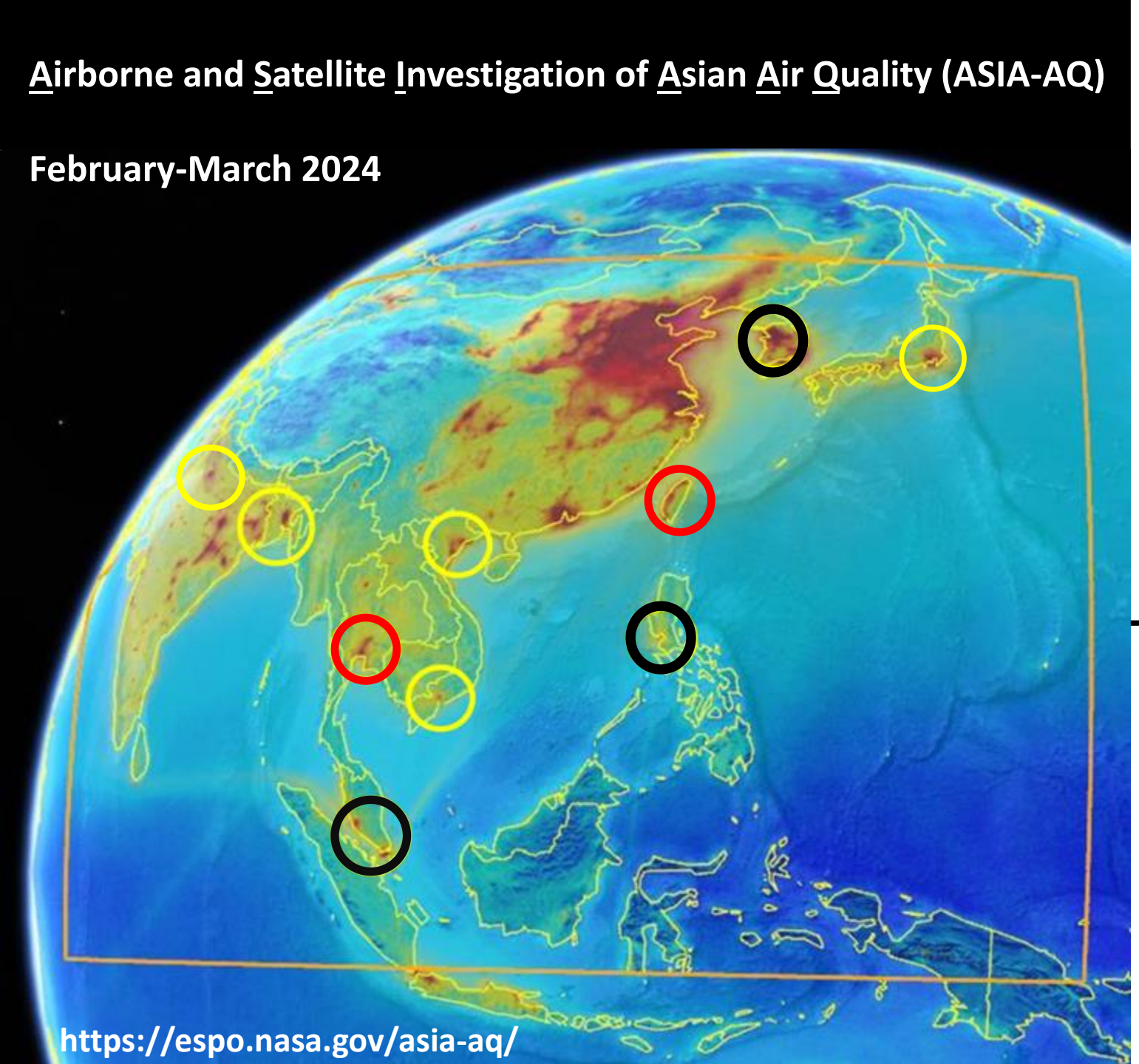
Airborne and Satellite Investigation of Asian Air Quality (ASIA-AQ)

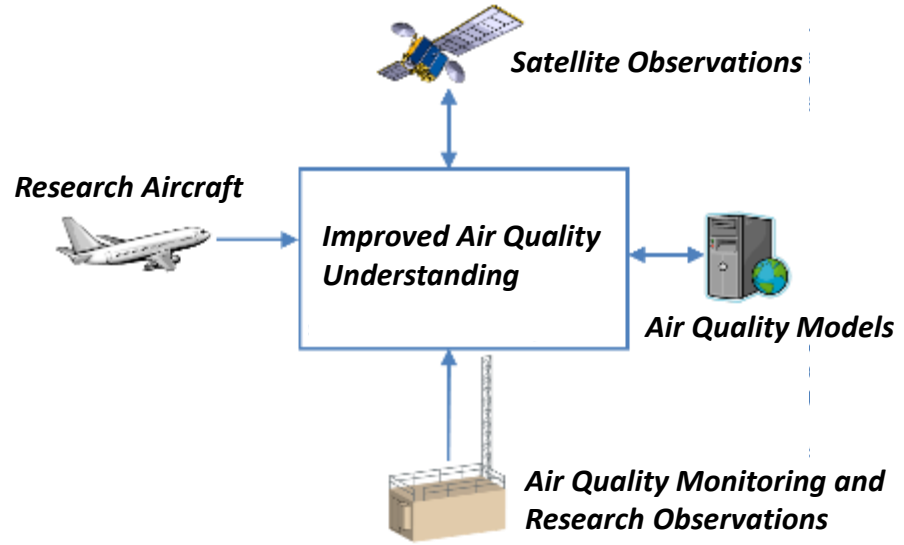
February-March 2024



Purpose: Improve understanding of the factors controlling local air quality across Asia through multi-perspective observations and modeling

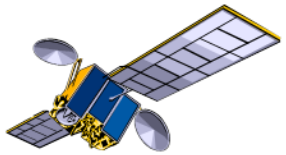
Approach: Conduct airborne sampling in the Philippines, South Korea, and Malaysia (with possibility of Thailand and overflight of Taiwan) in collaboration with local scientists, air quality agencies, and other government partners.

Philosophy: Openly share data during all phases, conduct joint analysis with local scientists and air quality agencies, and report findings to local governments



An integrated observing strategy is needed to bridge between satellite and ground measurements and to improve air quality models.

NASA GIII for remote sensing of air quality

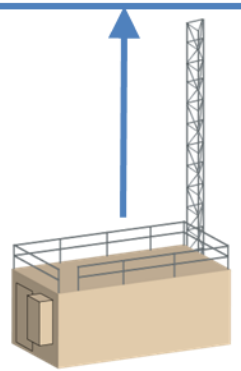


GEMS, TROPOMI, MAIA, GOSAT-GW
VIIRS, IASI, CrIS, etc.

NASA DC-8 for detailed in situ profiling of air quality above the surface

- Satellite validation and detailed mapping of air quality
- Emissions evaluation and model improvement
- Improved understanding through process studies

Operational and Research-Grade Air Quality Forecasts from Regional and Global models



Local air quality monitoring networks, research sites, Pandora Asia Network, AERONET, etc.

NASA DC-8 instrument payload

- The DC-8 will host 26 instruments and provide comprehensive observations of atmospheric composition for both gaseous and fine particle pollution.
- Investigators come from the United States, South Korea, Norway, Japan, and Germany.
- The DC-8 flies for eight hours and flight paths will be designed to enable sampling of pollution gradients between the metropolitan area and surrounding regions three times per day.
- Vertical profiling of the lower atmosphere (surface to 15,000 feet) will also be important to characterize the lower atmospheric distribution of gaseous and aerosol pollutants.

NASA GIII instrument payload

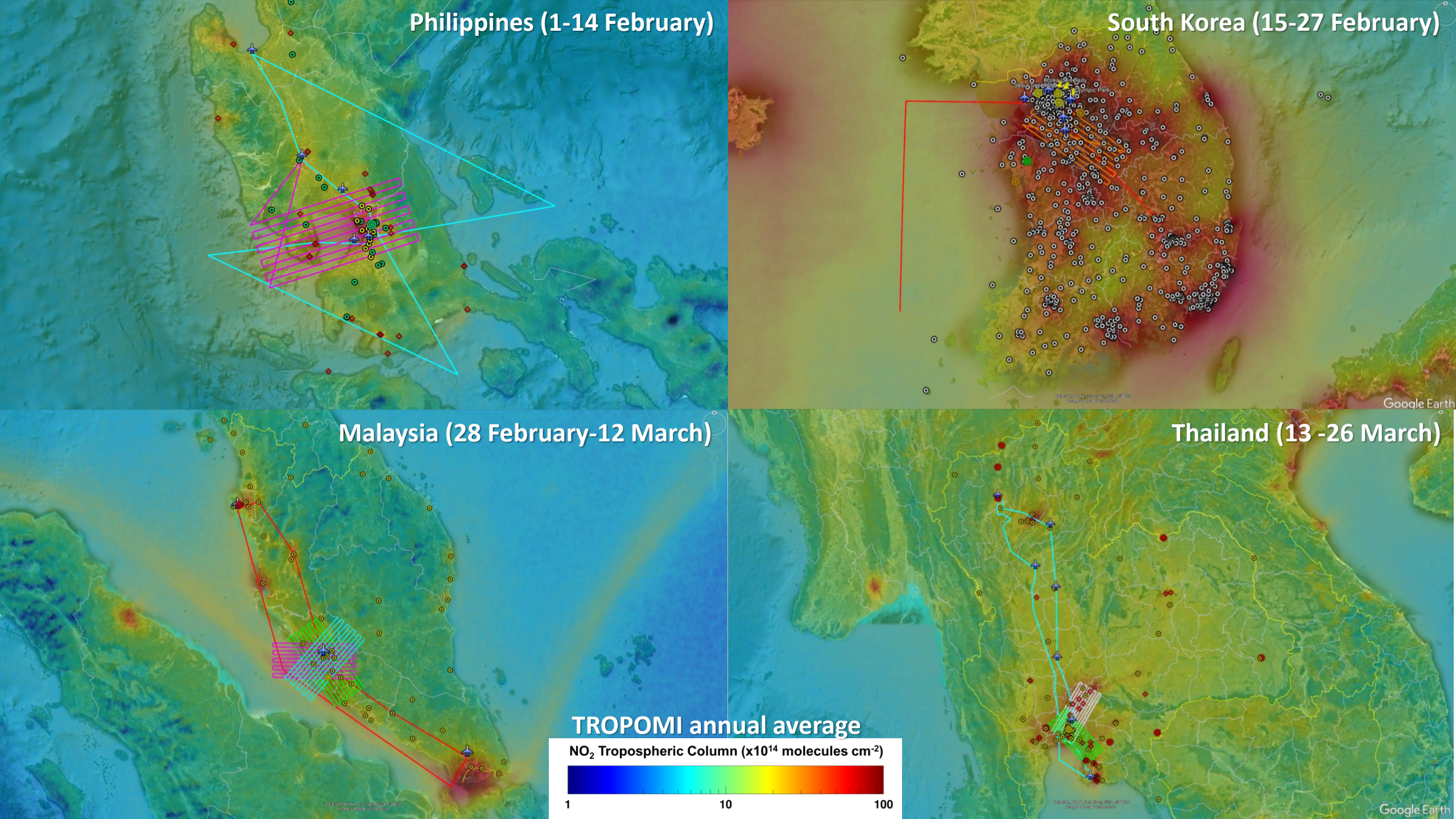
Flying at 28,000 ft, the GIII can map an area of 135 x 50 km three times each flight day, requiring two sorties, with the following payload.

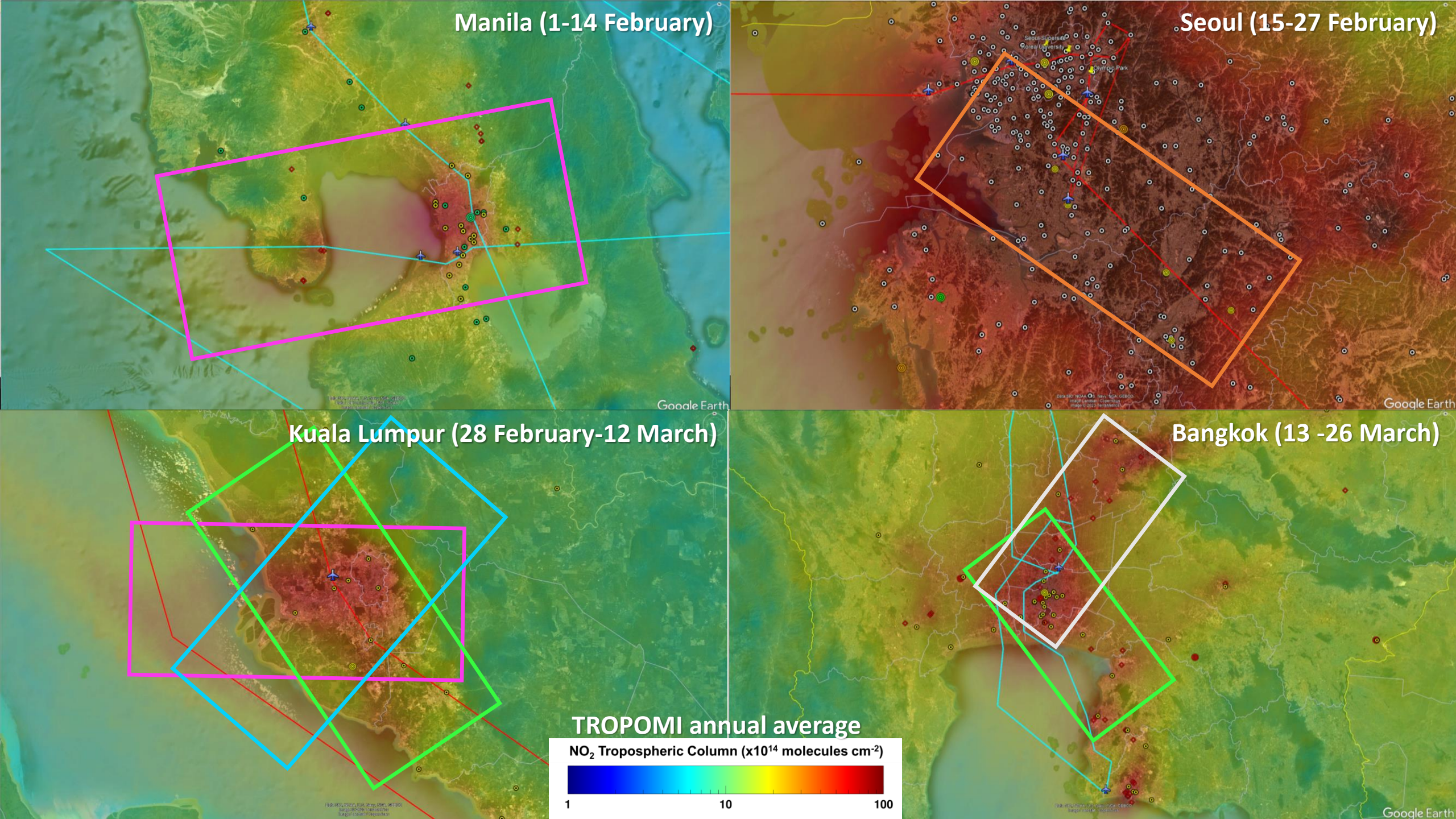
GEO-CAPE Airborne Simulator (GCAS)

- **2D distribution of NO_2 and HCHO at 250x550m resolution.**
- **Insight on NOx and VOC precursor emissions.**

High Spectral Resolution Lidar/Differential Absorption Lidar (HSRL/DIAL)

- **3D distribution of aerosols (HSRL) and ozone (DIAL).**
- **Insight on air quality outcomes and exposure.**
- **PBL evolution and behavior**


Philippines (1-14 February)
South Korea (15-27 February)
Malaysia (28 February-12 March)
Thailand (13 -26 March)
TROPOMI annual average
NO2 Tropospheric Column (x10^14 molecules cm^-2)
1
10
100
Google Earth
Google Earth


Manila (1-14 February)
Seoul (15-27 February)
Kuala Lumpur (28 February-12 March)
Bangkok (13 -26 March)
TROPOMI annual average
NO2 Tropospheric Column (x10^14 molecules cm^-2)
1
10
100
Google Earth

Deployment Plan and Sampling Philosophy

- **Deploy to Asia for 8 weeks (1 February-30 March)**
- **Spend at least two weeks and sample for a minimum of four flight days in each partner country (assuming four countries visited).**
- **Sample over Taiwan during transits from Korea and the Philippines.**
- **Negotiate a single flight plan for each aircraft in each country to be repeated under different meteorological conditions resulting in a range of air quality outcomes.**
- **Use GIII for dedicated sampling of megacity/metropolitan area**
- **Use DC-8 to sample the broader region with frequent return to the megacity/metropolitan area.**

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ASIA-AQ

NIER • DENR • UKM • GISTDA • MOENV • NASA