Using Real-Time ADS-B Data for Aircraft Emissions

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What we Do

- We develop advanced models for aircraft performance aimed at:

  - **Engine emissions predictions**
  - Engine damage due to flight into dust clouds
  - Aircraft noise

- In this note only emissions predictions are shown
- Our computer codes are widely demonstrated in the published technical literature
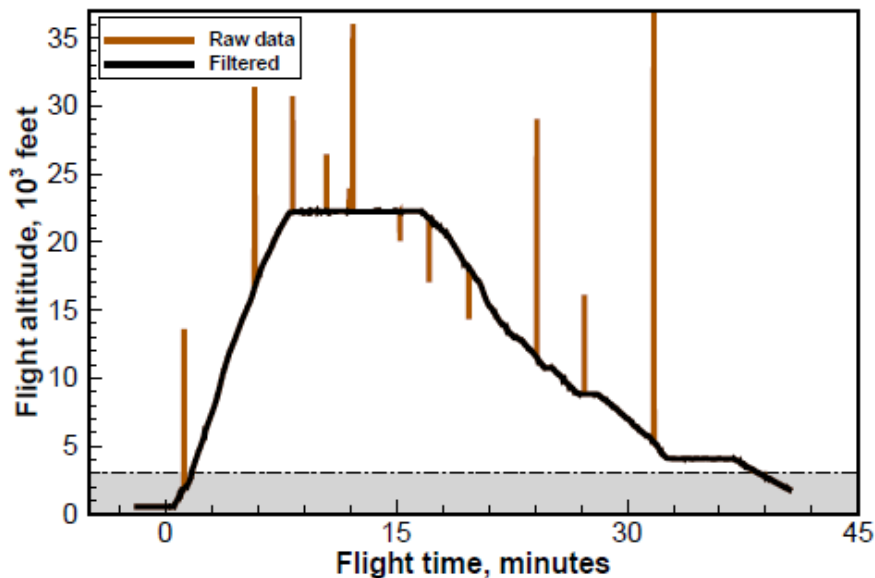
Software Framework for Emissions

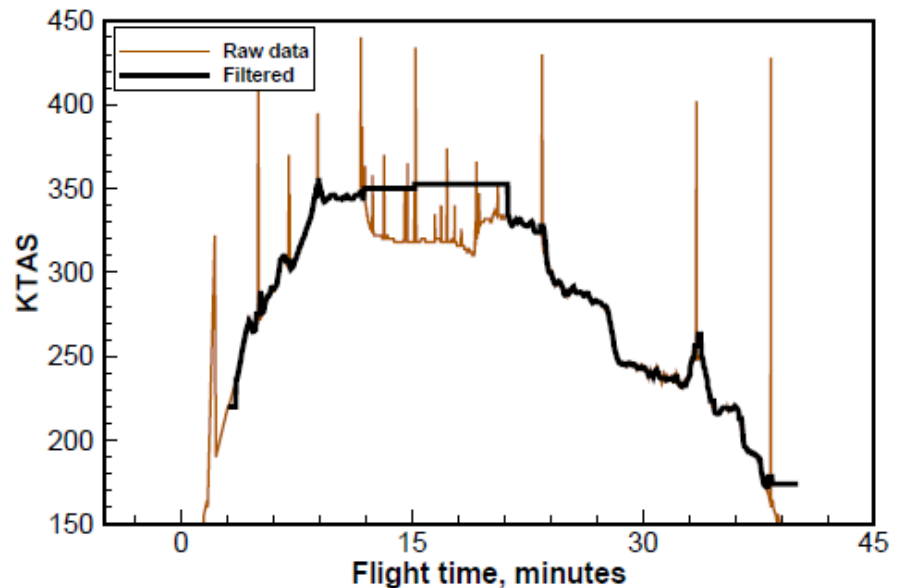## Near real-time analysis from flight data
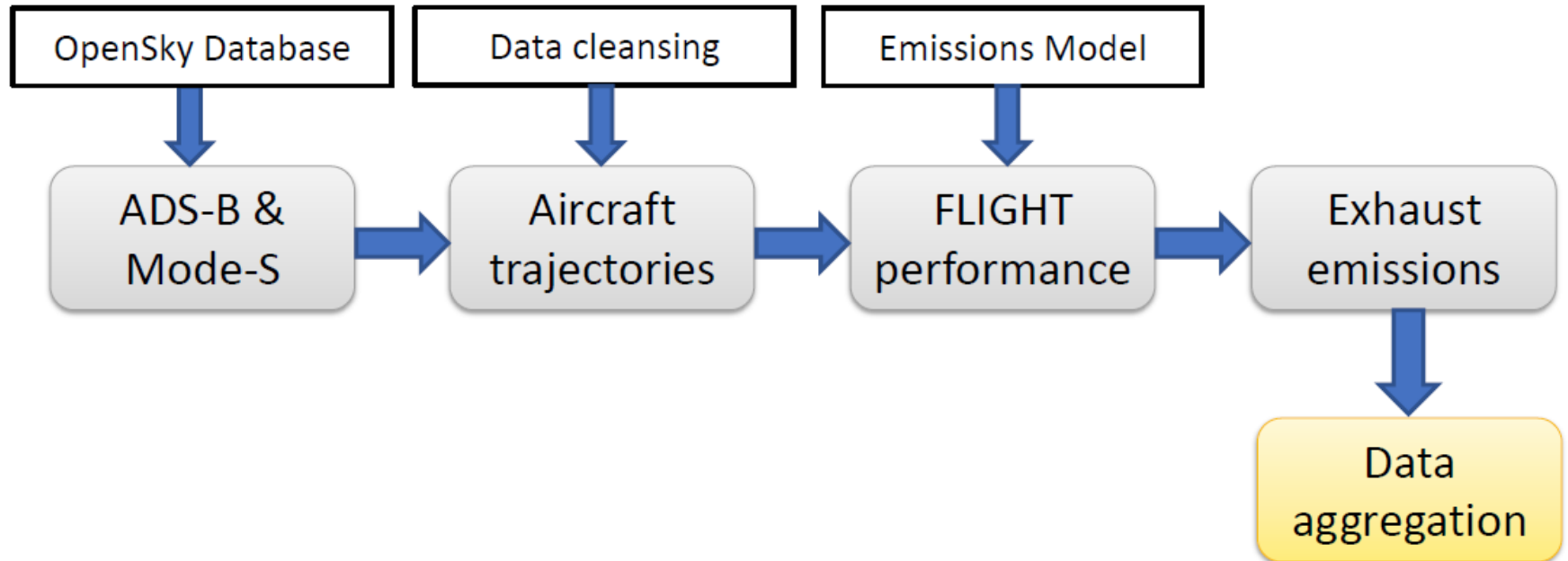
Raw data need Filtering

- Variety of filters and machine learning
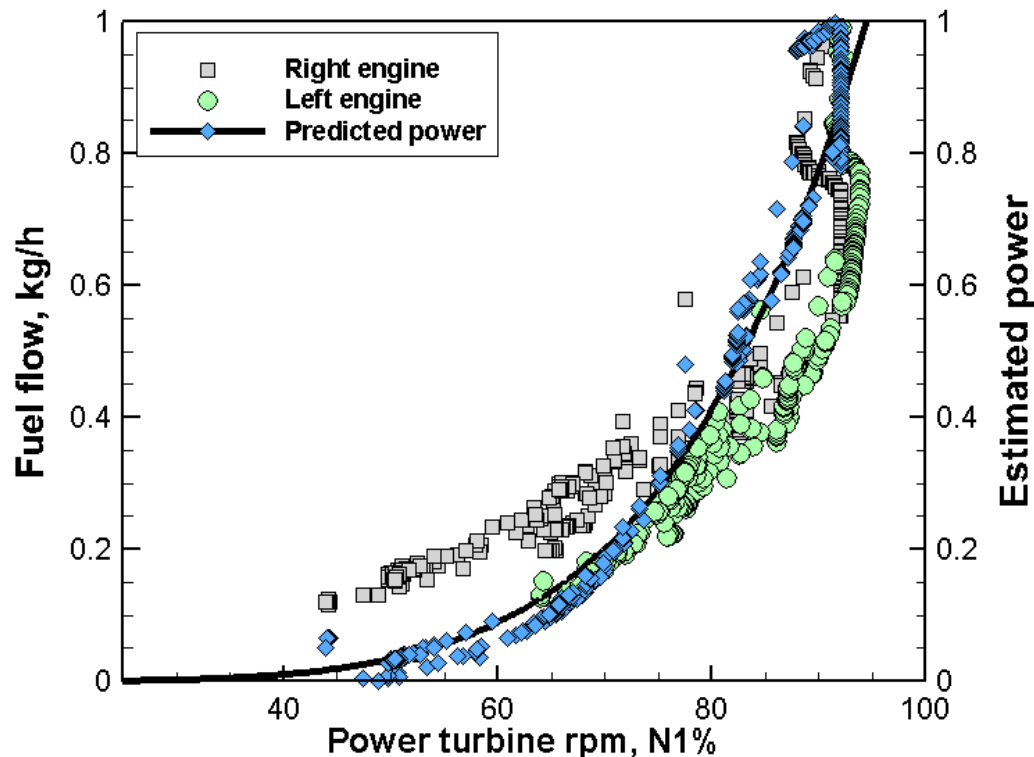- Example: A380 flight MUC to FRA

(a)

(b)

Engine models

- Gas turbine engines (turbofan, turboprops)
- *Detailed and validated*
- Example below is CF34 turbofan engine

Comparisons with FDR data

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Data Aggregation

- Flights can be processed according to
  - Origin or Destination airport
  - City-pairs
  - Single aircraft Type
  - Entire Fleet
- Emissions calculated by
  - Flight distance
  - Cruise altitude (LTO, tropospheric, stratospheric)
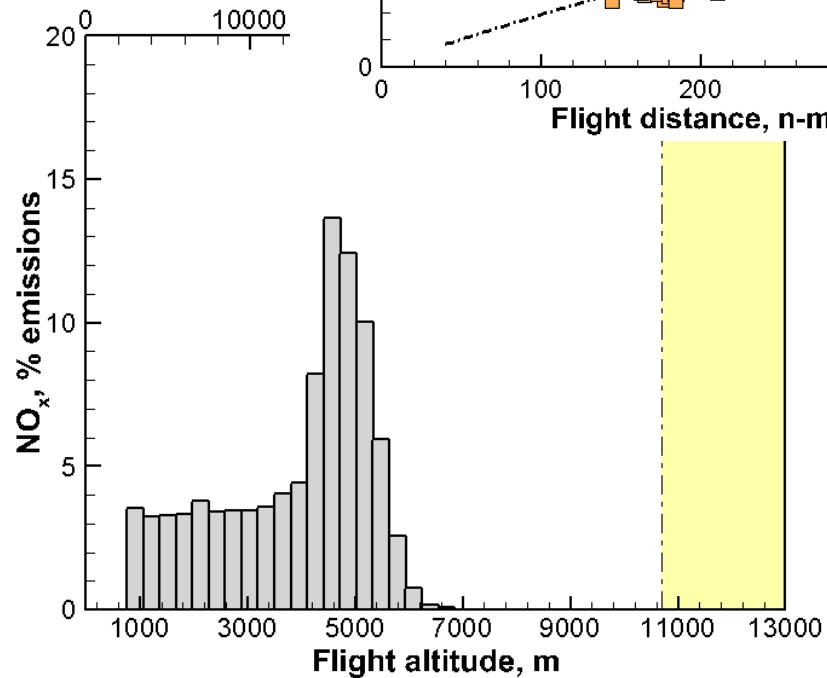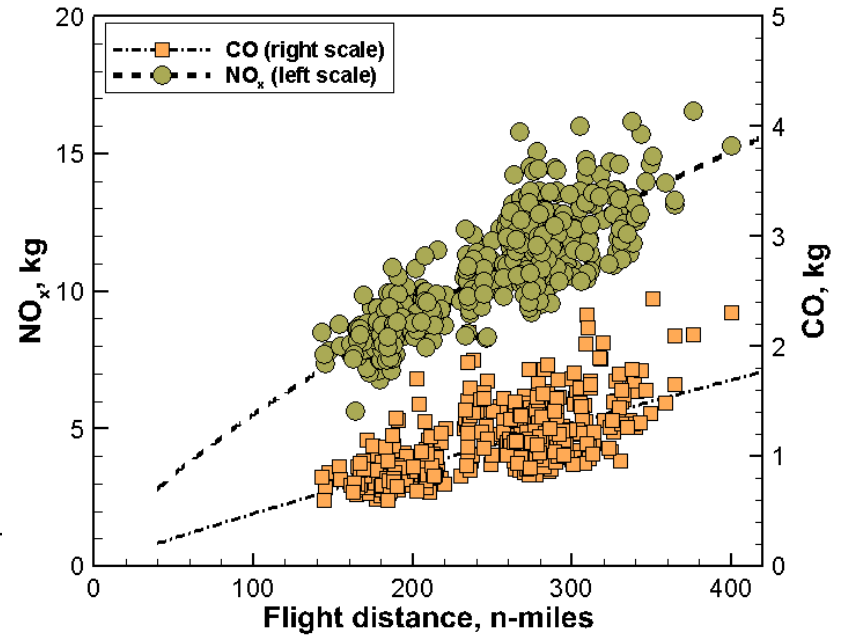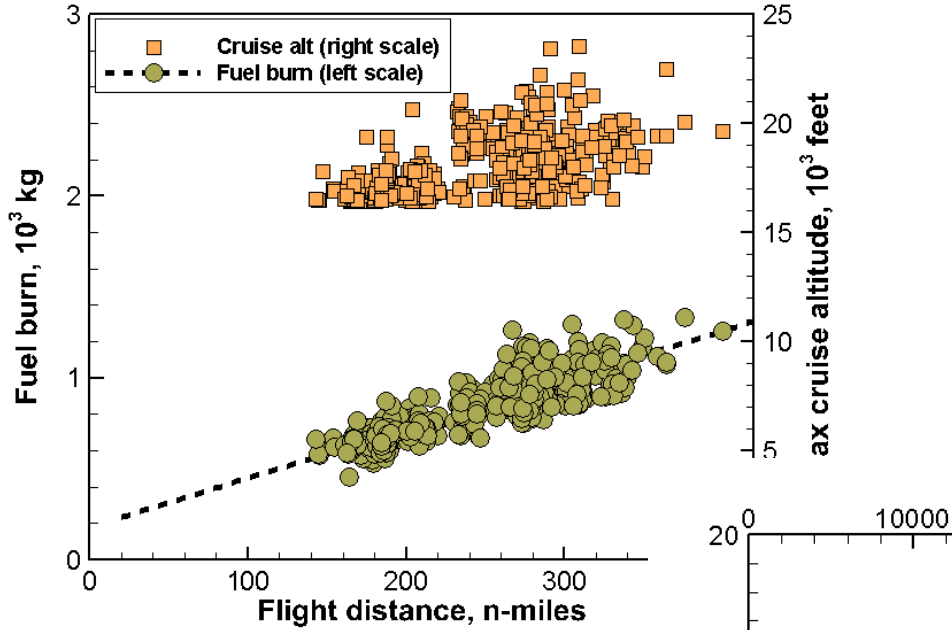 - Aircraft/engine type

Detailed Effects on Emissions

- Gross take-off weight

- Atmospheric winds (East- and Westbound)

- Seasonal averaging

- Geographical analysis

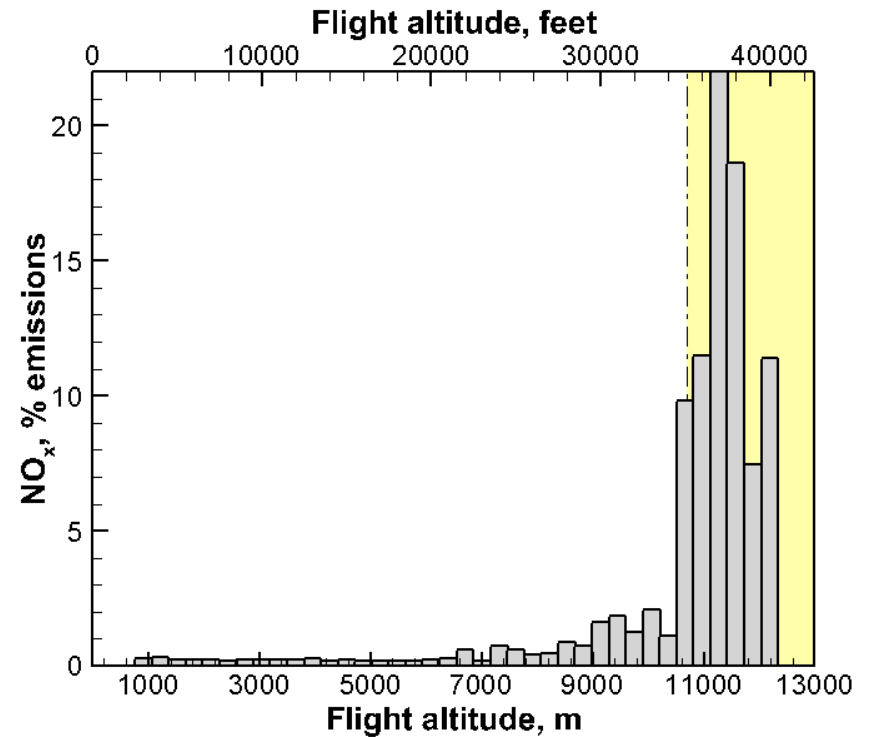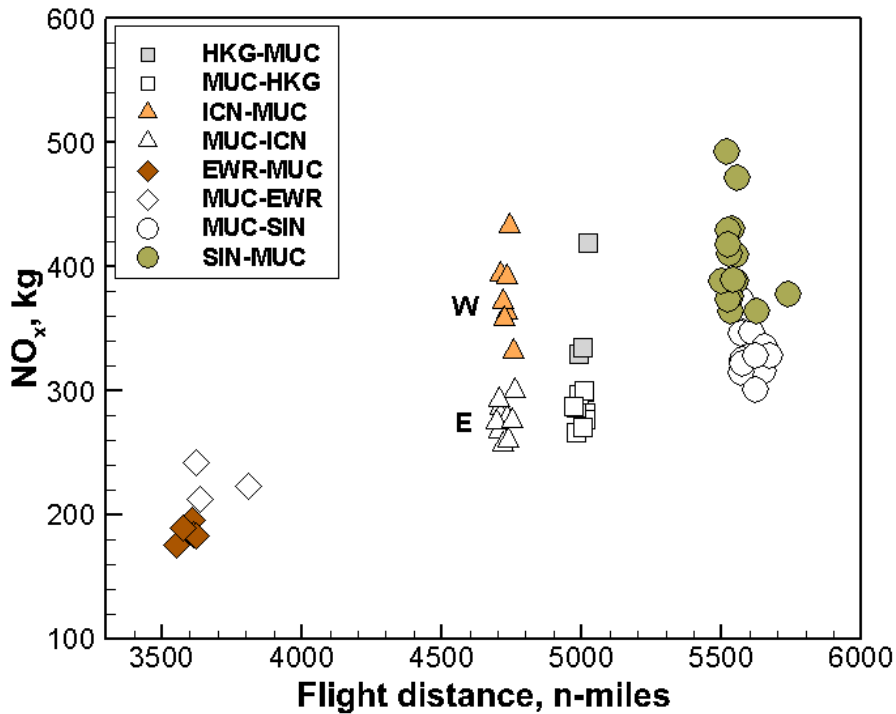- Dust ingestion damage in engine components

Emission Estimates available

- Fuel burn per mission
  - CO_2, CO, NOx, SOx, H_2O, UHC, soot, VOC

- [Example of sorting](post-processing) (post-processing)
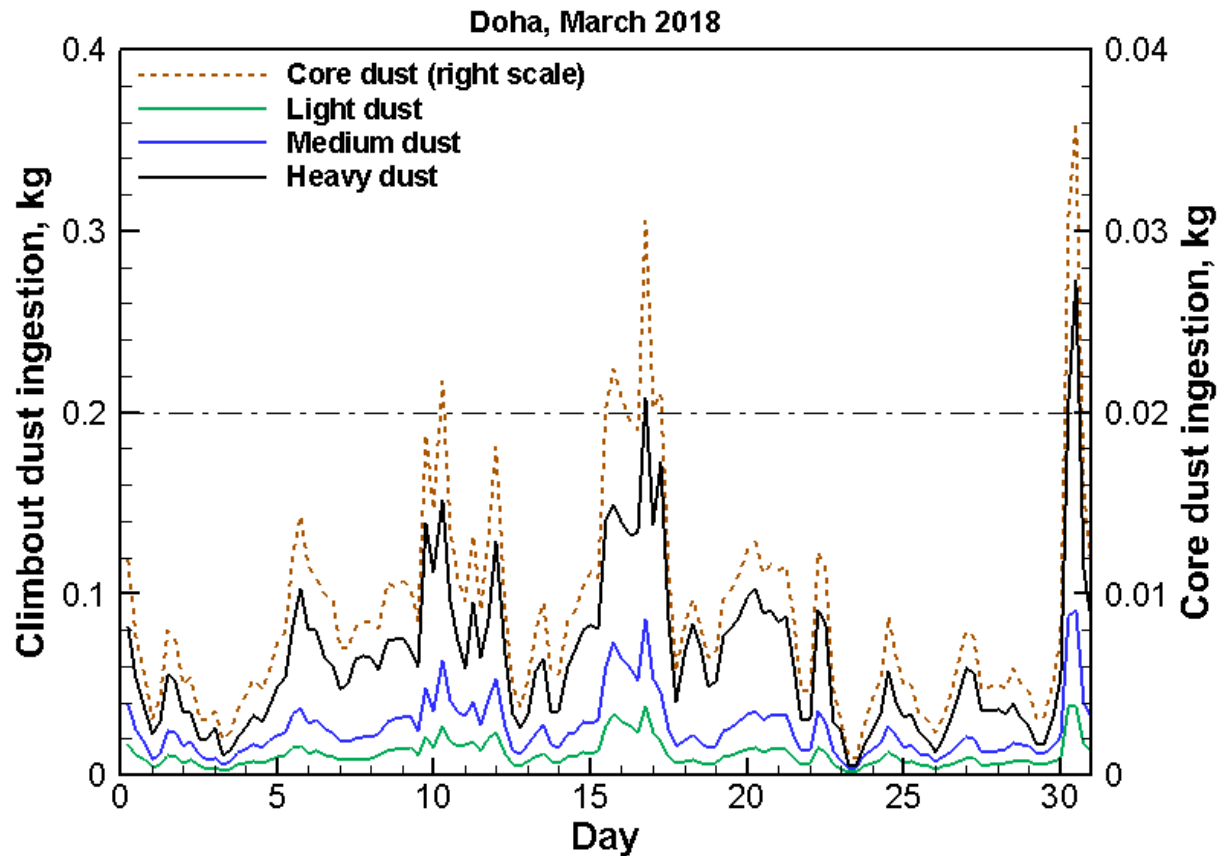
Data Visualisation: ATR72

Data Visualisation: A350-900

Flight into dust clouds

- A380-841/RR Trent 970
- Flights out of Doha in dust storms

Objectives

- We want to develop a commercial partnership with potentially interested parties to provide estimates of aircraft emissions on granular basis.

- We have aircraft models that cover about 20,000 airliners in service, including cargo, turboprops, business jets (and a few helicopters).

- Currently capable of processing ~2,000 flights/week, scalable to higher numbers for commercial purposes.

Example Aircraft