Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

Operational use of Aircraft Derived Data for meteorology and other applications

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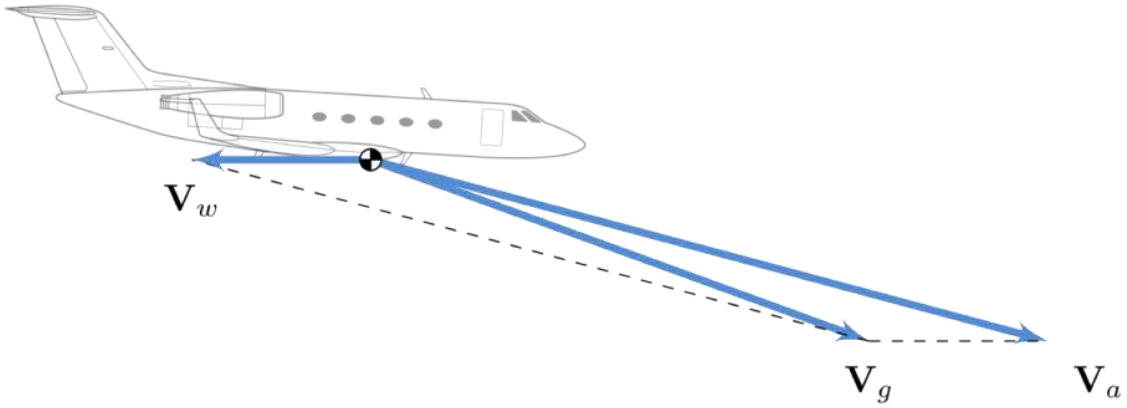
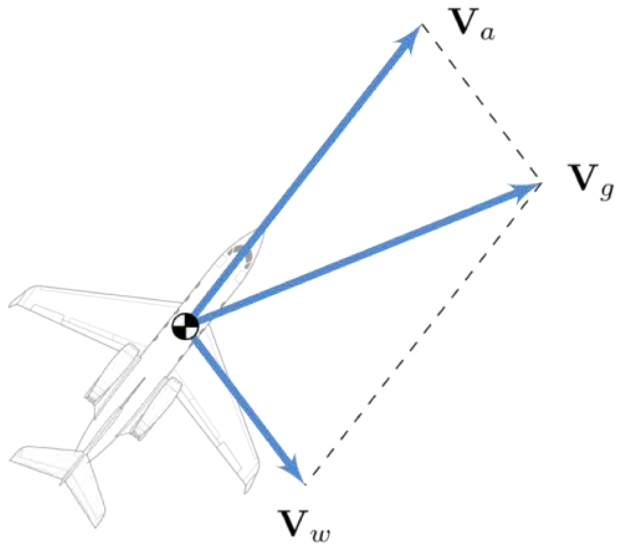
Aircraft Derived Data

- Direct vs. Indirect Data
  - Wind Speed and Direction
  - Temperature

$$\vec{V}_w = \vec{V}_g - \vec{V}_a$$

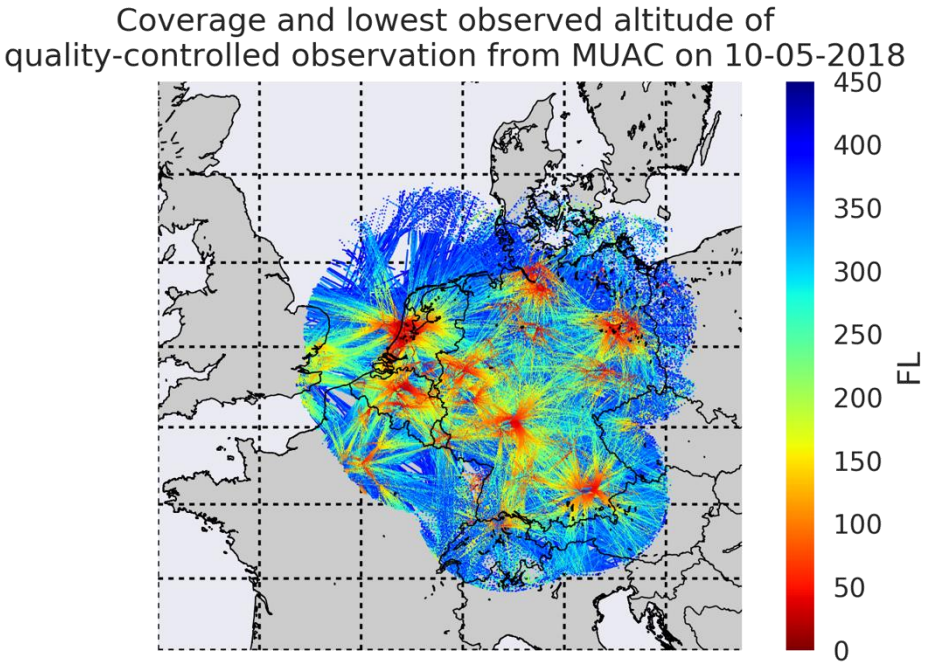
$$T = \frac{1}{\gamma R}\left(\frac{V_a}{M}\right)^2$$





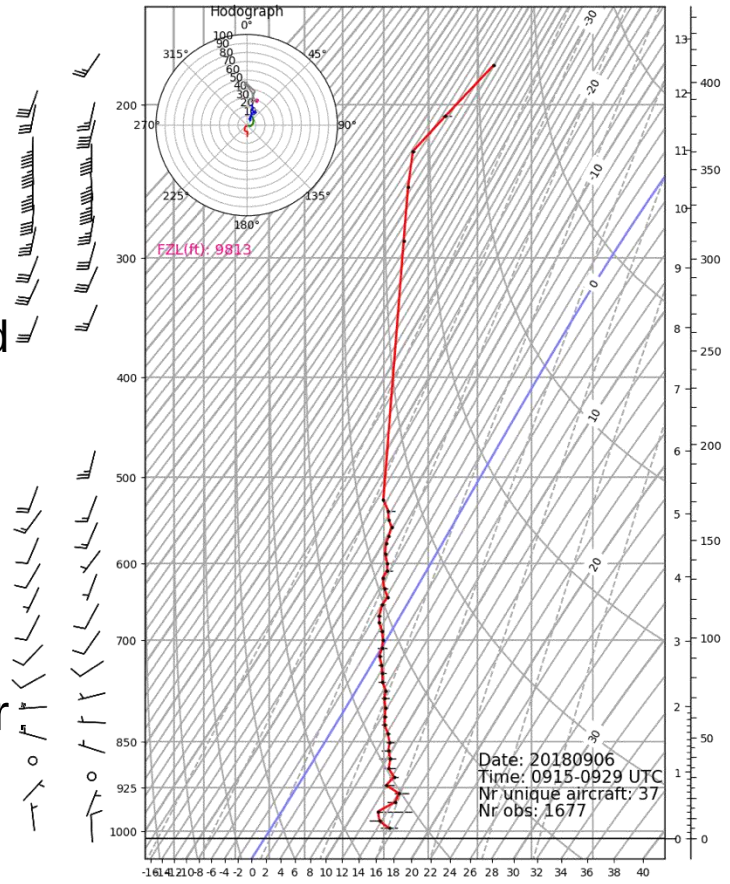
Aircraft Derived Data - Potential

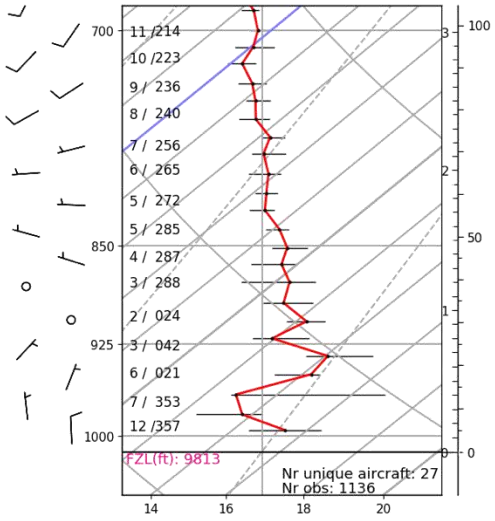
- Mode-S EHS
  - 3+ million QC obs per day in MUAC area
  - Coverage to be extended
- Quality:
  - Wind Speed : 1 – 1.5 m/s
  - Wind Direction: 5 – 10 degrees
  - Temperature: 0.5 - 2 K



Use Cases

- Meteorology
  - Assimilation into NWP
  - Weather Room
    - Vertical Profiles of Temperature and Wind
    - Nowcasting
  - Verification/Validation
  - “Climatology”
- Air Traffic Management
  - Enabler via improved wind forecasts for
    - Trajectory Predictors
    - Time Based Separation





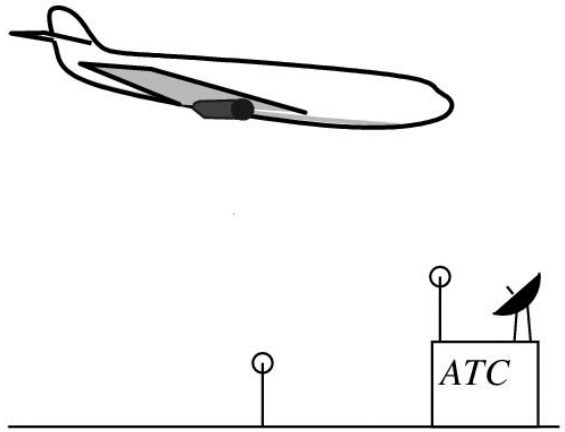
Data Collection

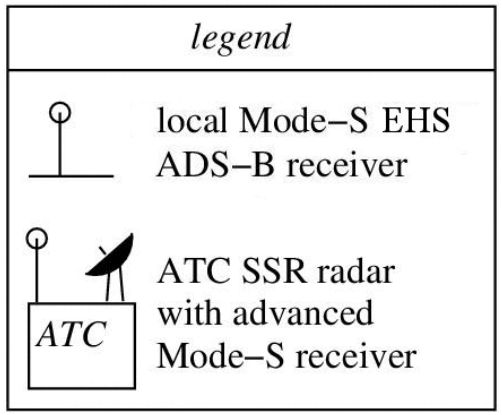
- Mode-S Enhanced Surveillance (EHS)
- See KNMI stand and UKMO poster (P2_2)

BDS Register	Basic DAP set	Alternative DAP Set
BDS 4.0	Selected Altitude	Selected Altitude
BDS 5.0	Roll Angle Track Angle Rate True Track Angle Ground Speed	Roll Angle - True Track Angle Speed
BDS 6.0	Magnetic Heading Indicated Airspeed (IAS) / Mach No.† Vertical Rate -	Magnetic Heading Indicated Airspeed (IAS) / Mach No.† Vertical Rate True Airspeed (TAS)‡

† Note: IAS and Mach No. are considered as 1 DAP (even if technically they are 2 separate ARINC labels). If the aircraft can provide both, it must do so.

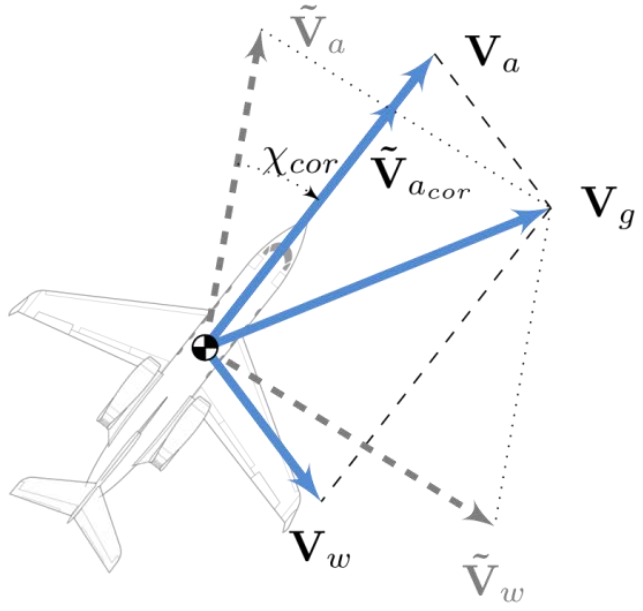
‡ If Track Angle Rate is not available.





From Science to Operations

- Started in 2007 to investigate discrepancies in ATC derived wind information
- Quality Improvements through Corrections
- Quality Validation
- Receiver -> UKMO
- DTAP
- Software Improvements
- Chain Management and Monitoring



European Meteorological Aircraft Derived Data Center (EMADDC)

Obtain as many near real time quality controlled meteorological upper air observations (wind and temperature) for Europe at large for as little cost as possible

- SESAR Deployment, lead by KNMI
  - runs until 2020
- UK Met Office, contributor
- Liaise with EUMETNET

EUMETNET
EUROPEAN METEOROLOGICAL SERVICES NETWORK

Co-financed by the European Union
Connecting Europe Facility

Next Steps of EMADDC

- Propose new BUFR format to exchange derived data to WMO
- Organize governance (standard contracts, IPR, business model)
- Produce standardized plug-and-play ADS-B/Mode-S receivers and processing software
- Roll out of local ADS-B/Mode-S receivers in the UK
- Expand geographical scope of surveillance data
- Increase towards near real-time processing instead of batch processing

Research

- Improve quality of Mode-S EHS derived temperature
- Improve quality control parameters and algorithms
- Regionalization of magnetic declination correction
- Research other data sets like ADS-C and other sources e.g. direct data from aircraft via Wi-Fi or nanosatellites
- Investigate opportunities to use ADD to derive e.g. turbulence

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Thank you!

For more information, please see http://mode-s.knmi.nl or mode-s@knmi.nl