Hanqin Tian[56], Bronte Tilbrook[38,57], Francesco N. Tubiello[58], Guido R. van der Werf[59], Andrew J. Wiltshire[51], and Sönke Zaehle[52]

Friedlingstein et al. (2019)

Ocean CO2 flux

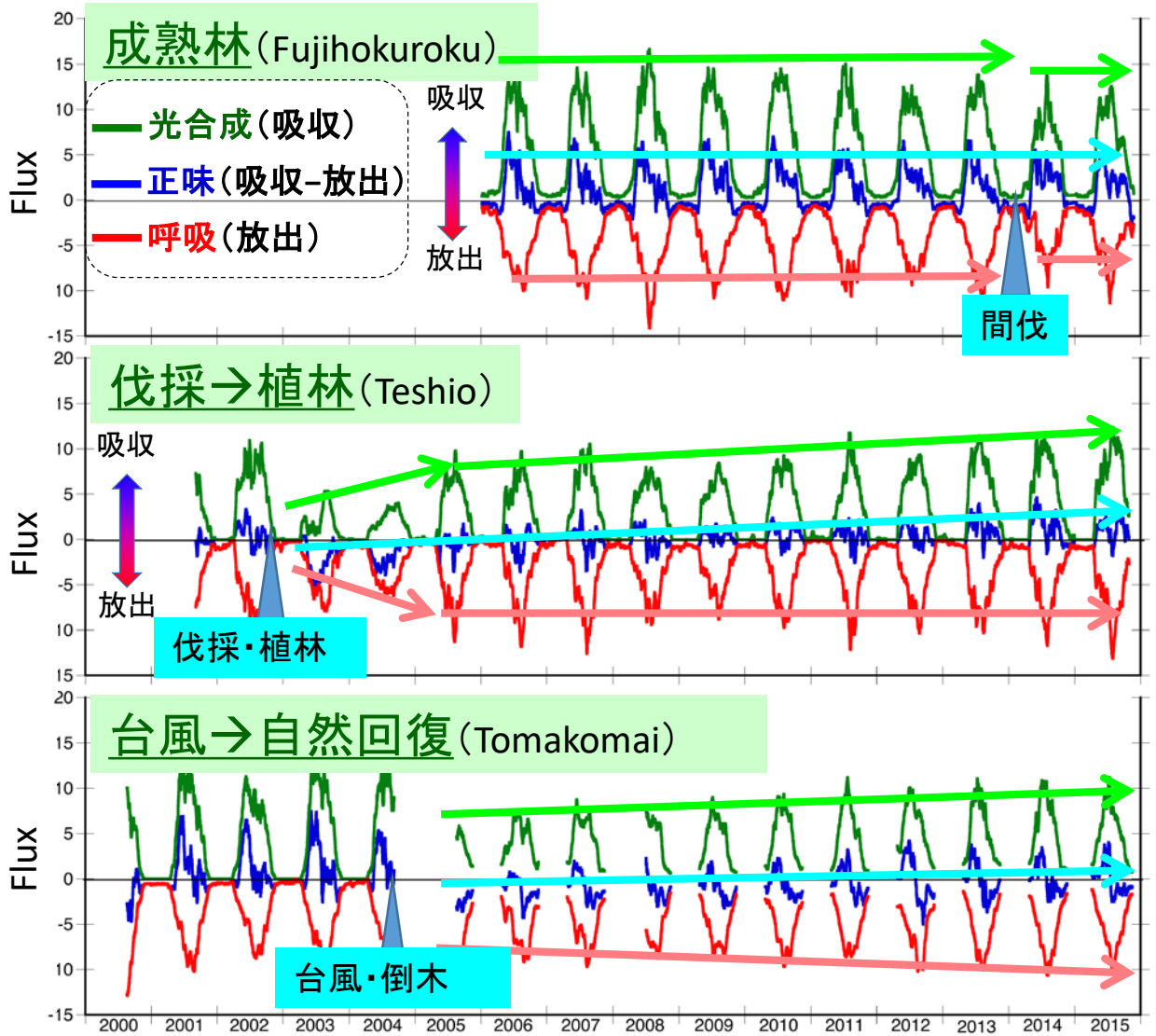


Forest CO2 flux monitoring



2000	苫小牧FRSで開始
2004	台風で本来の機能喪失
2006	富士北麓FOSを代替地として再構築
2018	**苫小牧に30mタワーを設置**

Long-term monitoring and comparison during 3 cases



Managed forest
Sink strength continued steadly

After planting, forest sink rapidly increased

Natural recovery case
Forest sink very slowly recovered

1) Long-term monitoring is necessary to detect slow natural processes
CGER/NIES have done monitoring about 30 years. We will continue.

2. Climate change will change carbon budget gradually with temperature
(i.e CO_2 sink strength by land biosphere and ocean may be decreased
at some point, so we would like to catch such points)

3) Anthropogenic CO_2 emission was reduced by COVID19 a little bit,
but still we have reduce more (i.e about 93% left of present emission)
we have to trace CO_2 concentration pathway until stabilized