

This supplement includes one slide introducing TROPOMI tropospheric NO<sub>2</sub> product and 6 figures listed below.

Slide 1. Introduction of KNMI & NASA TROPOMI NO<sub>2</sub> Trop. VCDs product

Figure S1. Figure S1. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019 and differences between 2020 and 2019 or 2021 and 2019, (Right) NASA data. The data with quality assurance > 0.50 and cloud radiance fraction < 0.4 are selected for analysis.

Figure S2. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019, 2020 and 2021, (Right) NASA data. The data with quality assurance > 0.50 and cloud radiance fraction < 0.4 are selected for analysis. ERA-5 wind vectors at 700 hPa are overlaid.

Figure S3. The number of days with available satellite data after filtering: (Left) KNMI tropospheric NO<sub>2</sub> columns, (Right) NASA data. The data with quality assurance > 0.50 and cloud radiance fraction < 0.4 are selected for analysis.

Figure S4. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019 and differences between 2020 and 2019 or 2021 and 2019, (Right) NASA data. The data with quality assurance > 0.75 and cloud radiance fraction < 0.5 are selected for analysis.

Figure S5. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019, 2020 and 2021, (Right) NASA data. The data with quality assurance > 0.75 and cloud radiance fraction < 0.5 are selected for analysis. ERA-5 wind vectors at 700 hPa are overlaid.

Figure S6. The number of days with available satellite data after filtering: (Left) KNMI tropospheric NO<sub>2</sub> columns, (Right) NASA data. The data with quality assurance > 0.75 and cloud radiance fraction < 0.5 are selected for analysis.

# Introduction of KNMI & NASA TROPOMI NO<sub>2</sub> Trop. VCDs product

## 1. KNMI product

- Retrieval process (README file of TROPOMI L2 data)

Base algorithm: QA4ECV (Boersma et al., 2018, AMT, <https://doi.org/10.5194/amt-11-6651-2018> ) (until Dec. 2020)

**+ an overall reduction of the observed cloud pressures, resulting in a decrease of AMFs and a substantial increase of NO<sub>2</sub> in the retrievals in polluted regions** (since Jan. 2021)

- Change in horizontal resolution

7.0 km x 3.5km to 5.5 km x 3.5 km at NADIR (since August 06, 2019)

## 2. NASA MINDS product (introduced in Nov. 2022)

- Retrieval process (Lamsal et al., README file of MINDS TROP. NO<sub>2</sub> TROPOMI)

Base algorithm: NASA Standard Product version 4.0 (Lamsal et al., 2021, AMT, <https://doi.org/10.5194/amt-14-455-2021> )

**+ created high resolution (0.25° latitude x 0.25° longitude) a priori NO<sub>2</sub> profiles and other auxiliary information from a global GMI-Replay simulation with satellite simulator [TROPOMI NO<sub>2</sub> SCD data operational ESA/KNMI product, version 2.3.1] (Lamsal et al., 2022, 10.5067/MEASURES/MINDS/DATA203)**

- Consistent horizontal resolution (2018.05 – 2021.12)

5.5 km x 3.5 km at NADIR

# Absolute Values

## KNMI product w/ original filter

## NASA product w/ original filter

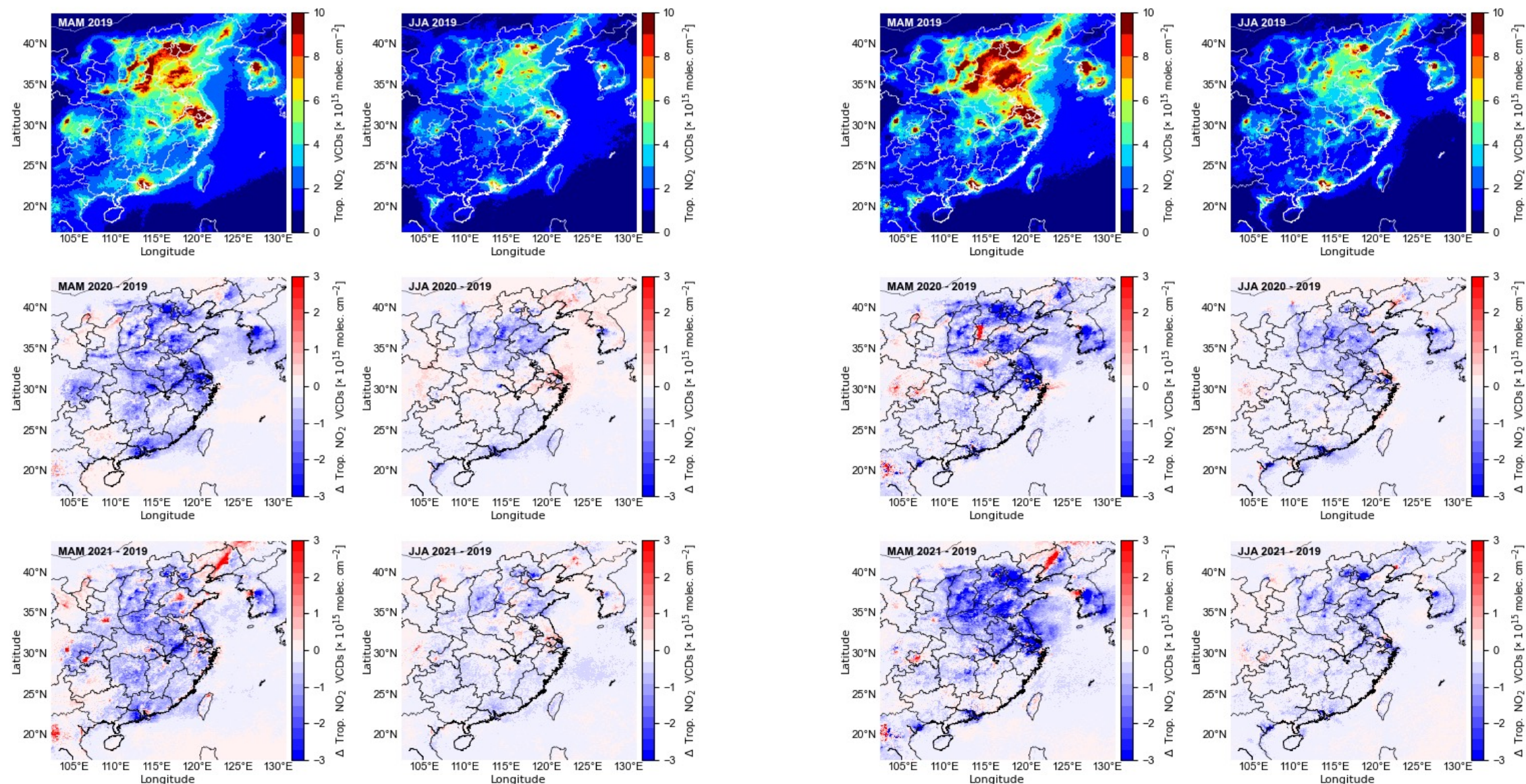


Figure S1. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019 and differences between 2020 and 2019 or 2021 and 2019, (Right) NASA data. The data with quality assurance > 0.50 and cloud radiance fraction < 0.4 are selected for analysis.



# Absolute Values

## KNMI product w/ original filter

## NASA product w/ original filter

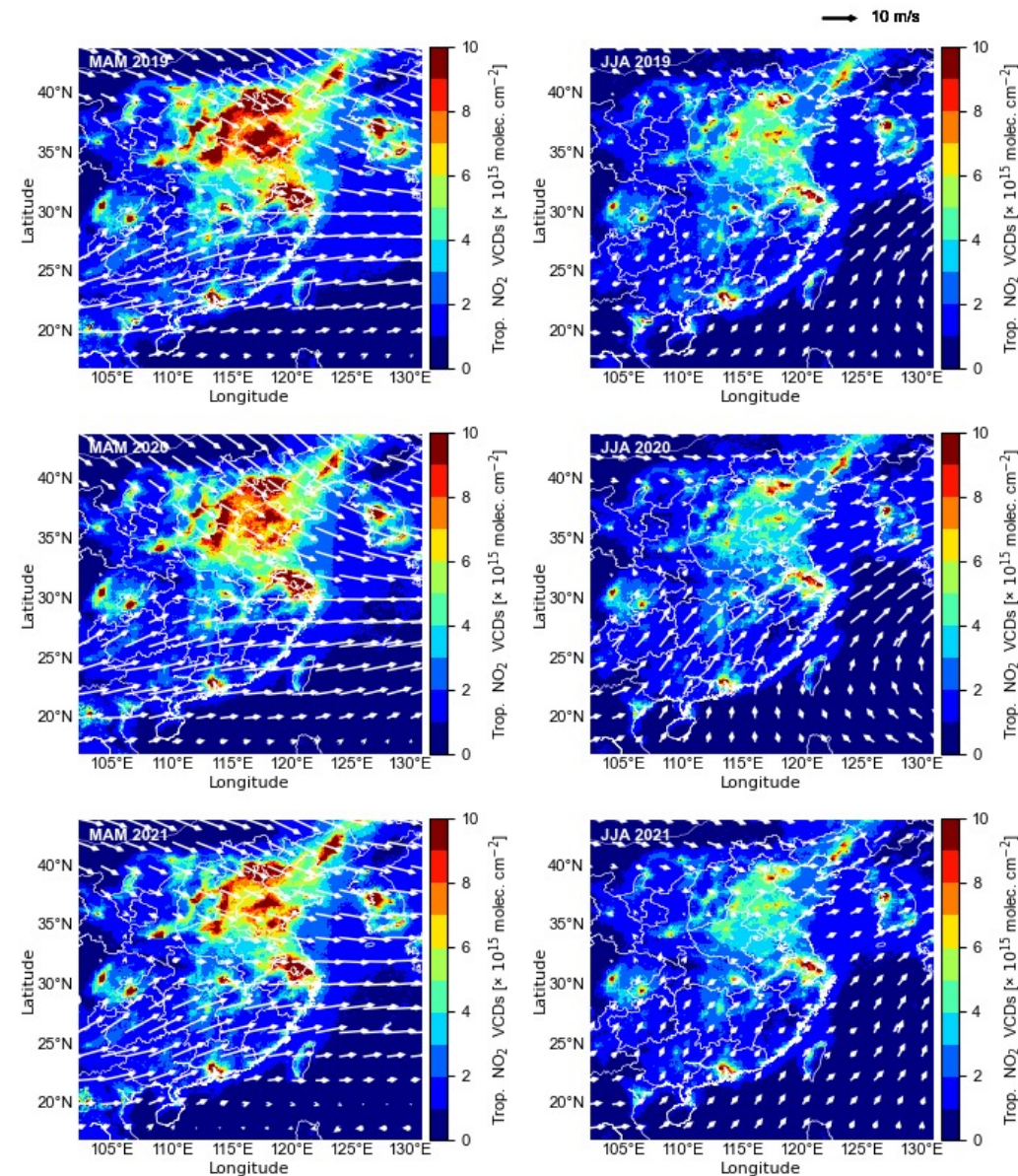
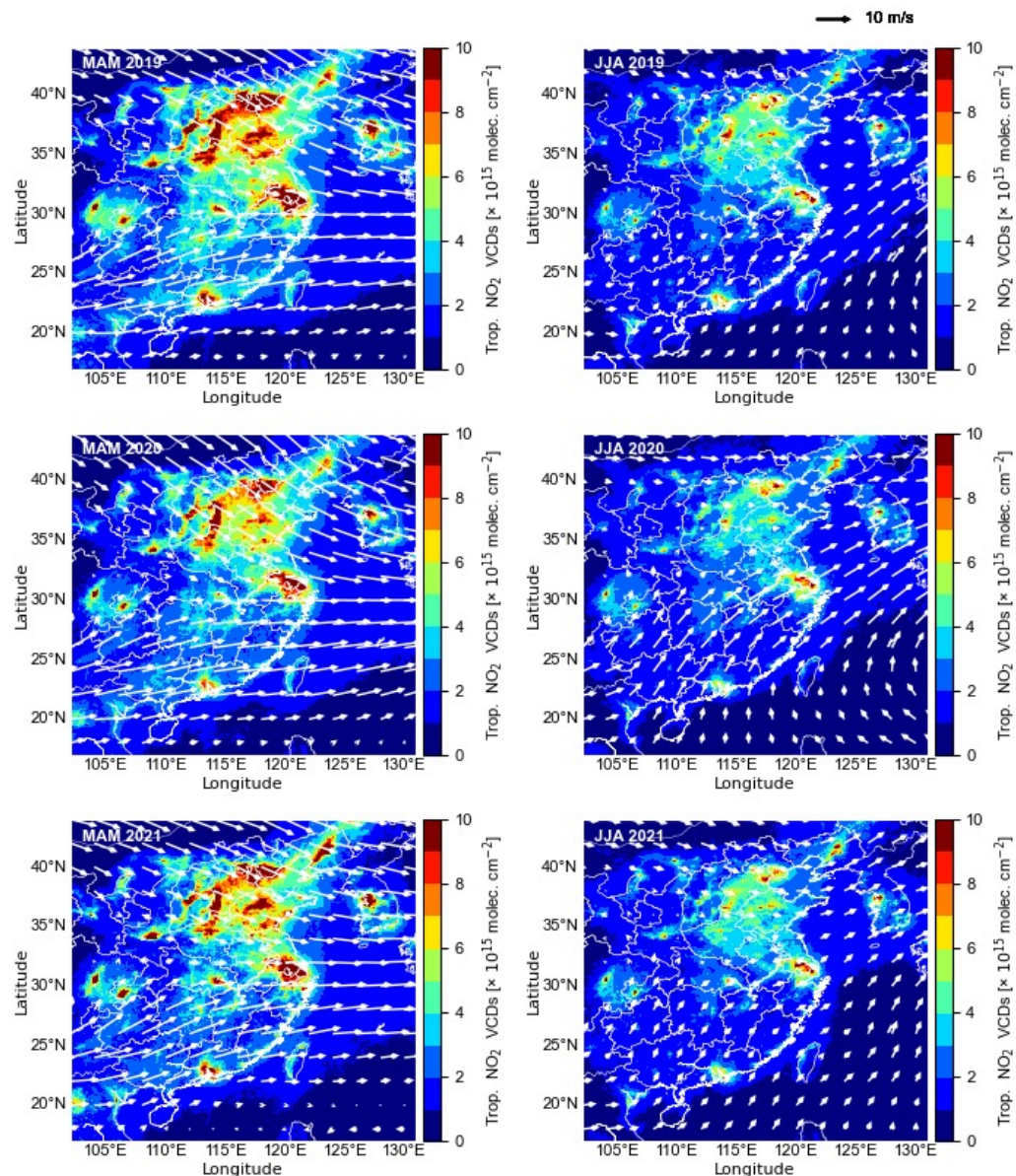


Figure S2. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019, 2020 and 2021, (Right) NASA data. The data with quality assurance > 0.50 and cloud radiance fraction < 0.4 are selected for analysis. ERA-5 wind vectors at 700 hPa are overlaid.



Days available from  
daily product KNMI product w/ original filter

NASA product w/ original filter

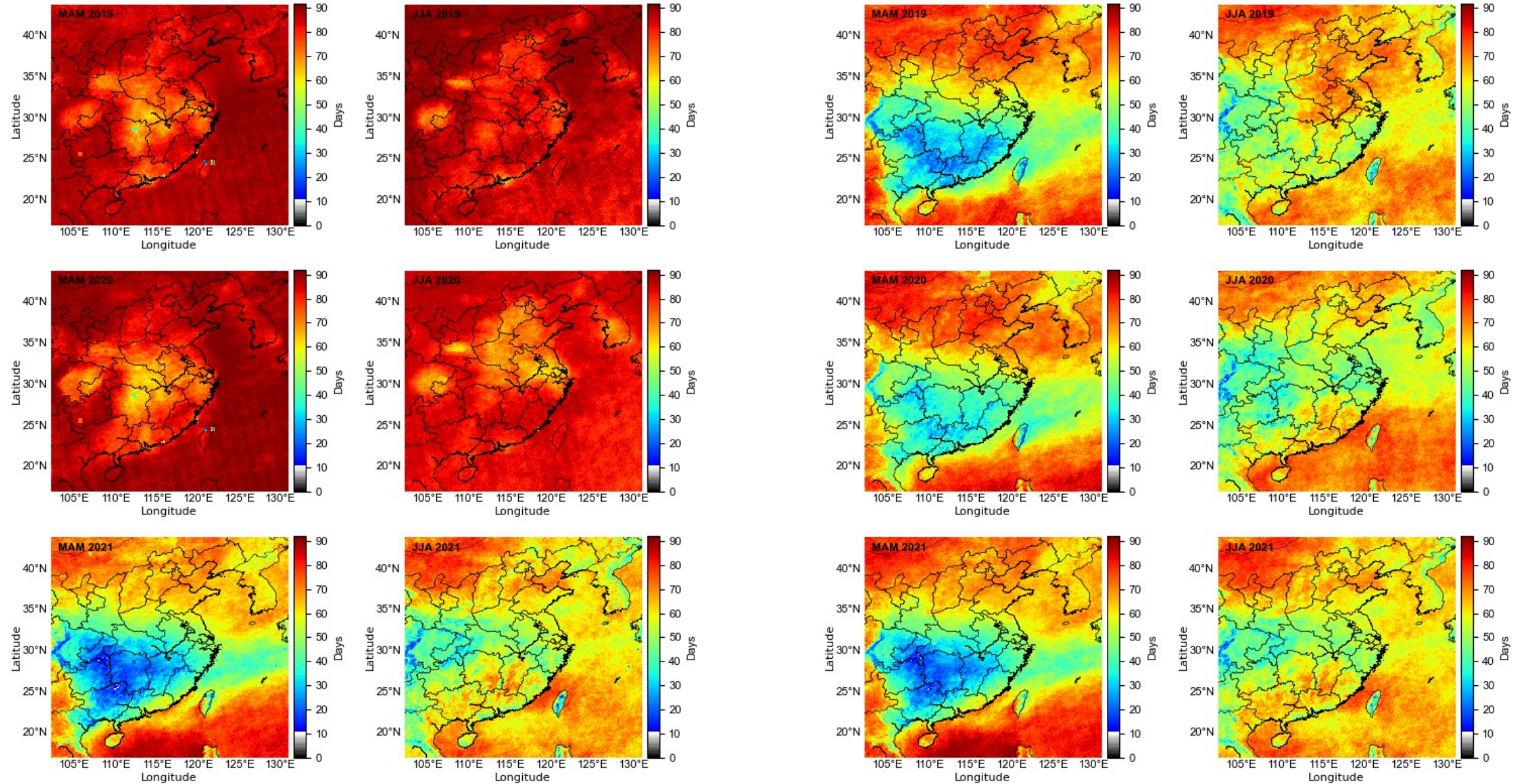


Figure S3. The number of days with available satellite data after filtering: (Left) KNMI tropospheric NO<sub>2</sub> columns, (Right) NASA data. The data with quality assurance > 0.50 and cloud radiance fraction < 0.4 are selected for analysis.



# Absolute Values

## KNMI product w/ new filter

## NASA product w/ new filter

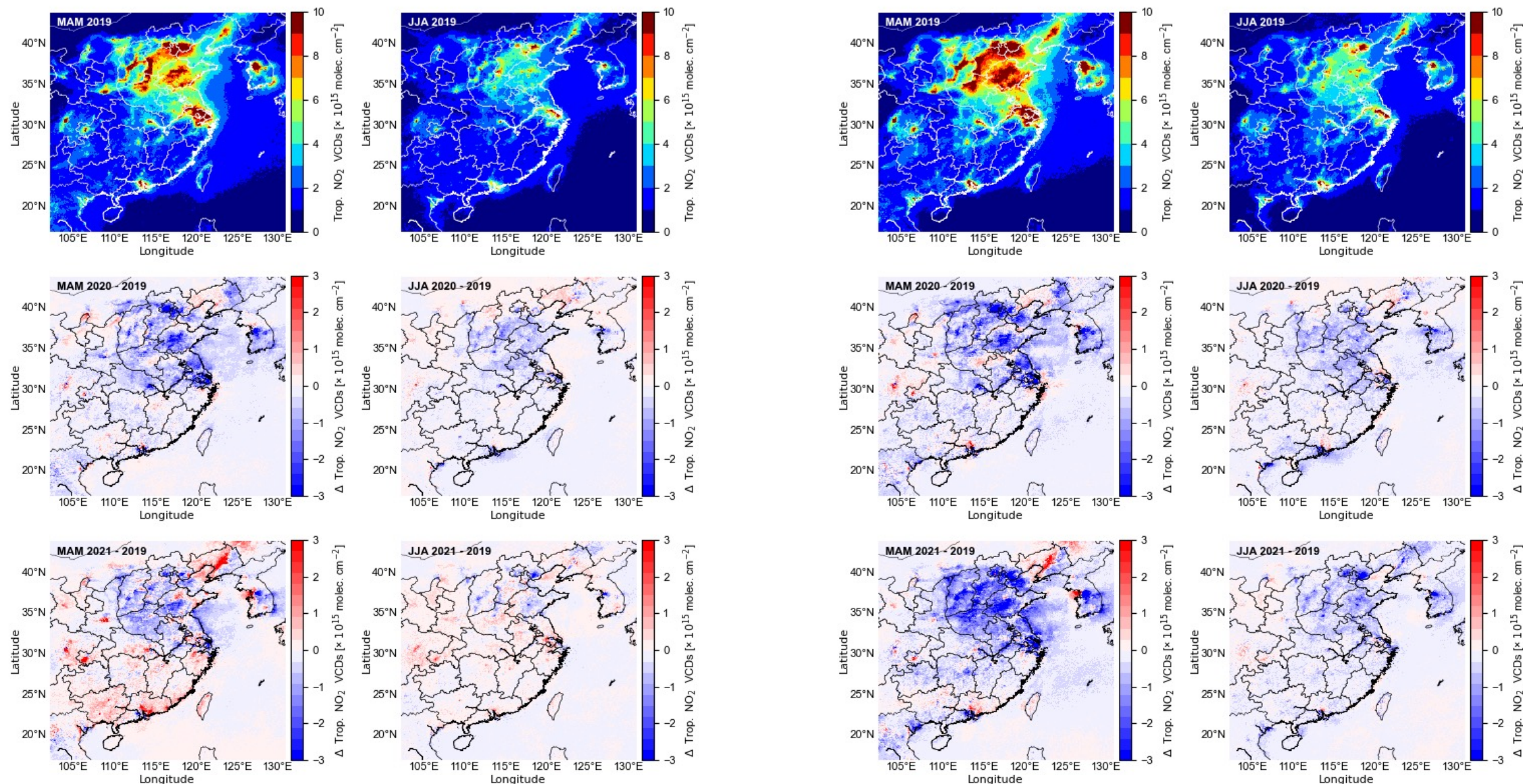


Figure S4. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019 and differences between 2020 and 2019 or 2021 and 2019, (Right) NASA data. The data with quality assurance > 0.75 and cloud radiance fraction < 0.5 are selected for analysis.



# Absolute Values

## KNMI product w/ new filter

## NASA product w/ new filter

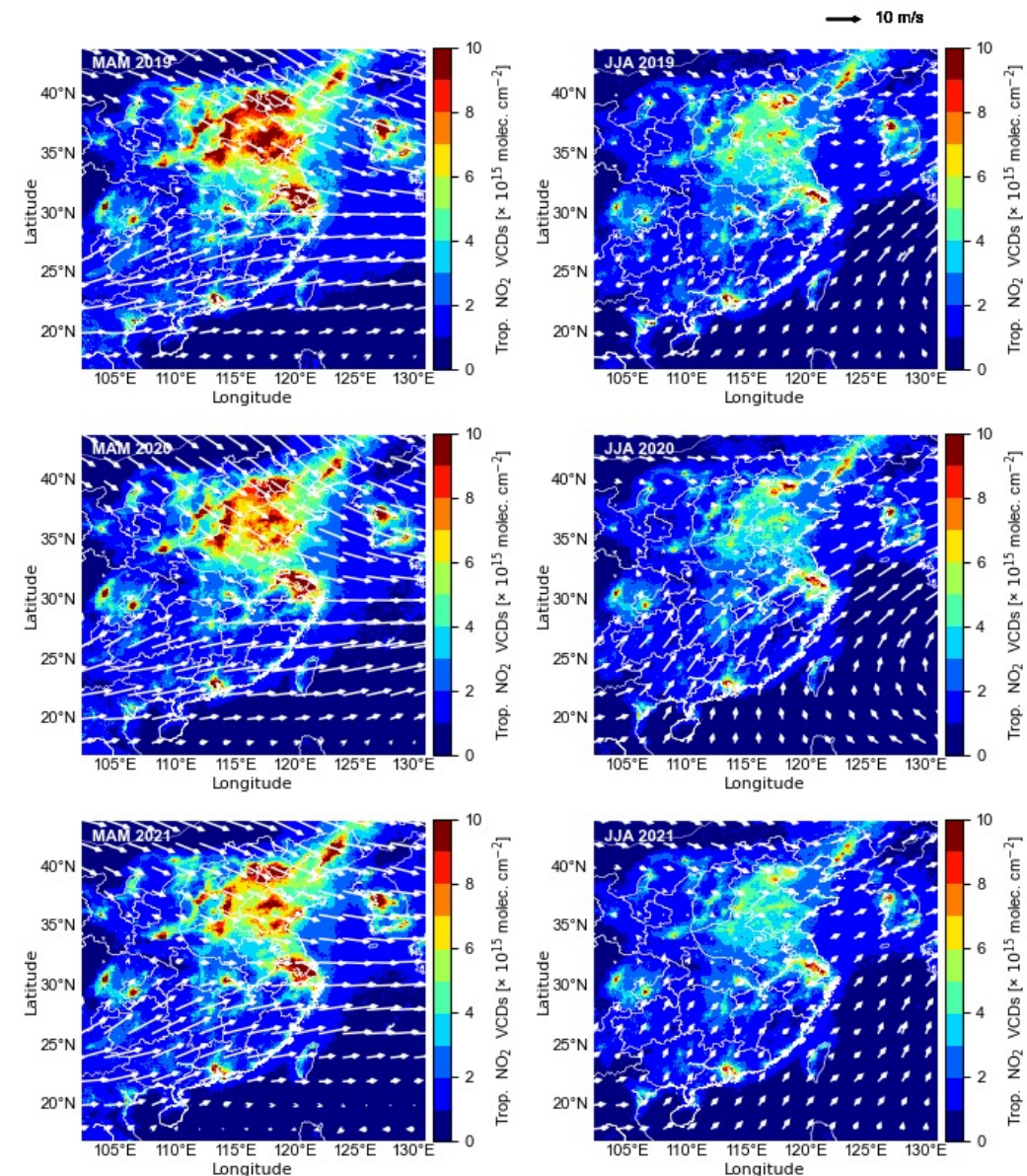
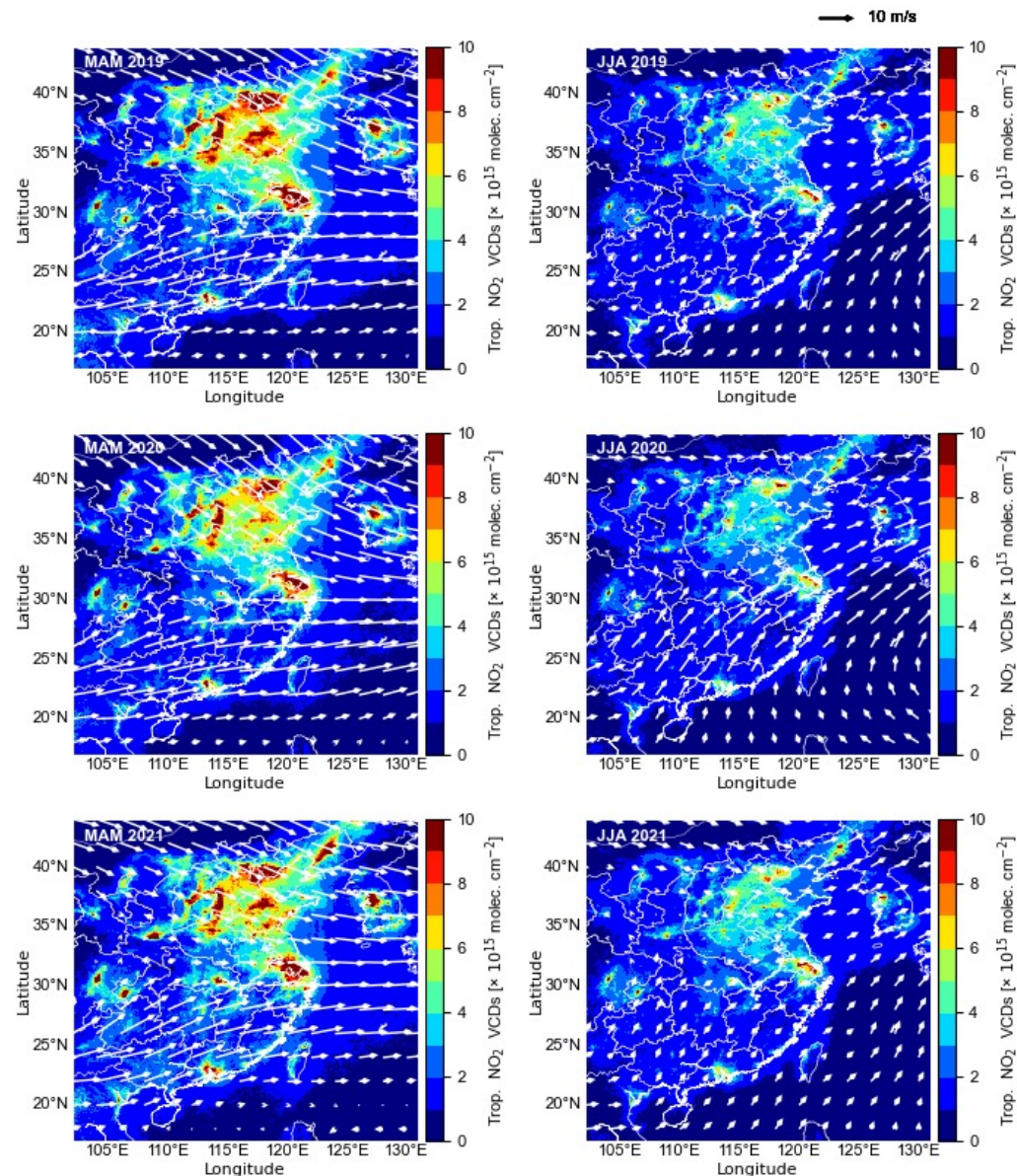


Figure S5. (Left) KNMI tropospheric NO<sub>2</sub> columns in 2019, 2020 and 2021, (Right) NASA data. The data with quality assurance > 0.75 and cloud radiance fraction < 0.5 are selected for analysis. ERA-5 wind vectors at 700 hPa are overlaid.



Days available from  
daily product      KNMI product w/ new filter

NASA product w/ new filter

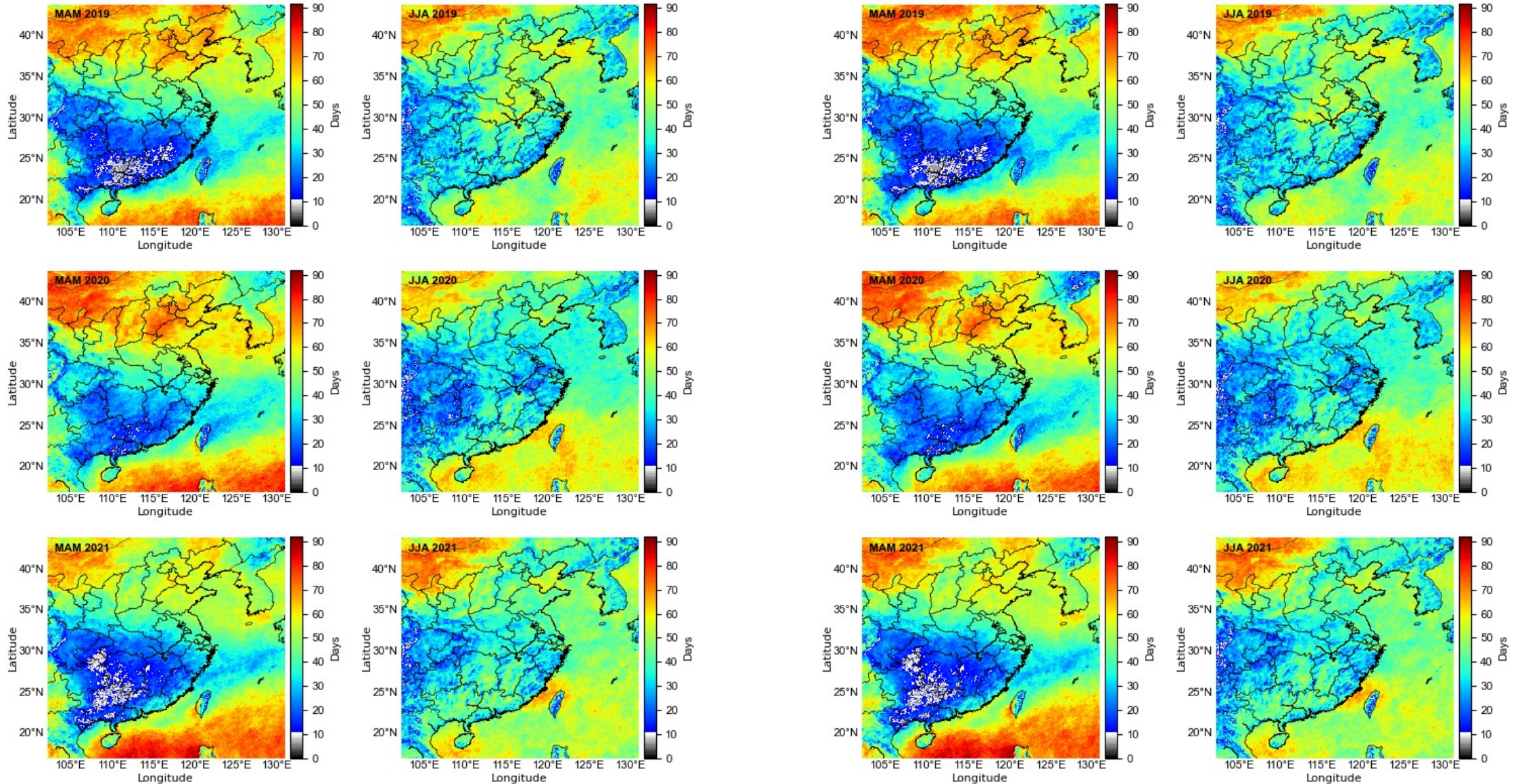


Figure S6. The number of days with available satellite data after filtering: (Left) KNMI tropospheric NO<sub>2</sub> columns, (Right) NASA data. The data with quality assurance > 0.75 and cloud radiance fraction < 0.5 are selected for analysis.