

# NILU – Norwegian Institute for Air Research

**NILU is a private independent, nonprofit institution established in 1969.**

- Research Council of Norway
- Norwegian and international industry
- Government agencies
- The EU's research programs, Ca 40% of the institute is international activity
- **~ 180 employees**
- Kjeller (Oslo) – Main office
- Tromsø
- Poland and in South Africa.

**Chemical analysis, atmospheric observatories, modelling, consulting services**

- Laboratories are among the most advanced in Europe
- Observatories in the Arctic, in Antarctica and in Norway
- Atmospheric data centre for ESA-EVDC, ESA-MPC, EMEP, GAW-WDCA, EU-projects and others



# About satellites and air quality

In the last years, the **capabilities of earth-observing satellites and the technological tools** have **advanced sufficiently**.

Satellite data can add synoptic and geospatial information to **ground-based air quality data and modelling**.

## Challenges:

Difficulty accessing and understanding new data, limited resources and agency priorities to develop new techniques, ill-defined needs, and poor understanding of the potential and limitations of the data.

## Opportunities:

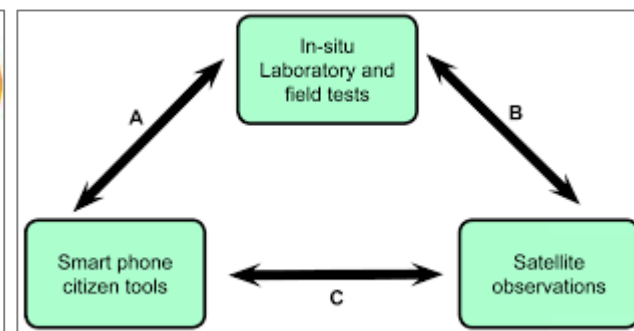
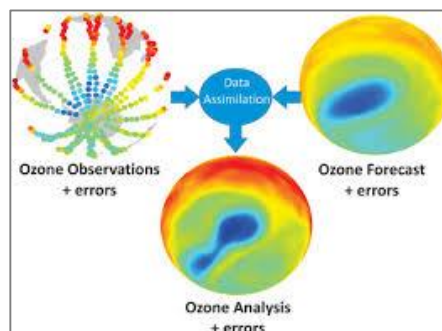
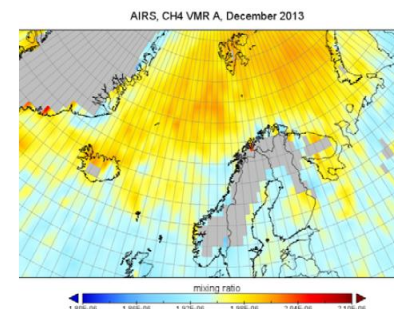
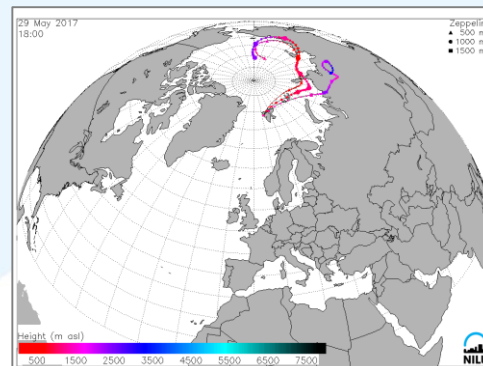
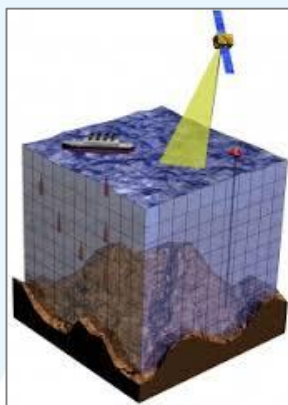
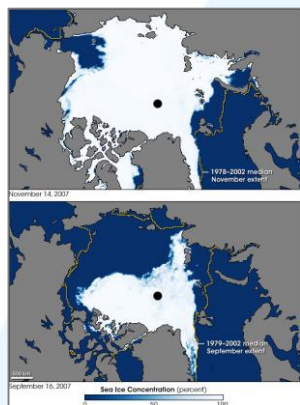
Collaboration between organizations, streamlined access to data, and resources for project implementation.



# Methodologies

Develop **methodologies, routines and tools** to prepare for operational use.

Developing **best-practices and future strategies.**



Support NILUs national and international monitoring obligations on behalf of the Climate and Environment Ministry and the international EMEP monitoring program.

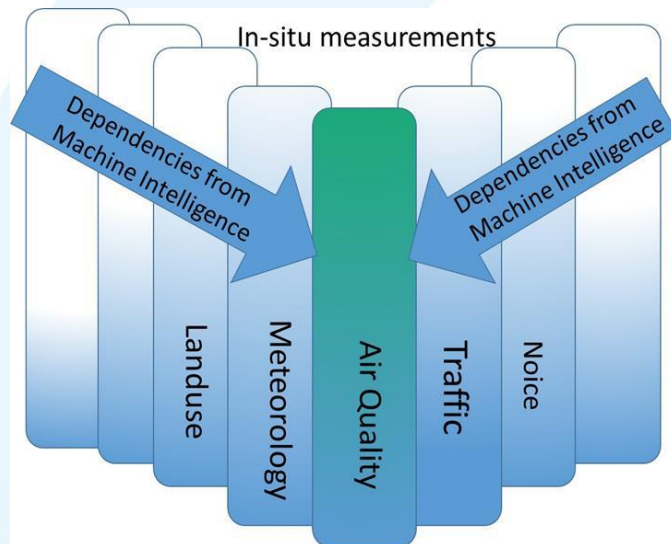
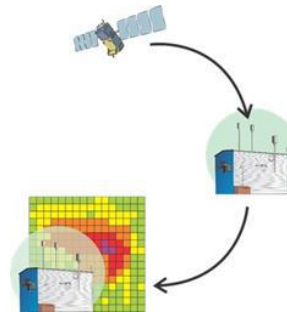
# Machine learning and satellites

Machine learning is the subfield of computer science that provides computers  
**"The ability to learn without being explicitly programmed"**

Satellite – aircraft – insitu – micro sensors

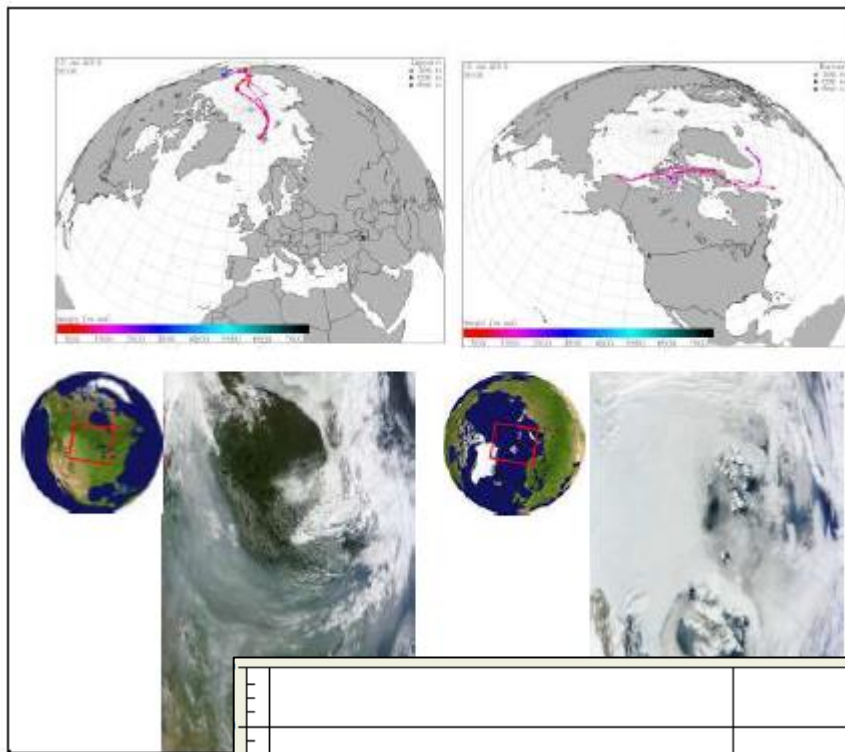
Various limitations in time and space

Can machine learning solve the problem?



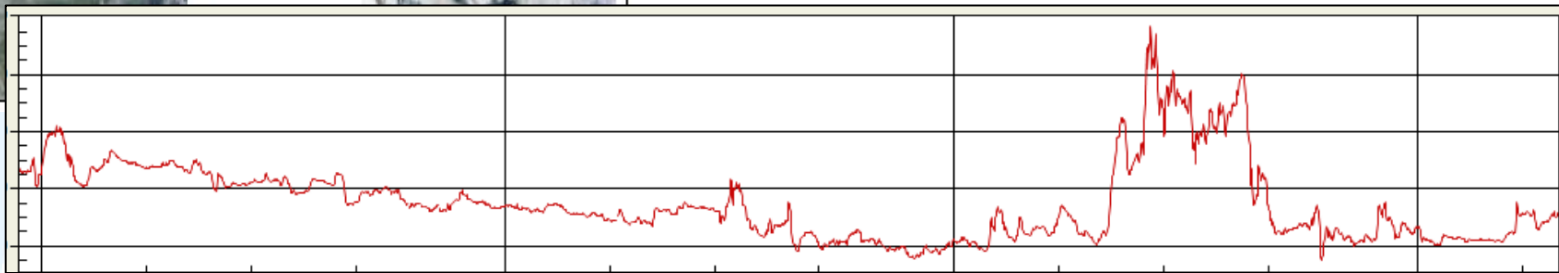
# Arctic Haze Alert System

Carbon Monoxide is an **excellent tracer for transport of smoke** from fires (biomass burning, agricultural- or forest fire)



July 2015, Canada

Increased CO concentrations as the Zeppelin Observatory in Svalbard





# VANDAM

**Validation of Nitrogen Dioxide and Arctic Methane from Sentinel-5P**  
Norwegian Space Centre – via PROXED

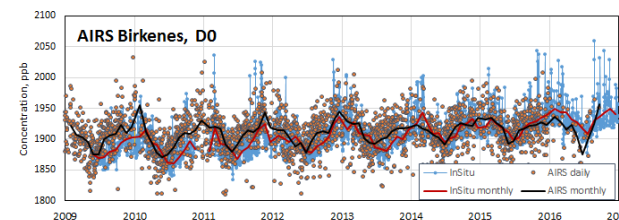
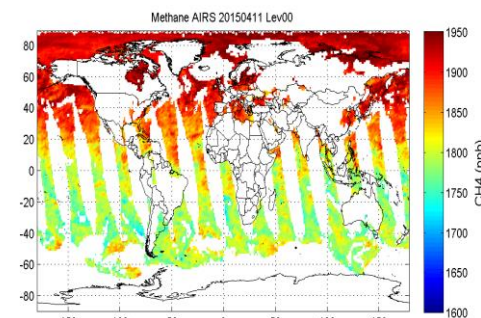
Monitoring changes in the greenhouse gas mixture ratio, regard to future climate change. The Arctic is changing rapidly, which affects the rest of the world. Global methane (CH<sub>4</sub>) mixing ratio reached record high levels in 2012-2016.

**Sources: emissions from**

**- gas- and oil installations, wetlands og melting permafrost**

Special focus on the Arctic, satellite products  
(GOSAT/Jaxa, AIRS/NASA, ENVISAT/ESA), EVDC

**Possible combinations with ice extent, changes in  
North west/east passages, forestry, meteorology....**



# VAST - Volcanic Ash Strategic Team



By the way, any idea if his plane can fly through volcanic ash clouds?

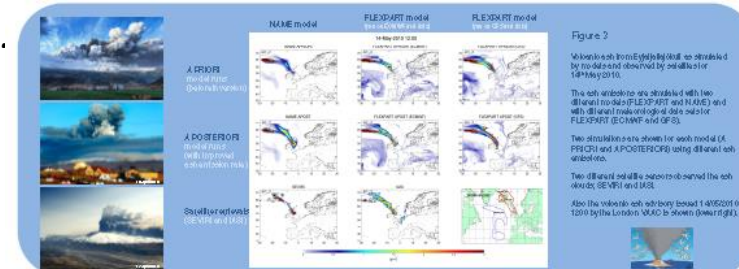


# VAST - Volcanic Ash Strategic Team

As part of an ESA initiative to enhance the use of Earth Observation (EO) data in volcanic ash monitoring and forecasting, the project VAST (Volcanic Ash Strategic-initiative Team) was set up.

Volcanoes can eject large amounts ( $\sim 1\text{-}50\text{Tg}$ ) of ash and gases high ( $>20\text{ km}$ ) into the atmosphere and thus intersect airspace from the ground up to jet aircraft cruising altitudes ( $>40,000\text{ ft}$ ).

- \* Access to EO data sources for volcanic plume observations.
- \* Consolidation of EO observations and other ground-based data for characterizing volcanic ash clouds.
- \* Development of operational volcanic ash products from EO data using advanced retrieval algorithms.
- \* Availability of real-time monitoring, including satellite data.





# Emission of international shipping seen from satellites

- The vessel "YARA Birkeland" is the world's first fully electric and autonomous container ship, with zero emissions.
- “Vision of the fjords” World's first hybrid tourist boat

Problem:

Can reductions in emissions be seen from space?

Is there a climate benefit?

Solution:

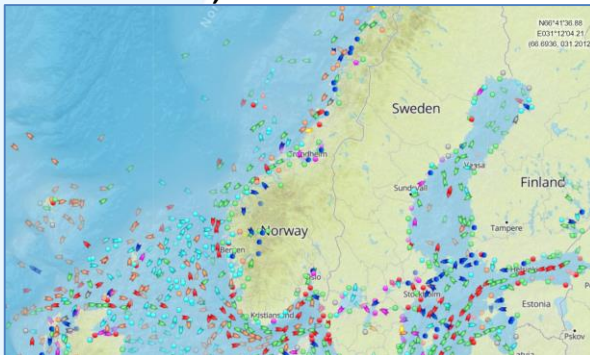
Use EO data, GPS/AIS, Ship information,  
Emission estimates, observations



YARA and KONGSBERG enter into partnership to build world's first autonomous and zero emissions ship



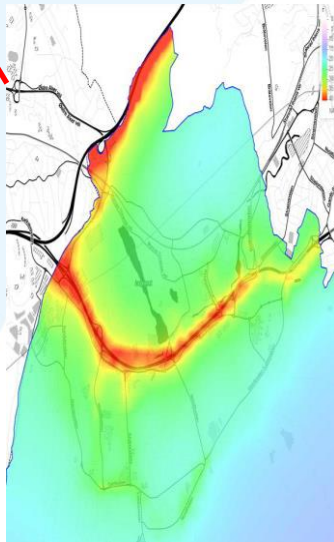
Autonomous and 100% electric, 'YARA Birkeland' will be the world's most advanced container feeder ship.



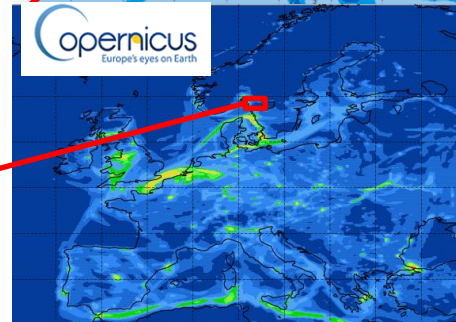
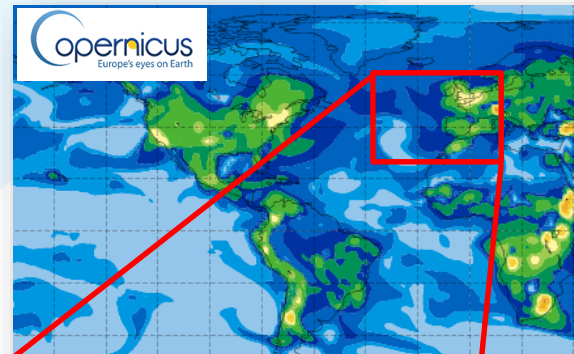
# InnoSense AS:

## *Insitu* monitoring & satellite data

Microsensor units

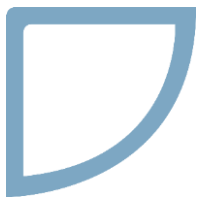


AQ satellite data



Copernicus delivers early warnings about the atmospheric compositions





# InnoSense

http://localhost/demo



localhost/demo

Google



17 march 10:00  
NO2

