



Contrails: R&D roadmap

Sustainable Skies

Conference: Contrails in Focus

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SESAR: ATM R&D since 2008

Three programmes:

- SESAR 1 (2008-2016)
- SESAR 2020 (2016 -2024) – ongoing
- Digital European Sky R&D programme (2021-2031)

Multiple remote towers



Enhanced vision systems



Virtual centres



L-band Digital Aeronautical Communications Systems (in the pipeline)



[Link to digital SESAR Solutions catalogue](#)

Contrails... “sometimes” -> ATM perspective



Persistent
contrails

SOMETIMES



Aviation
Induced
Cloudiness

SOMETIMES

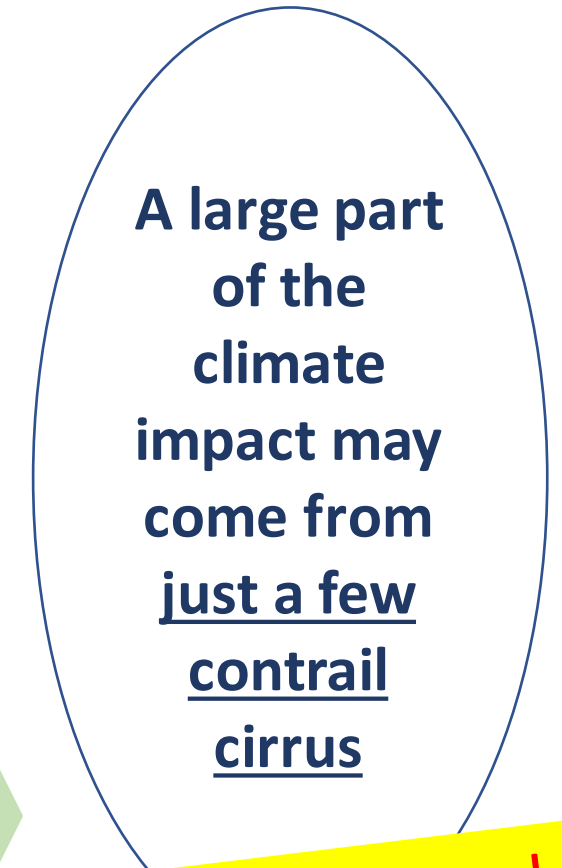
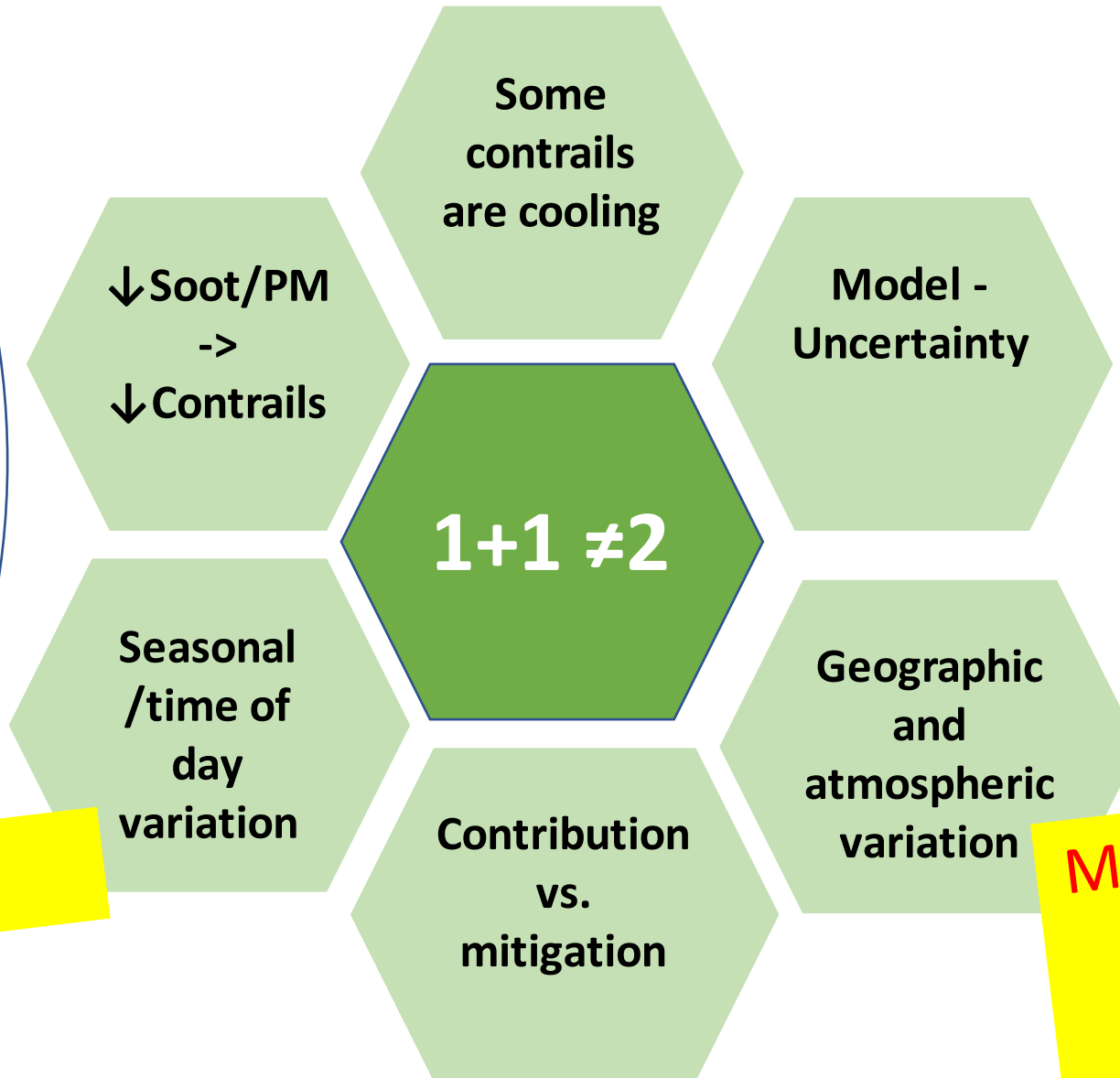


Warming
effect

The bad news and the good news



The complexity



Maybe we just need to worry about a few instances

Avoiding (those few) warming AIC

INCREASINGLY PROBLEMATIC

Cleaner fuels



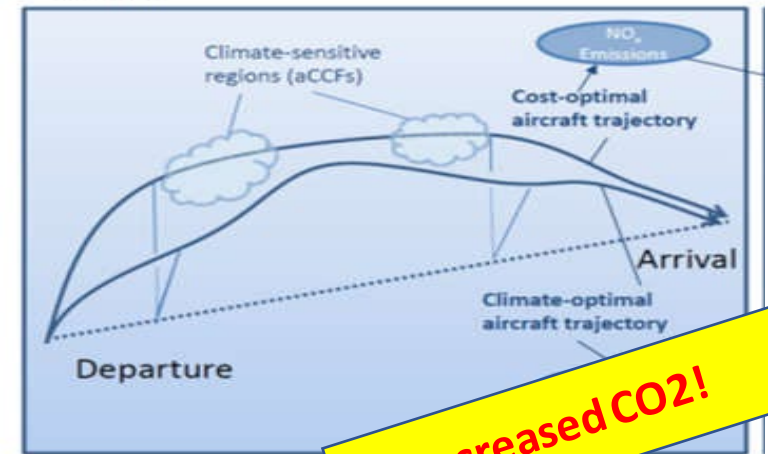
Not just SAF!

Change flight times



Seasonal/regional patterns

Change flight routes



Increased CO2!

ECO-SENSITIVE AREAS (E-AREAS)

AOM-0611

Prediction (e.g. 4 hours ahead) & monitor evolution in real time

Declare E-area and manage access as per agreed policy

Atmospheric situation, in particular humidity



Traffic demand (routes and fuel quality)

Calculate climate impact using Climate Change Functions
In case...

1) All traffic avoids E-area

2) Some aircraft avoid E-area

3) All aircraft are allowed through the E-area

Remember
1+1 ≠ 2

Network approach
~~Individual flight approach~~

Collaborative decision making

CONTRAILS AND TBO

TBO ≠ “ATC intervention by exception”:

SESAR TBO ↑ automation and efficiency of ATC intervention

- TBO is NOT a rigid 4D contract between ANSP and AU
- Separation and traffic synchronisation can't be arranged strategically **unless large buffers are added**
- ATC intervention will NOT be the exception

In particular, TBO cannot guarantee that cruising level in flight plan will be actual cruising level



Contrail-free flight plan ≠
contrail-free flight

(even without considering
uncertainty of MET prediction!)

Some key ATM R&D challenges

- Consider **contrails in context** to CO₂ and other non- CO₂ emissions
 - with choice of look ahead time / metrics)
- First look for **mitigations with no CO₂ penalty**:
 - Load cleaner fuel on aircraft that will fly through E-areas
 - Consider seasonal/regional timetable adjustments
 - If decision is to close E-area, can we recover at least some CO₂ by providing extra capacity in another sector/area?
 - ...
- **Work together** combining ATM +AOC + atmospheric physics
- **Do not forget 1+1 ≠ 2**
 - Avoid flight-by-flight perspective -> work with groups of flights
 - Take a network approach
- Remember **if re-routing, planning is not enough**
 - Need to follow up with ATC & flight crew in real time during the flight execution phase



Thank you for your attention

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