

Multi-species observations from Japanese passenger aircrafts towards the monitoring of the nations' climate mitigation progress

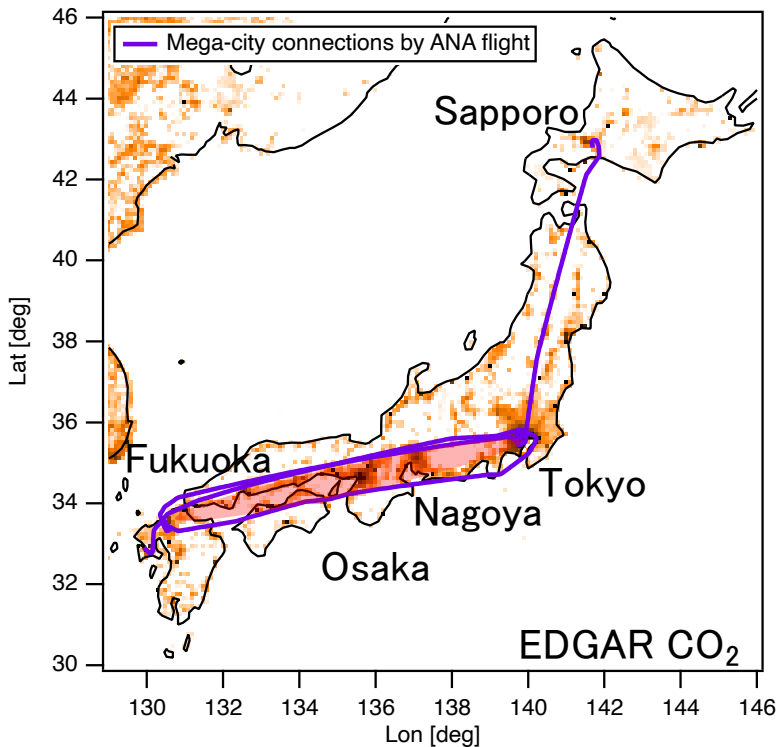
H. Suto, A. Kuze, S. Kosaki, C. Hoshino, K. Shiomi (JAXA)
A. Matsumoto, Y. Tsubakihara (ANA HD) F. Kataoka, T. Kaku (RETEC), J. Yoshida, Y. Nakamura (NEC)
S. Mori (JASTECS), T. Oda (USRA)

Monitoring from cabin

Instrument modules

NO₂
CO₂
SIF in July

Suto et al, in preparation



- Cities are responsible for more than **70 %** of the global total GHG emissions.
- **30 %** of the Japan's total CO₂ emissions are emitted between Tokyo and Fukuoka area (**shaded in red**).
- Towards the net zero goal, the sectoral emissions and their relative magnitude are expected to change drastically over the next decade.

Our objectives:

- Monitoring Japan's subnational ~ local climate mitigation efforts (e.g. emission reduction and sink enlargement) using high-resolution GHG and AQ measurements.
- Providing an independent assessment to emission estimates reported by inventories.

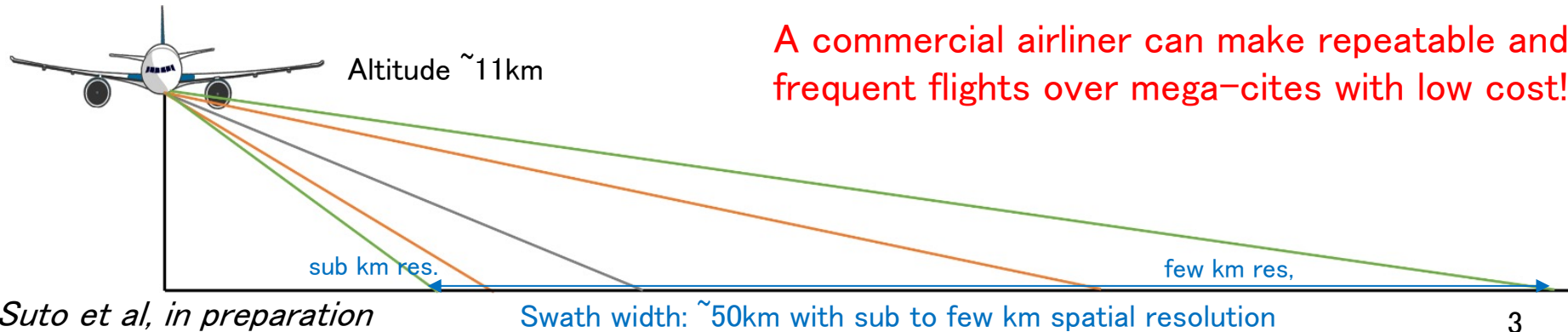
ANA Remote sensing from a commercial airliner

Our concepts:

- NO hardware modification for aircraft*
- Hand-carried instruments on cabin seats
- Observing through cabin window
- Small power consumption with mobile battery operation
- 3 modules: 450nm, 740nm and 1.6 μ m bands for NO₂, SIF and CO₂ with fiber coupling.

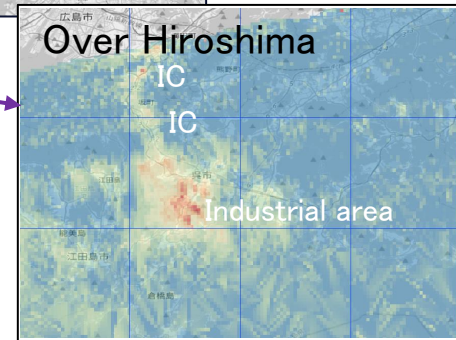
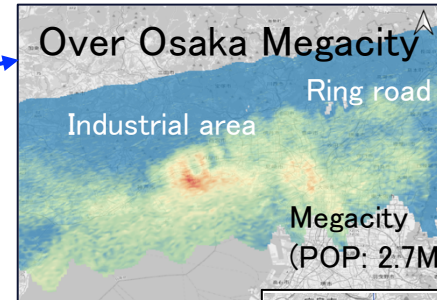
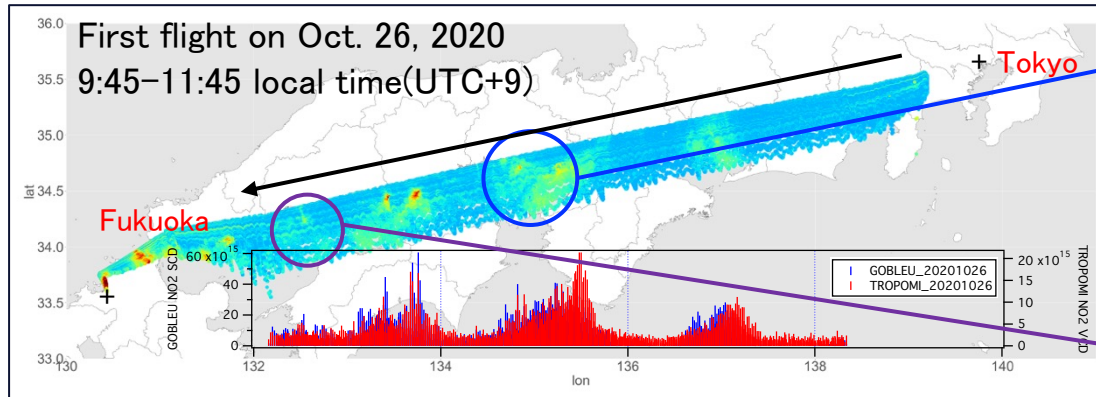


*Limitation of size and weight, the capacity of battery, electrical magnetic conduction from instruments have to be passed the certifications.



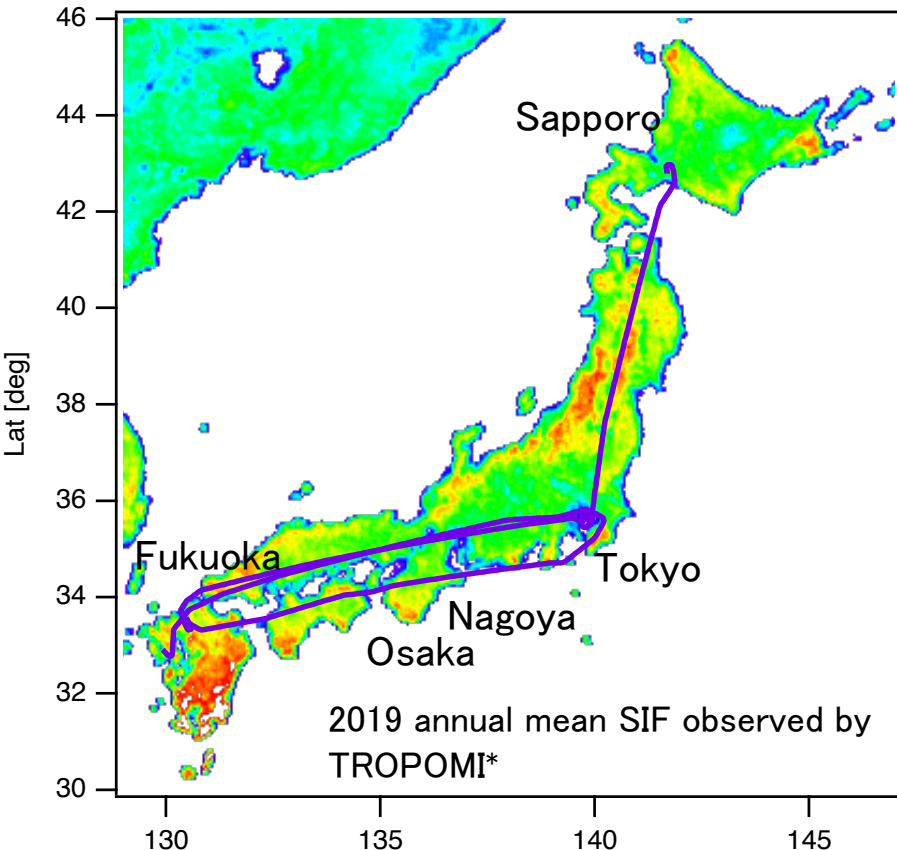
A commercial airliner can make repeatable and frequent flights over mega-cities with low cost!.

The first high resolution NO₂ observations from GOBLUE (GB)



Comparing longitude dependence with TROPOMI observation gird

- During 2 hours, 2 spectral images/sec were acquired with flight attitude information with sub km resolution.
- High NO₂ were observed over emission hot spots (cities, point sources, and traffic)
- Large NO₂ spatial patterns from GB and TROPOMI are in good agreement, while GB showed some local peaks.



*data from
<https://climatesciences.jpl.nasa.gov/sif/>



- Instrumental packages are upgraded.
- Ready for flight both NO₂, SIF and CO₂.
- Expect to start regular observations (more than once per month), after the current COVID-19 restrictions are lifted.
- Plan to observe SIF over forested areas with an additional flight route to Sapporo this summer.