



Calculating Global Emissions from Aviation – FAST

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Outline

- Global aviation inventory model
- Purpose
- Construction
- Usage – example applications



Global aviation inventory models



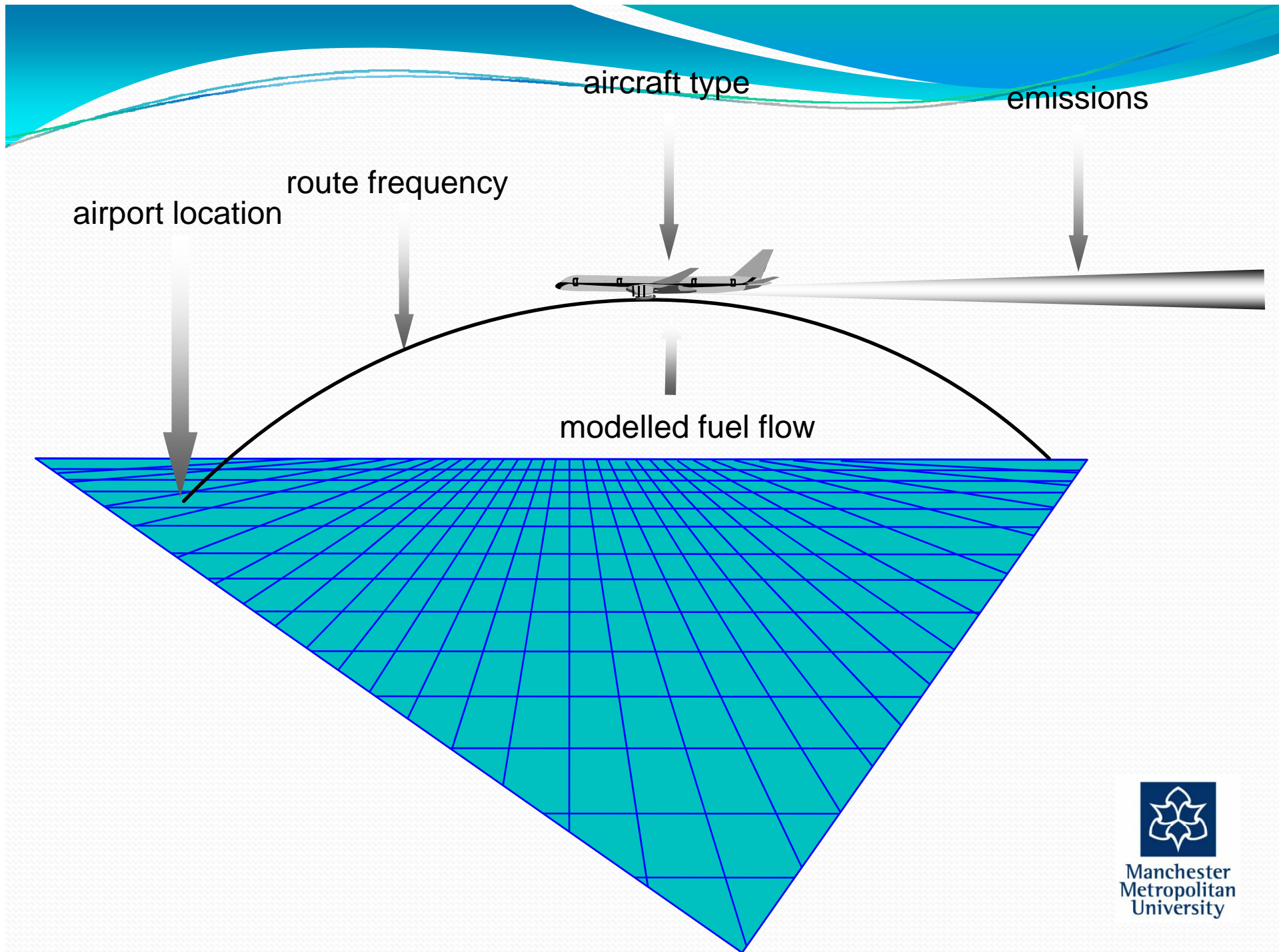
FAST model construction

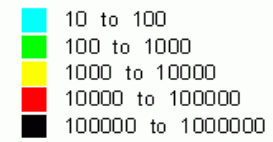
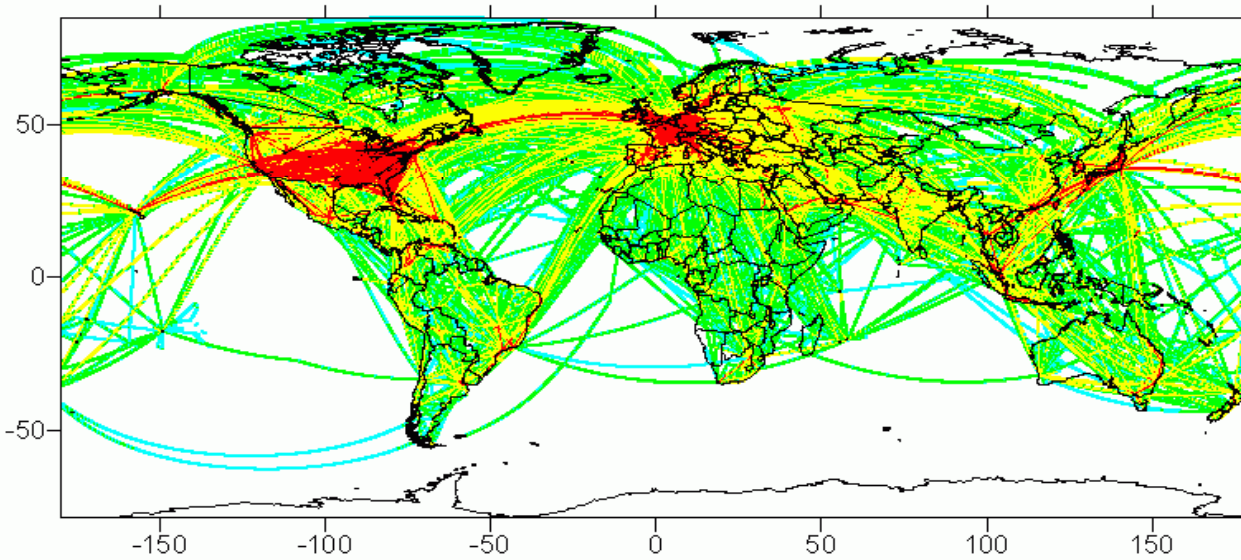
- Developed 1998 – 1999, DERA; MMU 2003 on...
- Based upon ANCAT/EC2 methodology
 - ANCAT/EC1 published in *Atmospheric Environment* (1998)
 - ANCAT/EC2 report published 1998
 - ANCAT/EC2 major component of current-day inventories in Chapter 9 of IPCC (1999)
- Improved methodology and functionality over ANCAT/EC2 method
- Used extensively in 5FP project ‘TRADEOFF’ – underpins revised RF calculations (*Sausen et al., 2005*); cirrus trend analysis (*Stordal et al., 2005*); chemistry calculations (*Gauss et al., 2006*)
- Currently being used for base-year and 2050 scenario calculations within EU Integrated Project ‘Quantify’
- Used for policy analysis – e.g. Emission allocations for UK DEFRA



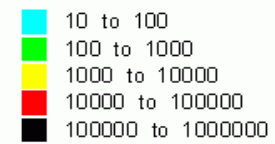
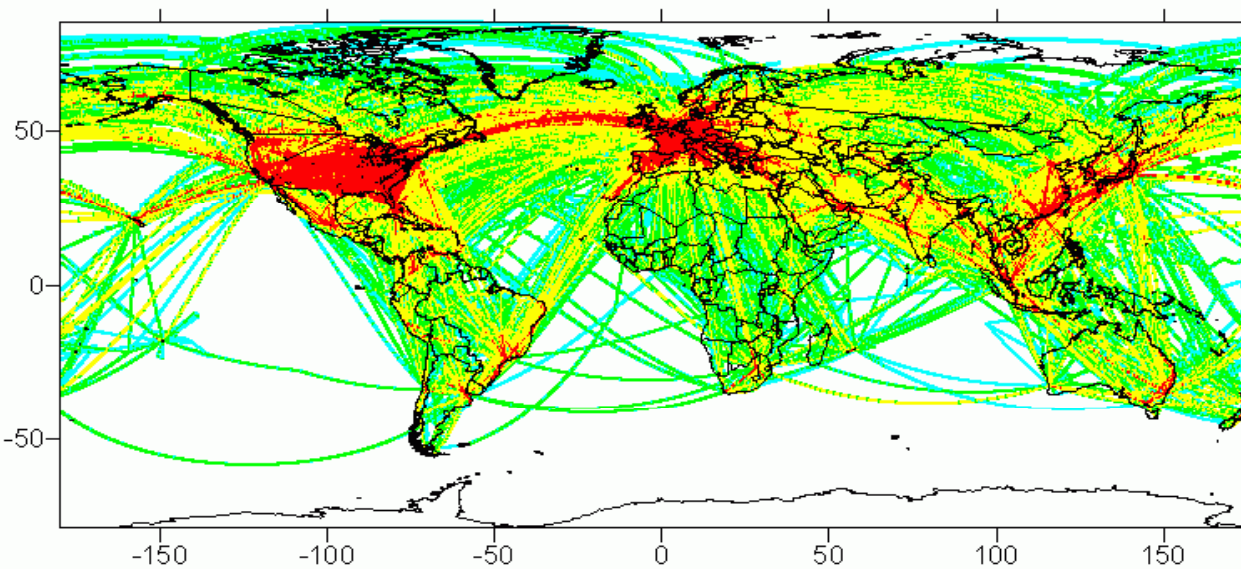
How does it work?

- Movements database OAG, AERO2K(1990, 2000, 2001; 1995, 2005)
- Great circle distances (**routes**)
- Fuel flow characteristics (PIANO) ~60 aircraft types
- Infinitely variable horizontal/vertical resolution in 3D grids
- Pollutant (NO_x etc.) algorithms
- Underlying country database
- Facilitates forecasts and scenarios (external data)

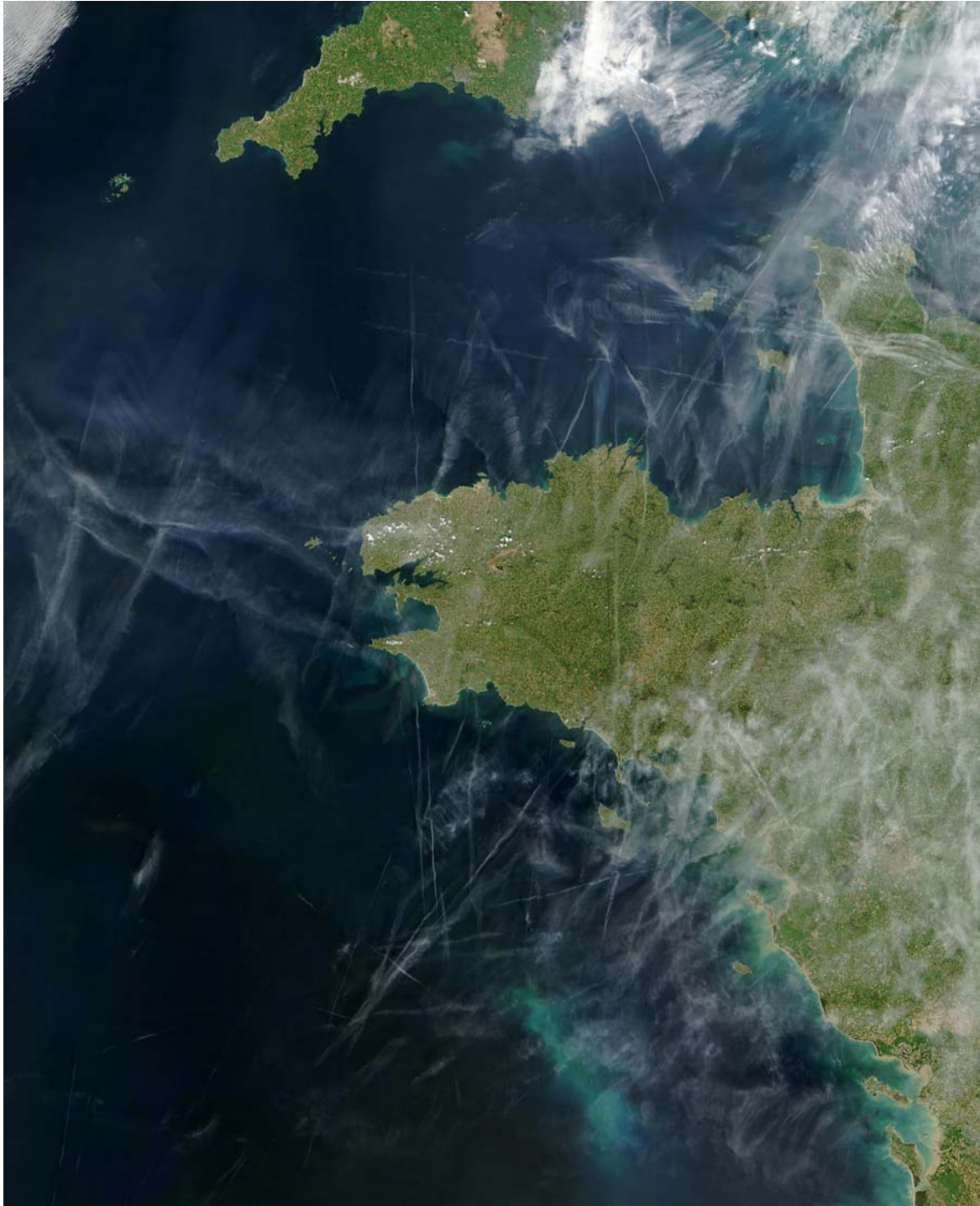




1990



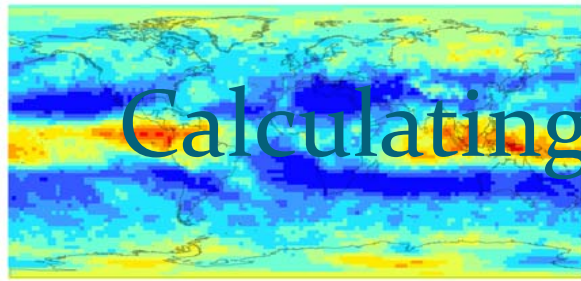
2000



Application examples

- Contrail analyses
- Operational analyses
- Scenarios
- Policy options

Cirrus coverage, 1983-1993 (100 to 500 hPa)



Calculating contrail coverage and RF

Bcf (%)

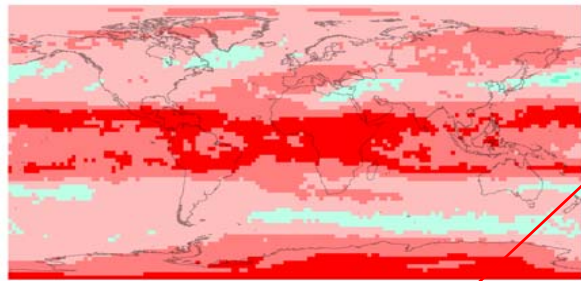


Cirrus cloud fraction

Contrail observations



Potential contrail coverage, 1983-1993 (100 to 500 hPa)



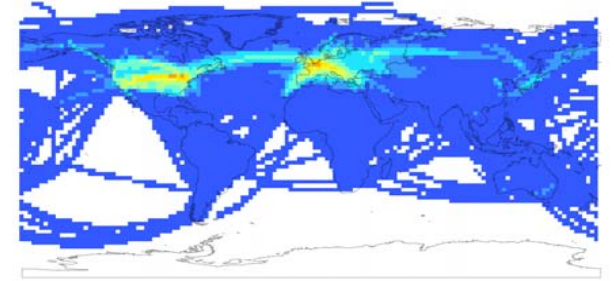
Potential contrail coverage

Contrail coverage

Bpc (%)



Contrail coverage (linear distance)

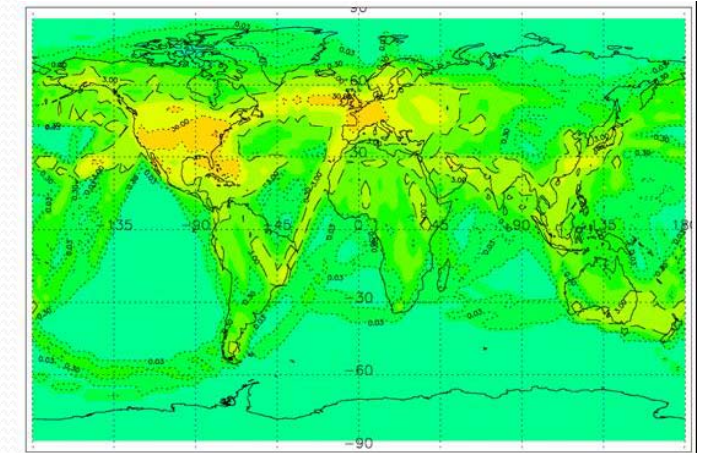
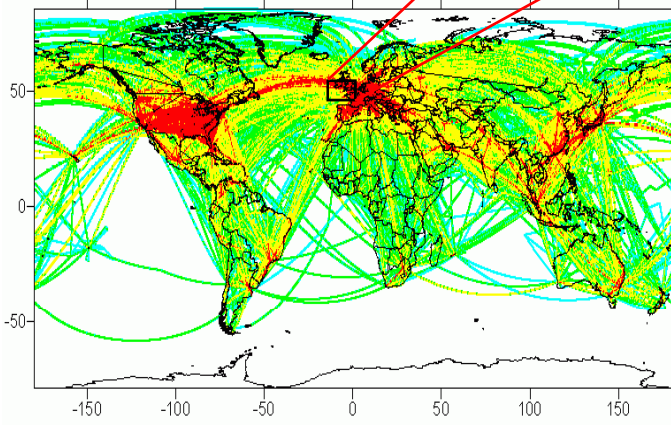


%

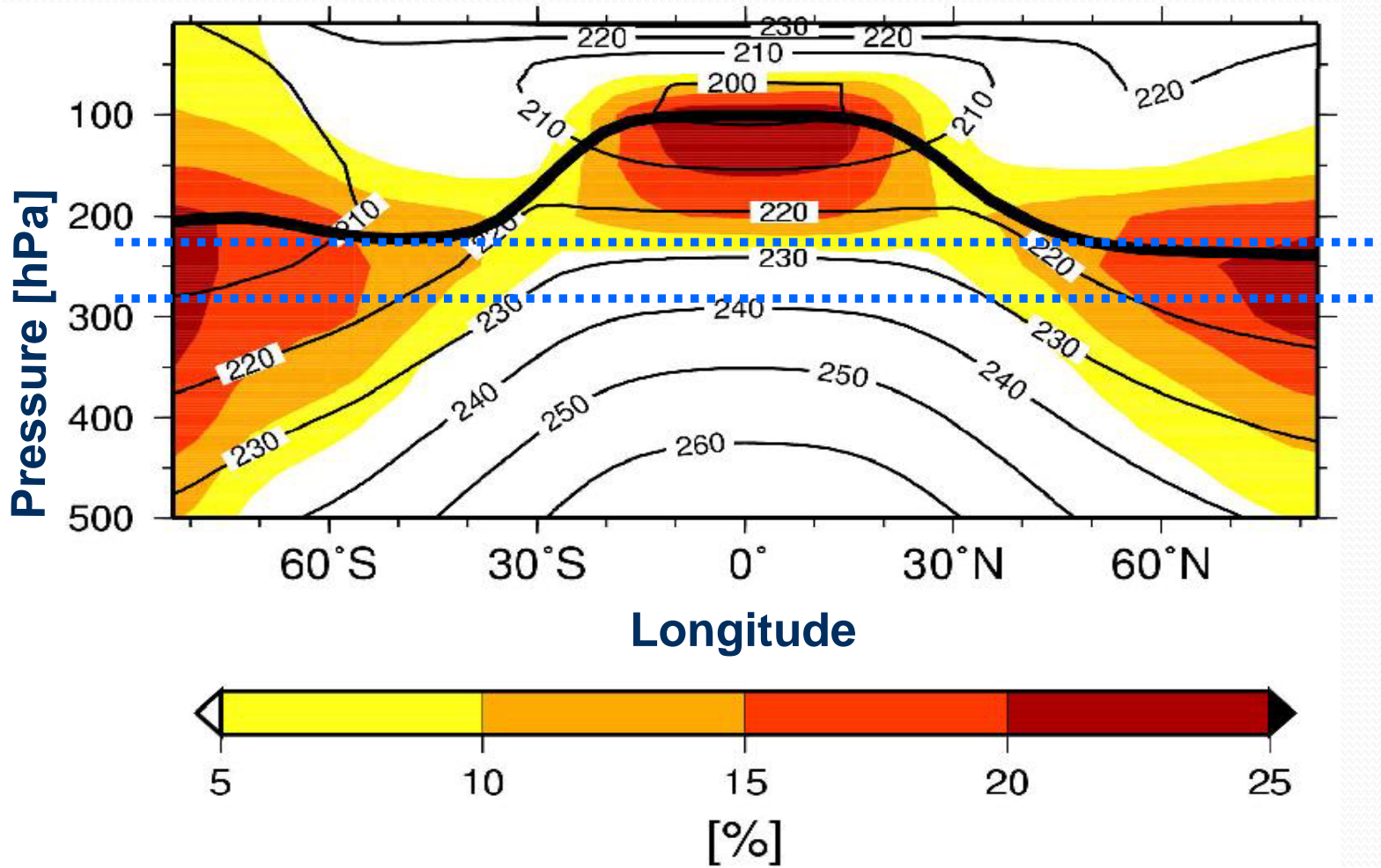


Air traffic density

Contrail RF



Potential contrail coverage

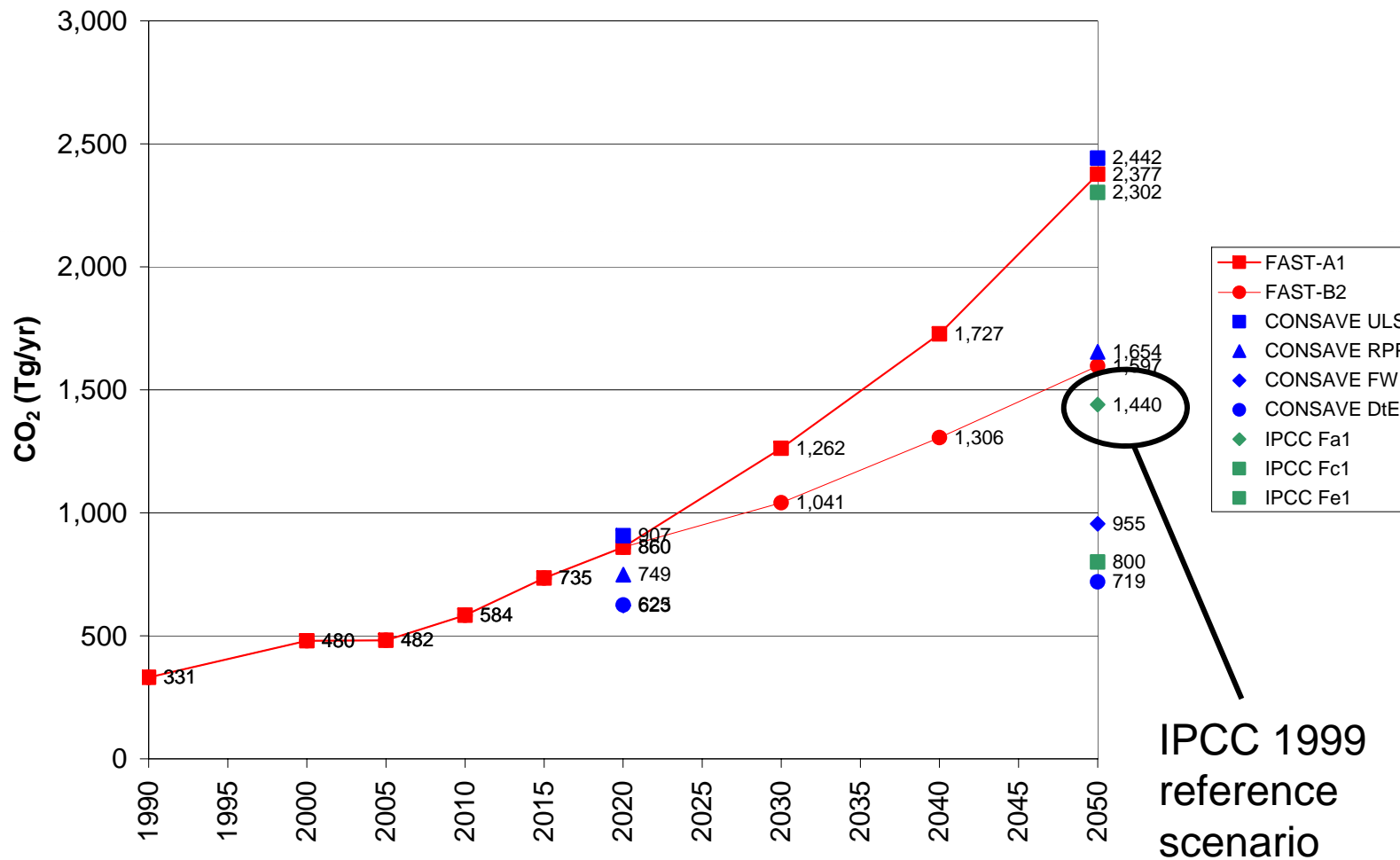


Changes in global fuel, contrail coverage and RF – altitude variations

	Fuel Consumption	Visible Contrail Cover	net RF by Contrails
TRADEOFF + 2kft	- 0,45 %	+ 5,5 %	+ 5,3 %
TRADEOFF base case	111,5 Tg	0,0472	1,9 mW/m ²
TRADEOFF - 2kft	+ 2,69 %	- 12,7 %	- 15,8 %
TRADEOFF - 4kft	+ 3,59 %	- 28,4 %	- 31,6 %
TRADEOFF - 6kft	+ 5,83 %	- 44,5 %	- 47,4 %



Scenarios



IPCC 1999
reference
scenario

Policy analysis – emissions allocations

1. None
2. Pro rata global bunker fuels with national emissions (UNFCCC low tiers from bunker fuel)
3. Where the fuel is sold
4. Nationality of airline, country of registration, country of operation
5. 'Standard' definition of international aviation
6. As above but by passengers or freight (b)
7. By nationality of passenger or freight
8. By air space

data

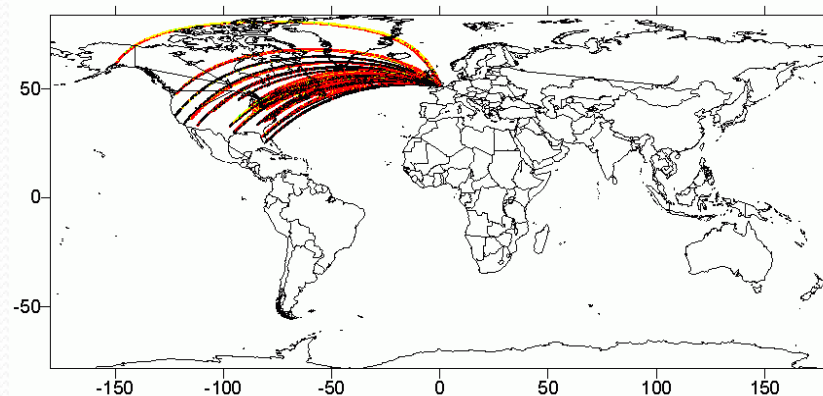
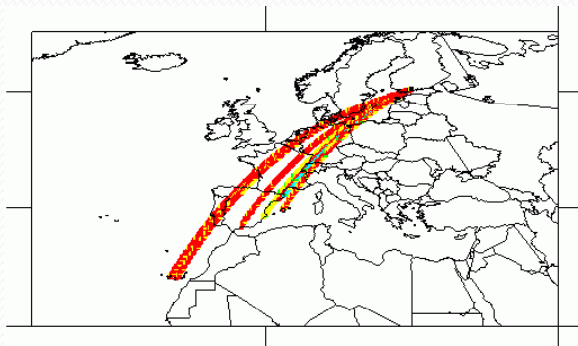
modelling



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UNFCCC allocation options

- What is the impact (quantitative emissions) of different allocation option methodologies on the UK and EU25 States?



Statistical analysis of favoured allocation options (3, 4, 5, 6 year 2000)

- Using a Coefficient of Variation statistic (COV)
- Variation for 3, 4, 5, 6 across EU25 is 2.73%
- Variation for 3, 4, 5, 6 across Annex I is 1.29%
- Five countries in EU25 account for 81.6 – 82.6% of EU25 international emissions (UK, De, Fr, NL, I, Es)
- Of these five countries, within-option COVs range between 0.8 – 9.2%
- **Allocation methodology should not be a barrier to progress**



Thank you for your attention

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