# Update on the development of the EU MRV system for aviation non-$CO_2$

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# EU ETS Directive context…

- Overall climate impact represent at least 2 times the $CO_2$,
- Recital (11): … *non-$CO_2$ aviation effects, in line with the precautionary principle, can no longer be ignored…*
- Article 14(5): Commission Implementing Regulation laying down the detailed rules of monitoring and reporting non-$CO_2$ effects of aviation by 31 August 2024. From 1st January 2025: MRV of non-$CO_2$ effects per flight.

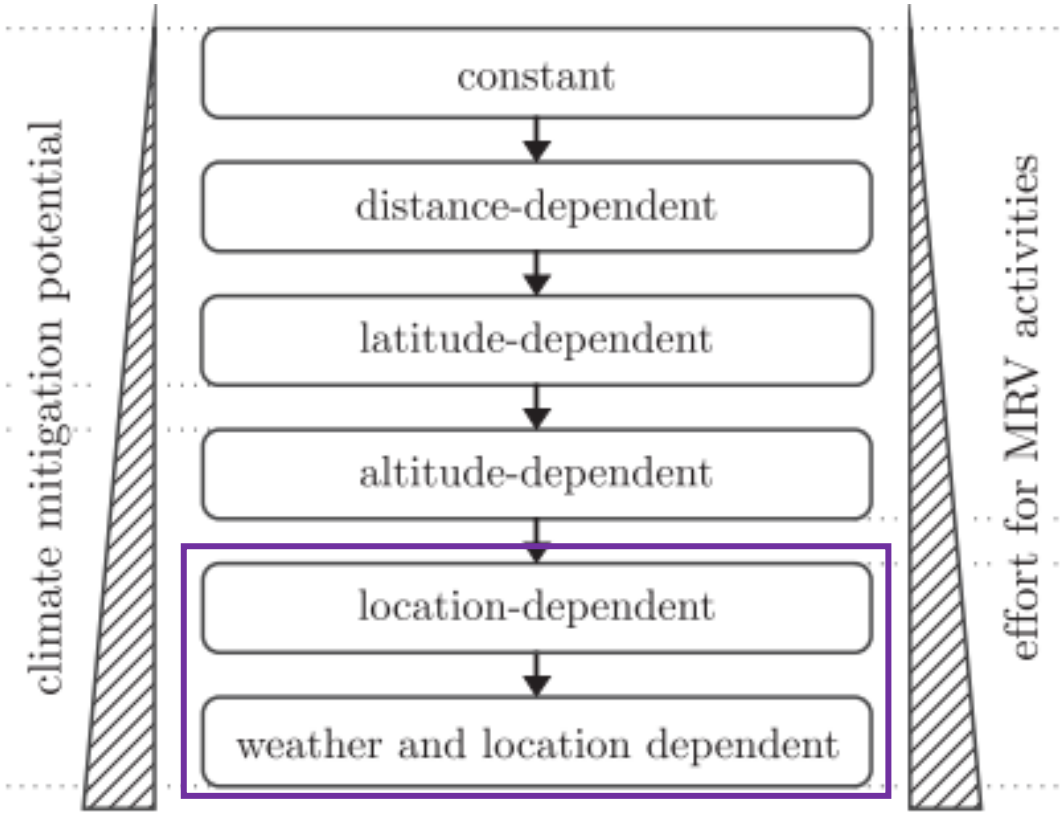
# …and beyond

- Innovation Fund latest methodology (Nov.2023) includes non-$CO_2$,
- Communication on Europe's 2040 climate target identifies the impacts of non-$CO_2$ as part of the path of the sector towards climate neutrality (also Annex 12 of Impact Assessment)

# Flexibility…

- **Metric innovative** - GWP with multiple time horizons (20, 50, and 100 years), with efficacy, to express the $CO_2$eq/flight, avoiding lock-in effects,
- **Menu-like IT tool (*NEATS*)** automatising the entire MRV process, where other than the fuel properties (e.g. aromatic content; H:C ratio), only aircraft properties (aircraft type, engine UID and aircraft mass) are to be sourced by the aircraft operators (unless automatized as well), with simplification for small emitters (<25 $ktCO_2/y$)
- **No mandatory quick access recorder (QAR) or equivalent data** - using third-party available data (e.g. provided by EUROCONTROL and national weather services with a common reference NWP model) rather than data measured in-flig (measured data allowed in NEATS – confidential data is protected)
- **Conservative default values** (fuel properties, engine UID, aircraft mass) in case no data is provided, possibility of fully automatic MRV. Crucial for ensuring transparency and consistency
- **Evolutive design** of the MRV – to be reviewed regularly by the Commission to take into account evolving understanding of the non-CO2 effects

**Schematic of tradeoff between administrative effort and climate mitigation potential depending on accuracy of $CO_2$eq calculation approach**




Source: Niklaß et al. (2020)

# … and data precision

- **Transparent and state-of-art models and modules:** climatological location-simplified model approach (**openAirClim**) for **small emitters**, while default is the weather-based approach (**CoCIP** and **aCCF**). Those are preceded by modules: **BADA** and **BFFM2** respectfully for fuel-burn and the non-CO2 emissions.

# MRV data and NEATS

1. Flight information (call sign in UTC)
   a. Flight number
   b. Day and time
   c. Departure and arrival airport (ICAO codes)

Provided by NEATS (can be checked and corrected by AO)
Non-confidential
Needed in both Method C (weather-dependent (DEFAULT) approach and Method D (location-simplified approach)

2. Flight trajectory (4D)
   a. Timestamp (time interval between 2 time stamps, ideally 60 sec but could be more (linear interpolation within cruise phase)
   b. Latitude
   c. Longitude
   d. Altitude

Provided by NEATS (source: ECTL : model 1,2,3 with possible alternatives and equivalence in terms of data, ex: ADS-B, where relevant)
Non-confidential
Needed in both Method C&D (different definition depending on the Method)

3. Aircraft properties
   a. Aircraft type
   b. Engine UID
   c. Aircraft mass

Can be provided by NEATS (if Defaults are used, Annex IIIb of MRR – conservative defaults values for engine UID per aircraft type, based on ICAO EDB)
Non-confidential (unless aircraft mass is not provided, and if AO needs to provide load factor, unless Default value of 1 is used)
Needed in both Method C&D

4. Aircraft performance (***optional***)
   a. Fuel flow
   b. Aircraft performance model
   c. Engine efficiency

If no fuel flow measured or estimated through own models, NEATS can estimate (ECTL BADA)
Confidential
Optional in both Method C&D
+ for SAF

5. Fuel properties
   a. Hydrogen to carbon (H:C) ratio
   b. Aromatic content of the fuel
   c. Net calorific value

Challenge : mixed in airport fuel farm. Leads on finding the data : e.g. info from fuel suppliers per batch to purchasing AO, to be facilitated by update of IATA fuel invoice standard; AO to determine dynamic max levels per airport according to batches, used to calculate H:C per flight. Coordination with ReFuelEU (Art.10) encouraged.
Confidential (?). Defaults in NEATS: max regularatory (known) levels (ASTM)
Needed in Method C
+ for technology

6. Weather data
   a. Basic weather data (altitude corrected humidity, temperature, pressure), OR
   b. Enhanced weather data (above + RHi, etc) through NWP

Common reference NWP model provided through NEATS (national weather service)
Enhanced and basic needed respectively in Method C and Method D
+ for operations

# Models' comparison

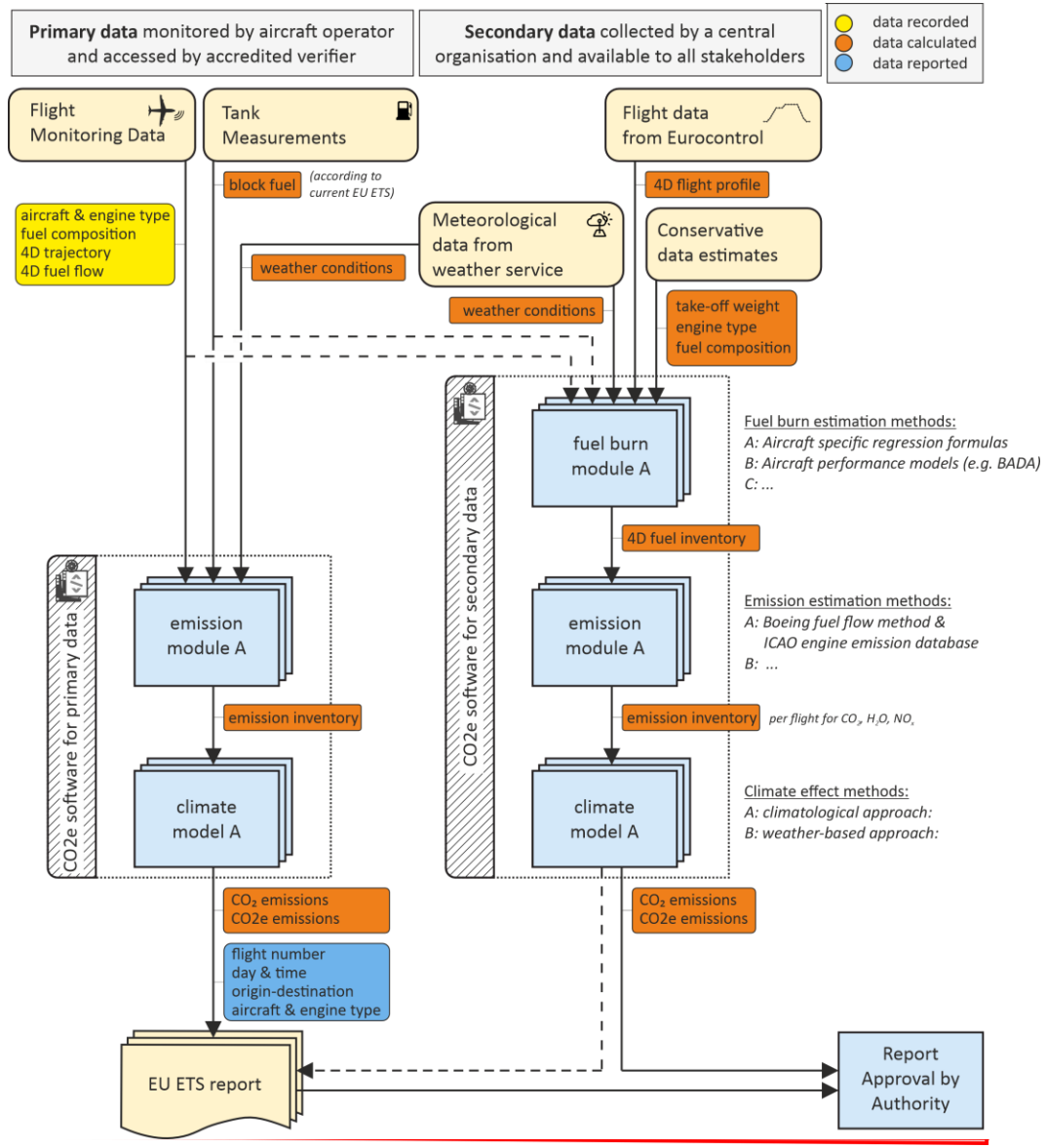
| Model/ Requirement | (Open) AirClim | CoCiP (pycon-trails*) | aCCFs | LinClim | FAiR | OSCAR | LEEA |
|---|---|---|---|---|---|---|---|
| Scope of output | ++ | - | ++ | ++ | ++ | ++ | ++ |
| Weather dependency | -- | ++ | ++ | -- | -- | -- | -- |
| Location dependency | ++ | ++ | ++ | -- | -- | -- | 0 |
| Availability of required data | ++ | ++ | ++ | - | + | ++ | ++ |
| Transparency | + | ++ | ++ | - | ++ | ++ | - |
| Computational effort | ++ | + | ++ | ++ | + | + | ++ |
| Fuel type consideration | + | ++ | + | ? | -- | -- | -- |
| Engine/aircraft type consideration | 0 | ++ | 0 | ? | -- | -- | -- |

Source: To70, DLR, AerLabs

** The pycontrails framework includes an interface to run aCCFs, which facilitates consistent treatment of input variables (flight and weather data) in the separate models CoCiP and aCCFs, allowing analysis of all non-CO2 effects with aCCFs (contrails, NOx and H2O) and detailed contrail analysis with CoCiP in one environment.*

- **Scope of output**: Can the model calculate aviation non-$CO_2$ effects of all climate agents?
- **Weather/Location dependency**: Are the computations sensitive to weather/location dependent aircraft emissions data?
- **Availability of required data**: Are all required data for application of the models available from AOs and weather services for operational use (under the assumption that data providers have no restrictions in providing data)?
- **Transparency**: Are the models and their underlying attributes well documented and freely available?
- **Computational effort**: Is the effort to apply the model applicable in an operationalised manner for AOs and authorities?
- **Fuel/engine/aircraft type consideration**: Are the results sensitive to the fuel/engine/aircraft type?

# MRV Functioning



# Thank you

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