

SPACEKNOW

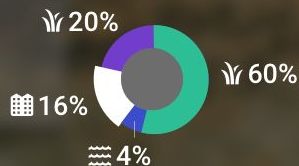
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⋯ This year ☐
⋯ Last year ☐

✈️ 31 ↑(+20%)



⚓ 66 ↓(-31%)



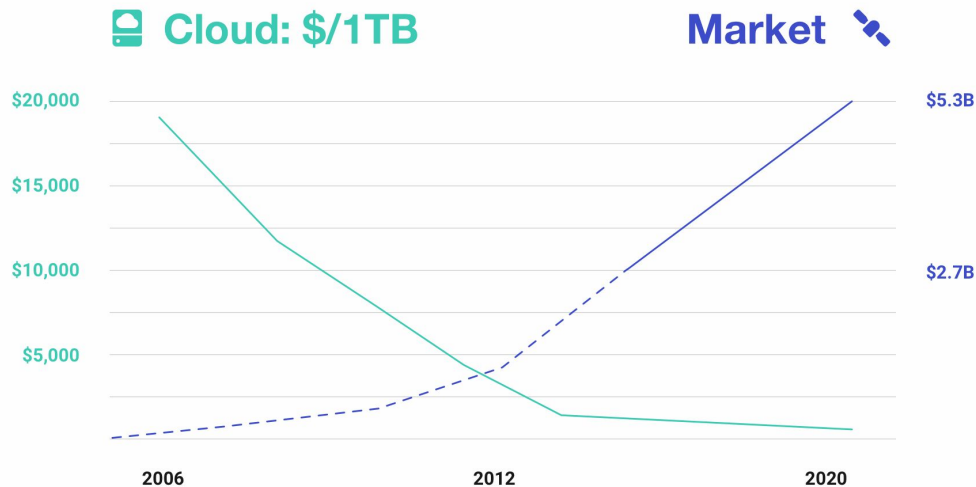
Robert Cardillo

National Geospatial-Intelligence Agency, Director

“If NGA were to attempt to manually sort through all the data it will receive in the next 20 years, it would have to hire 8 million analysts.”

Our Motivation

- ✓ Increasing resolution of satellite images to 30 cm/pixel
- ✓ Increasing number of satellites in orbit
- ✓ Hundreds of millions km² of imagery are collected every day
- ✓ Greater proliferation of machine-based analysis due to scalable cloud solutions
- ✓ Emerging market with analytics is a great opportunity for unicorns!

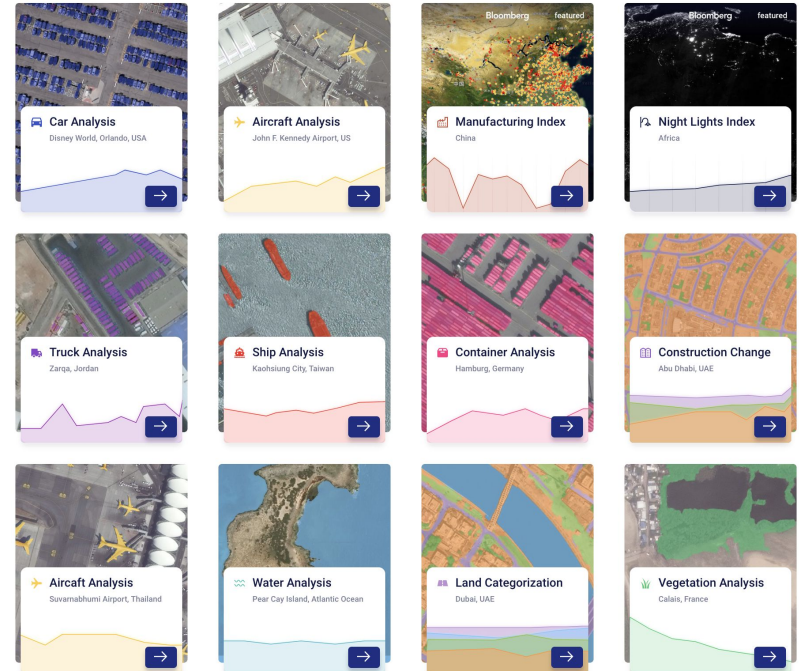


Our Mission

Our mission is to train machines to analyze satellite images to generate insights and provide actionable intelligence

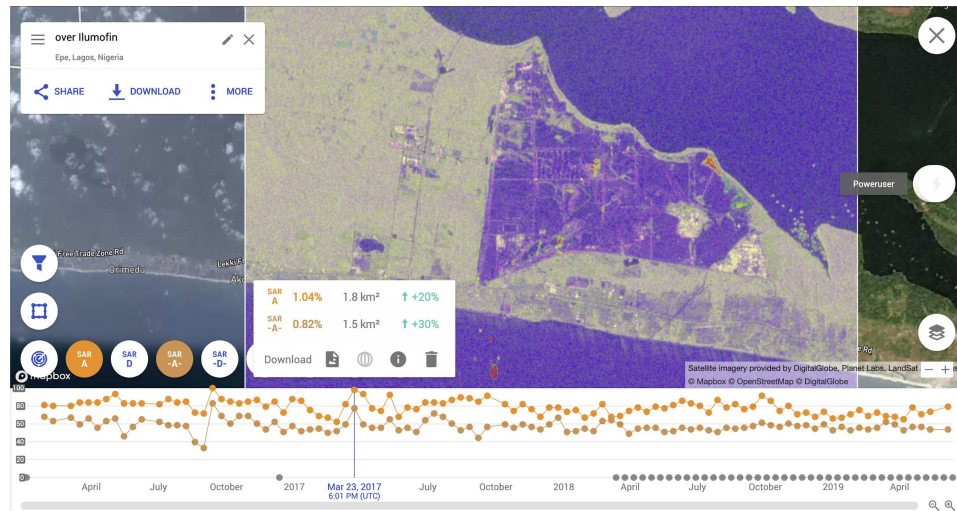
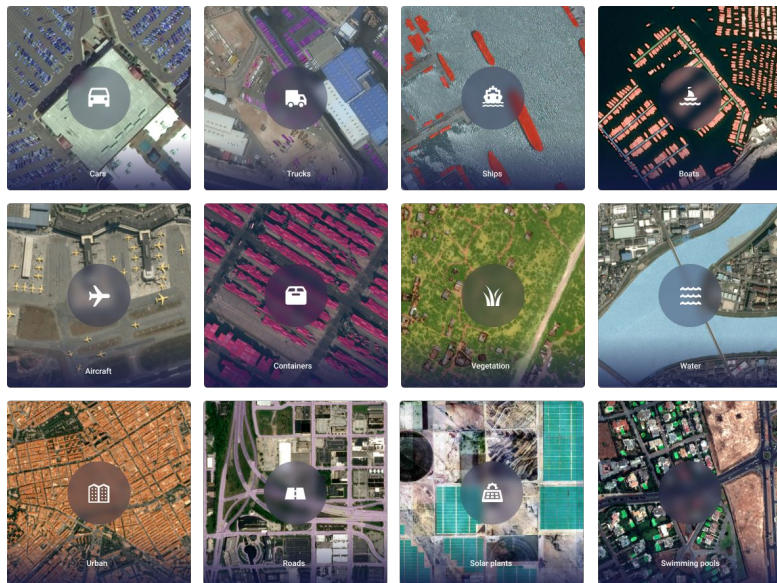
We offer analytics of any *Area of Interest* for a variety of objectives:

- Economic Indexes (production monitoring)
- National security and safety
- Construction site oversee
- Defense operations (uncommon target detection)
- Industrial facility analysis
- Disaster site damage assessment
- Environmental changes
- Agricultural production
- Natural resources (e.g. oil storage, coal, water)



Deep Neural Networks for Generalization

Deep neural networks are statistical models with a high capacity to capture hidden underlying patterns in provided training data that can be exploited to predict and generalize over previously unseen data.



CARS



TRUCKS



SHIPS



BOATS



AIRCRAFT



URBAN



NATURE



ROADS



WATER



BUILD



SOLAR



POOLS



CARGO



LITHIUM



COAL



COWS

Our Solutions using ESA's Sentinels

Sentinel-1 SAR and Sentinel-2 based algorithms

We apply image processing, machine learning, and deep neural networks to provide:

- Generalized change detection - RGB images, SAR images, derived indices, ...
- Scene semantic segmentation into regions of interest - clouds, roads, urban and non-urban areas, water
- Detection - coal, lithium, ships, gas flares, oil pads, spruce beetle
- Derivation of indices - e.g. vegetation index, and proprietary indices
- Recently also monitoring of air pollution using Sentinel 5P - utilizing preprocessed Level 2 products of pollutants' concentrations

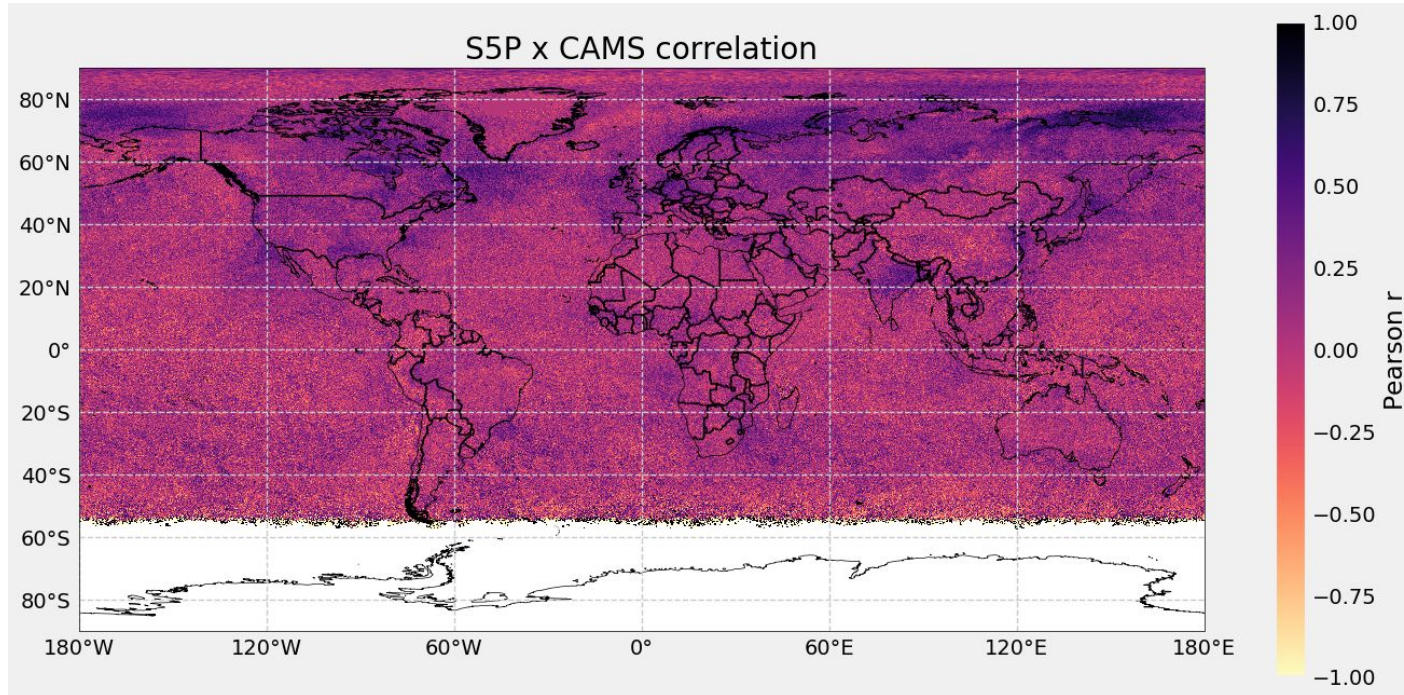


Google Cloud Platform



Sentinel-5P

SpaceKnow worked as a part of validation effort, and performed large-scale validation of formaldehyde product with respected to ECMWF's reanalyzed CAMS dataset of **HCHO** concentrations.



Sentinel-5P validation: examples

- Temporal validation
 - a. Overall
 - b. A day of the week
 - c. Month
 - d. Season
 - e. Weekday / Weekend
- Spatial validation
 - a. Overall
 - b. Latitude dependence
 - c. Longitude dependence
 - d. Cloud fraction dependence
 - e. Surface albedo dependence

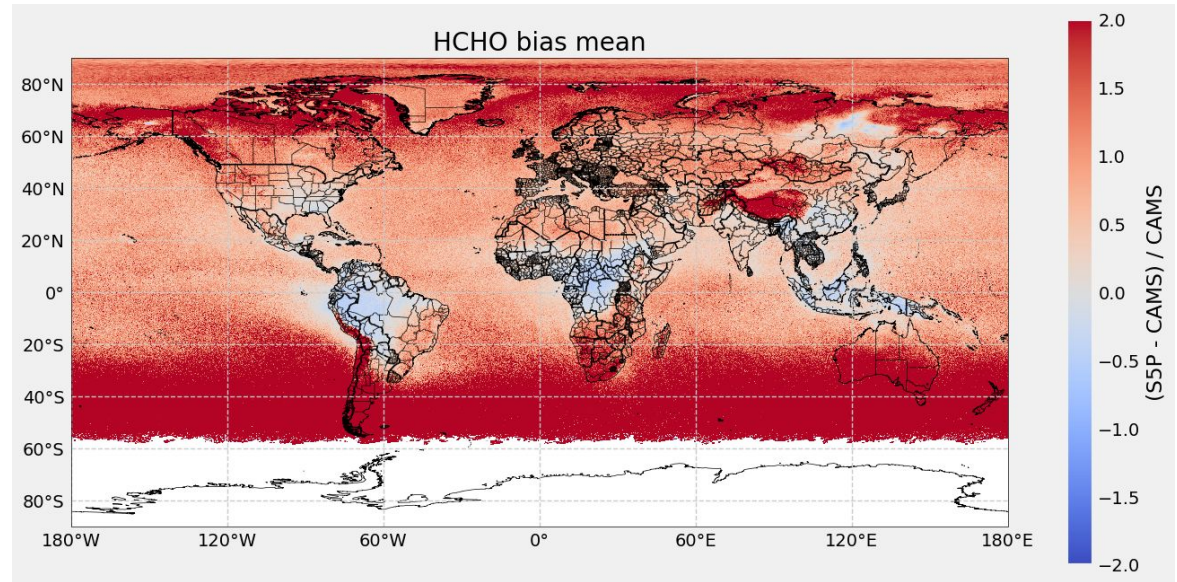


Fig.: Spatial map of bias in temporally averaged dataset

Sentinel-5P validation: examples

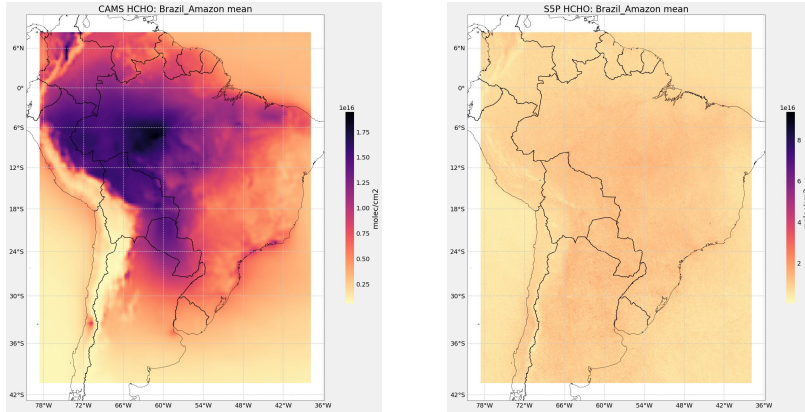


Fig.: Temporal mean of HCHO concentrations over Amazon basin in South America: CAMS dataset (left) and Sentinel-5P (right).

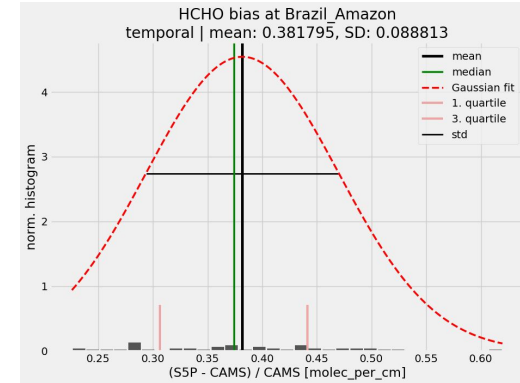
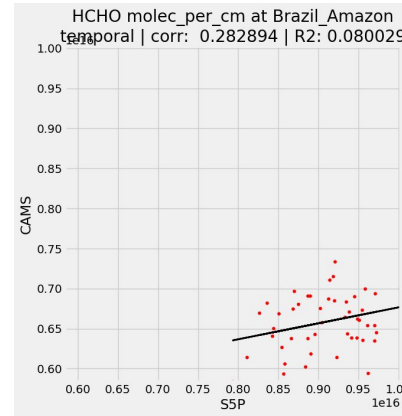


Fig.: (left) Scatter plot of CAMS vs. Sentinel-5P HCHO concentration values; the title displays the correlation and R² coefficient. (right) Histogram of spatial bias (computed as the difference between the two datasets, normalized with CAMS dataset) over Amazon basin; average bias at 55% level.

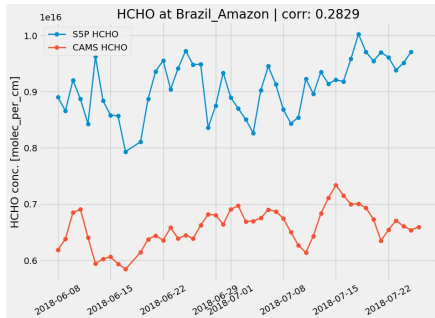
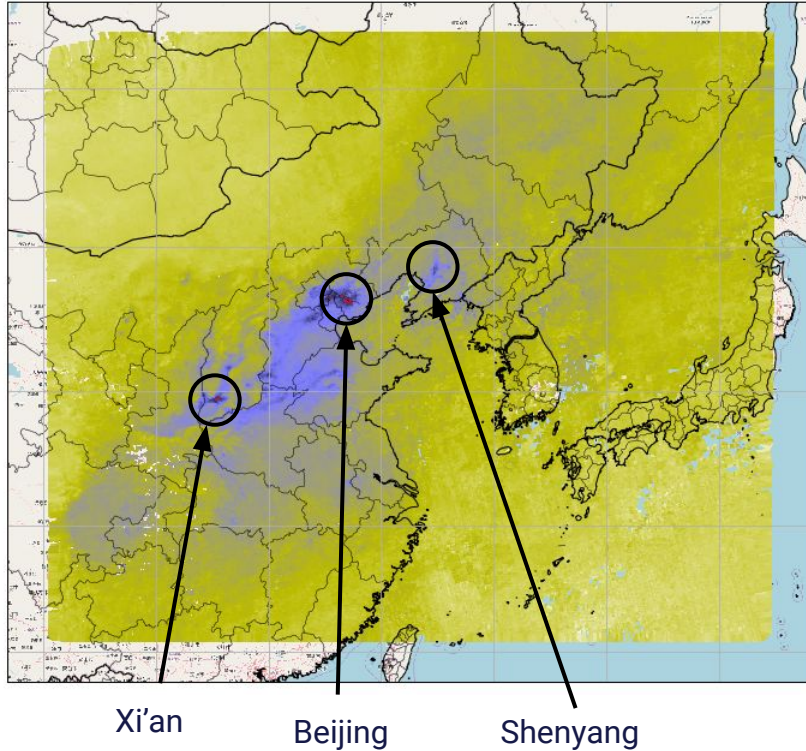
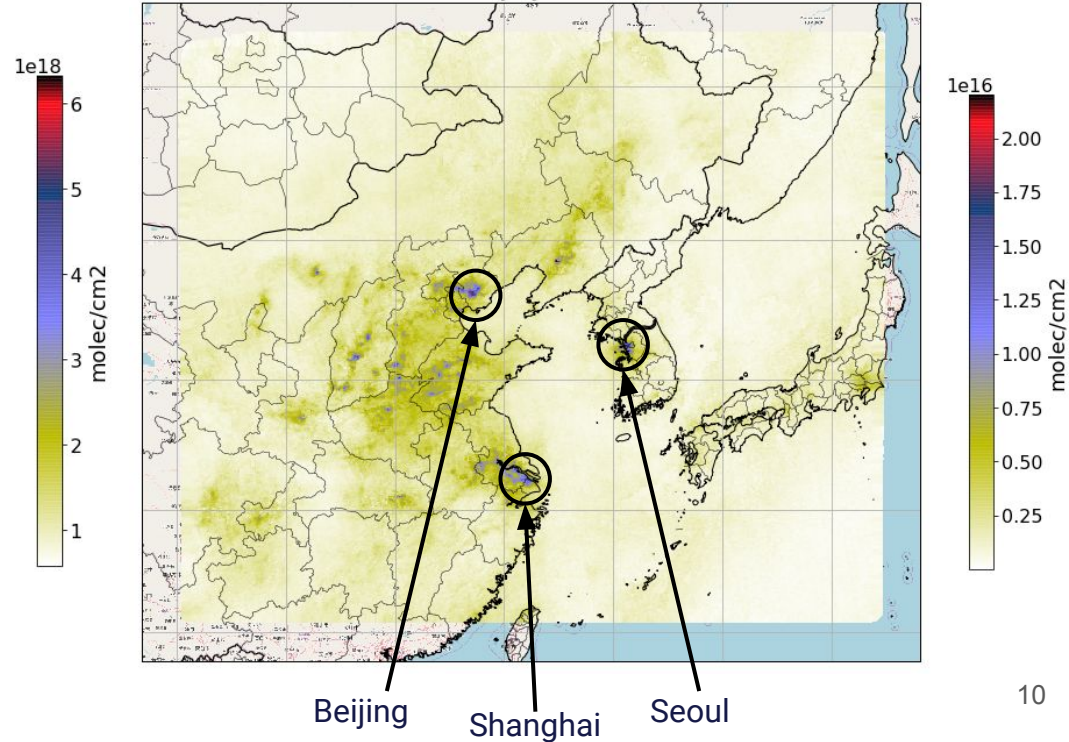


Fig.: Time series of a spatial mean over Amazon basin in South America.

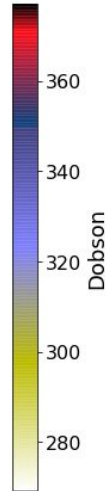
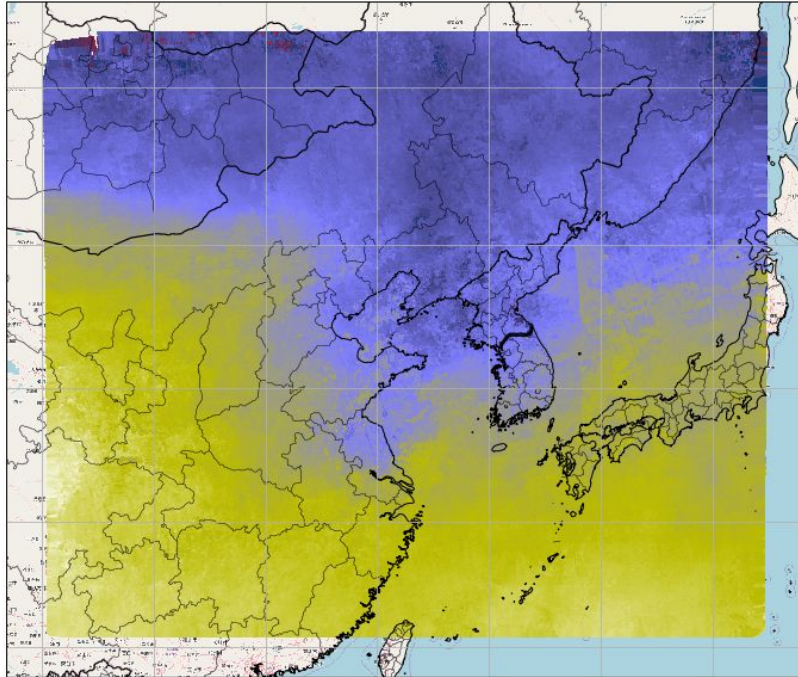
Sentinel-5P case study: North-east China pollution

CO July mean

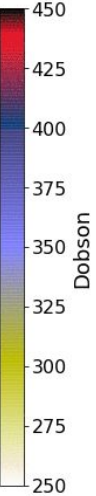
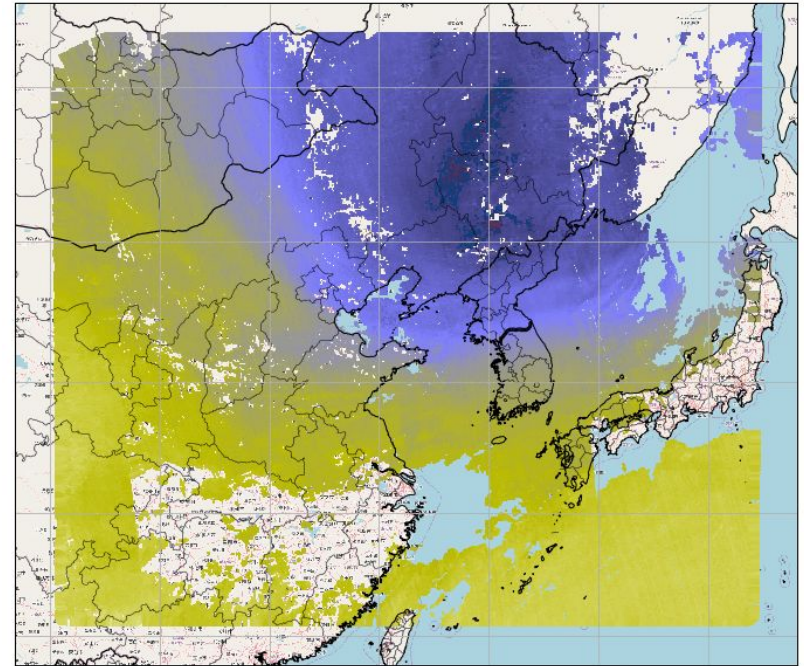
NO₂ July mean

Sentinel-5P case study: North-east China pollution

O3 July mean



O3 on 2018-06-20



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“Commission your own traffic and construction studies without ever leaving bed using SpaceKnow”



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