Contrail Cirrus Coverage and Radiative Forcing derived from MSG-SEVIRI Data

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TAC Conference, Oxford, 2006 - 06 - 28

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Contrail Cirrus:

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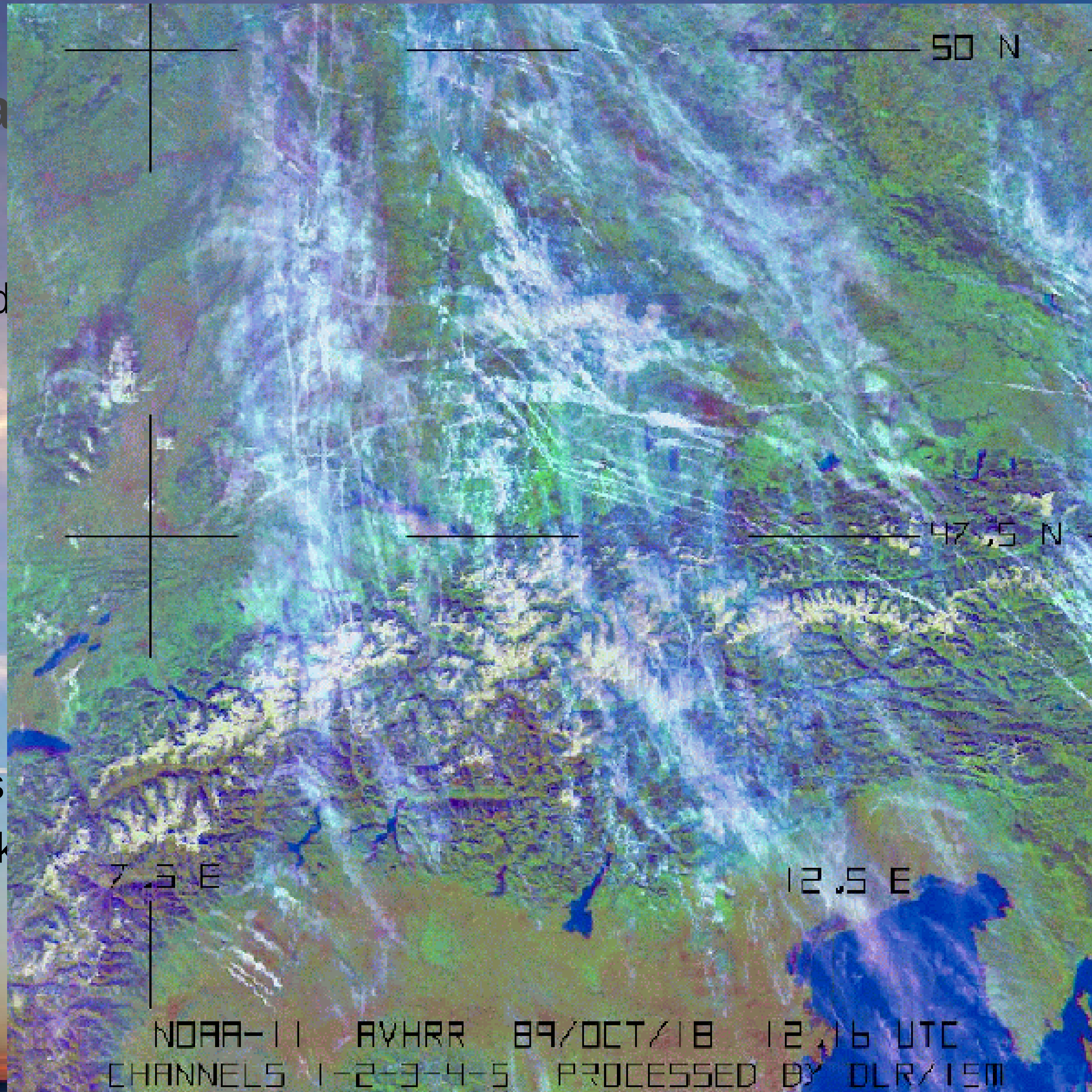
Most results are part of the PhD thesis of Waldemar Krebs

The work shown here was funded by the ESA DUE project CONTRAILS

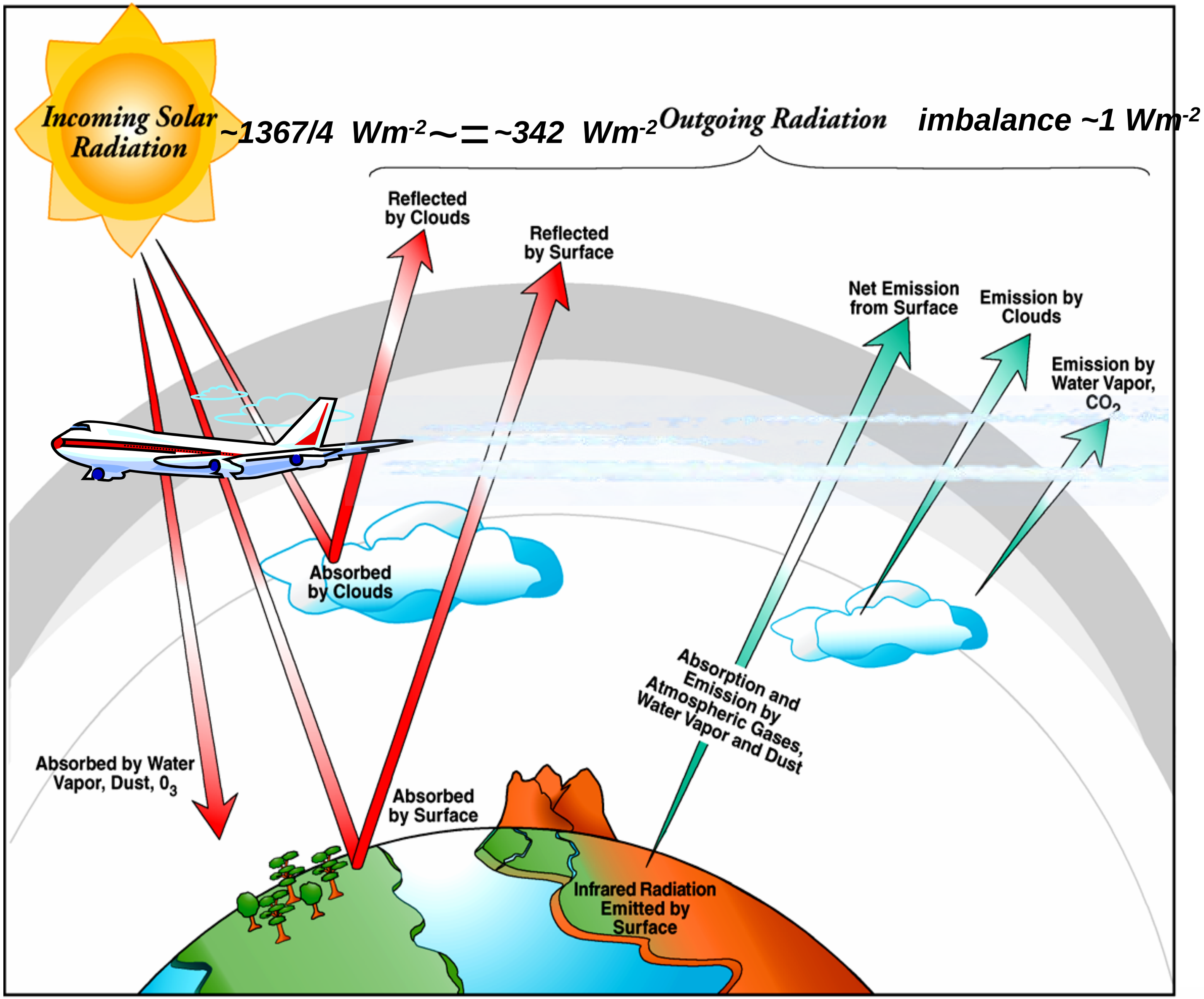
Contra

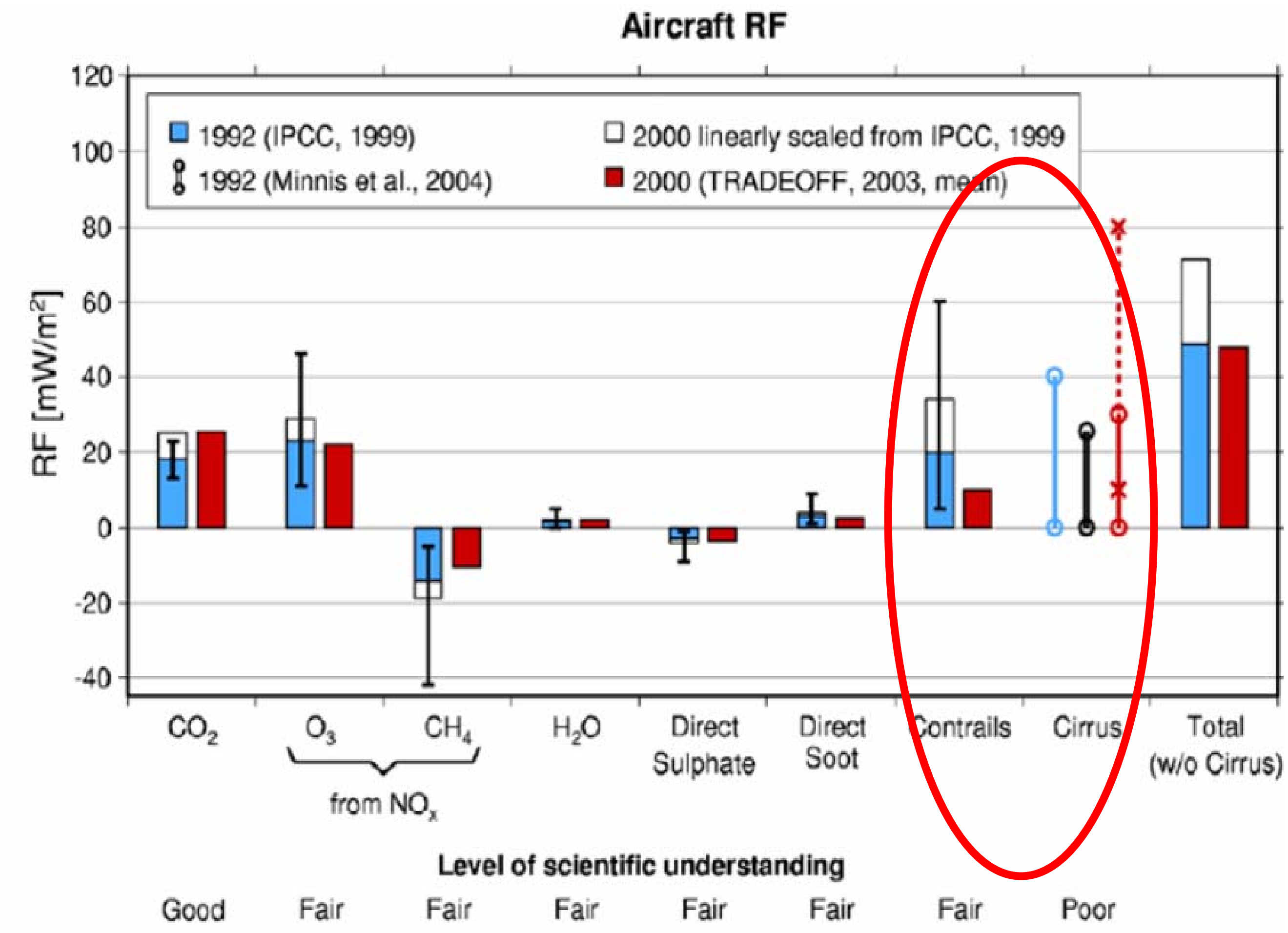
Wald mann



Most res

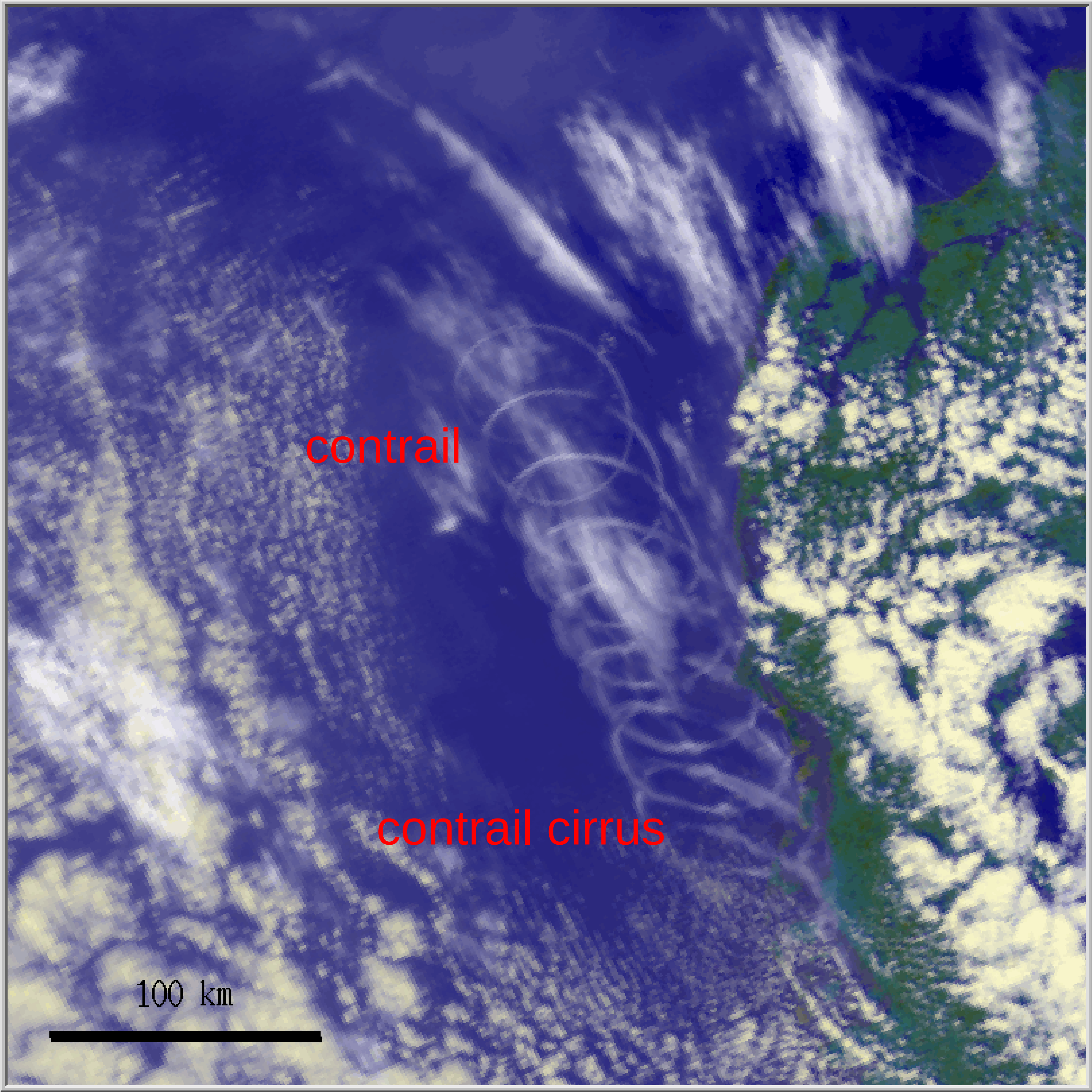
The work RAILS


Incoming Solar Radiation
~1367/4 Wm^{-2} ~= ~342 Wm^{-2}
Outgoing Radiation
imbalance ~1 Wm^{-2}
Reflected by Clouds
Reflected by Surface
Net Emission from Surface
Emission by Clouds
Emission by Water Vapor, CO_2
Absorbed by Clouds
Absorption and Emission by Atmospheric Gases, Water Vapor and Dust
Absorbed by Water Vapor, Dust, O_3
Absorbed by Surface
Infrared Radiation Emitted by Surface



Sausen, Robert; Isaksen, Ivar; Grewe, Volker; Hauglustaine, Didier; Lee, David S.; Myhre, Gunnar; Köhler, Marcus O.; Pitari, Giovanni; Schumann, Ulrich; Stordal, Frode; Zerefos, Christos: **Aviation radiative forcing in 2000: An update on IPCC (1999)** Meteorol. Z. No 14, 4, August 2005, pp. 555-561

- NOAA 14 AVHRR
- May 22 1998 12:36
- ‘Corkscrew’ contrail
- ~1600km long,
- ~2.6 h old at the end

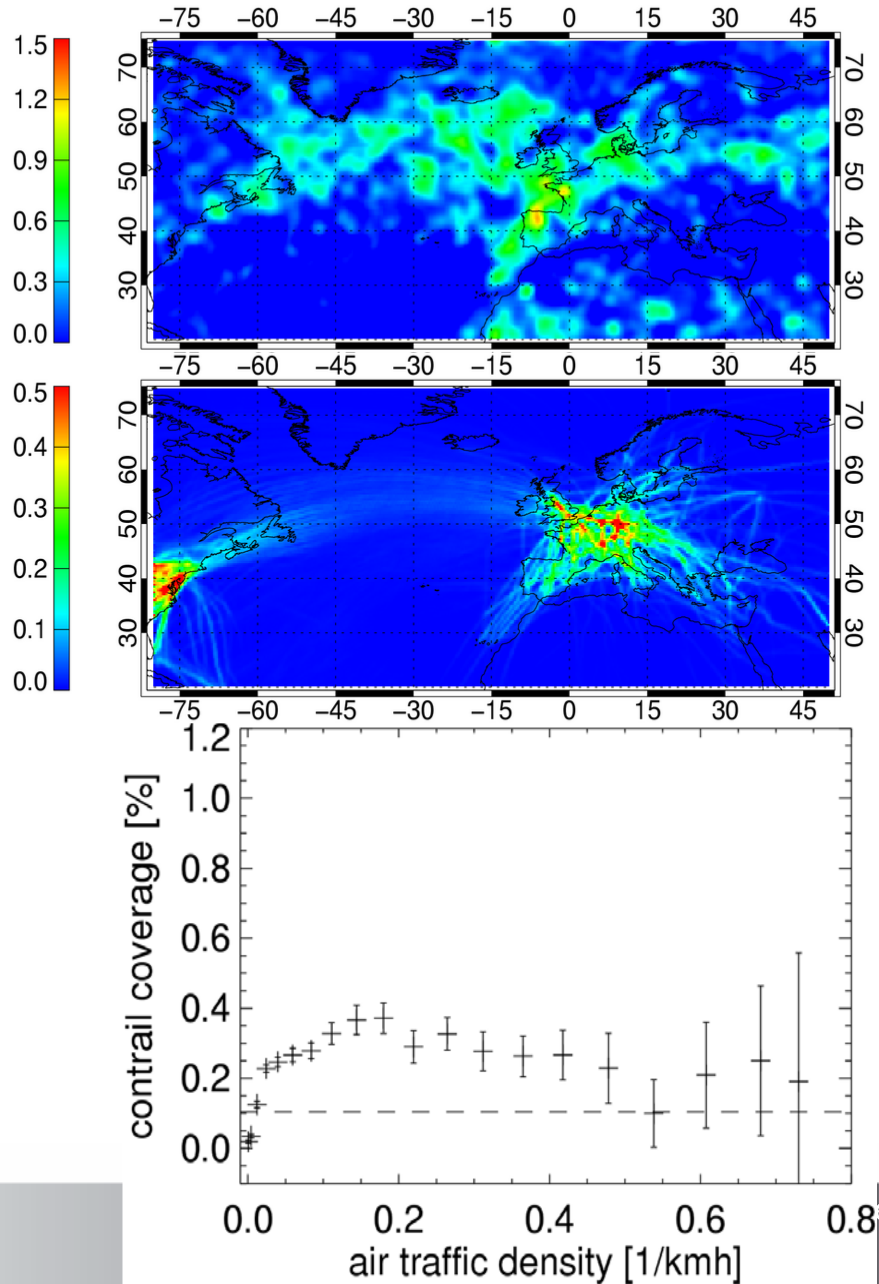


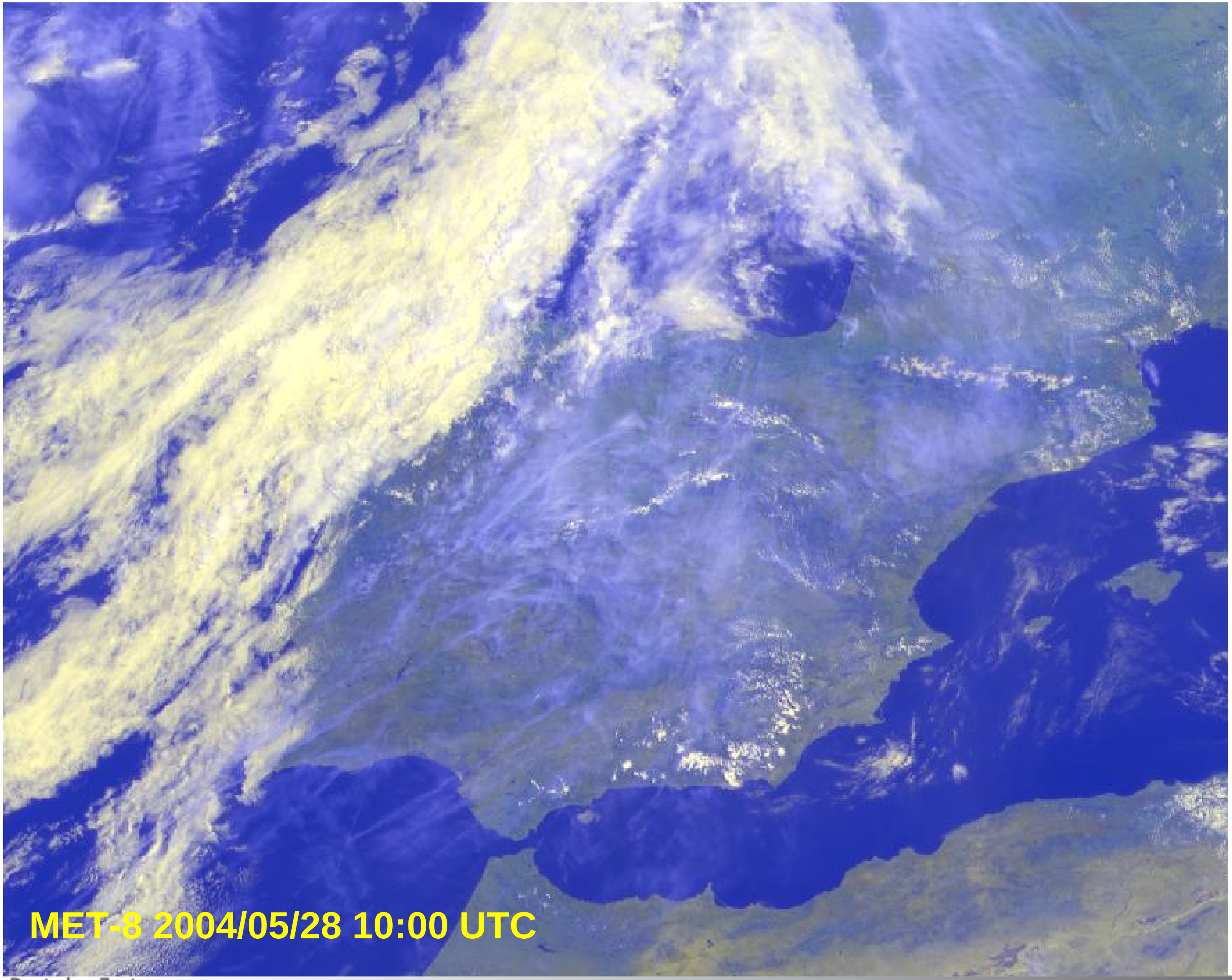
contrail coverage (%) from AATSR data 2004
mean: 0.11 ± 0.04%

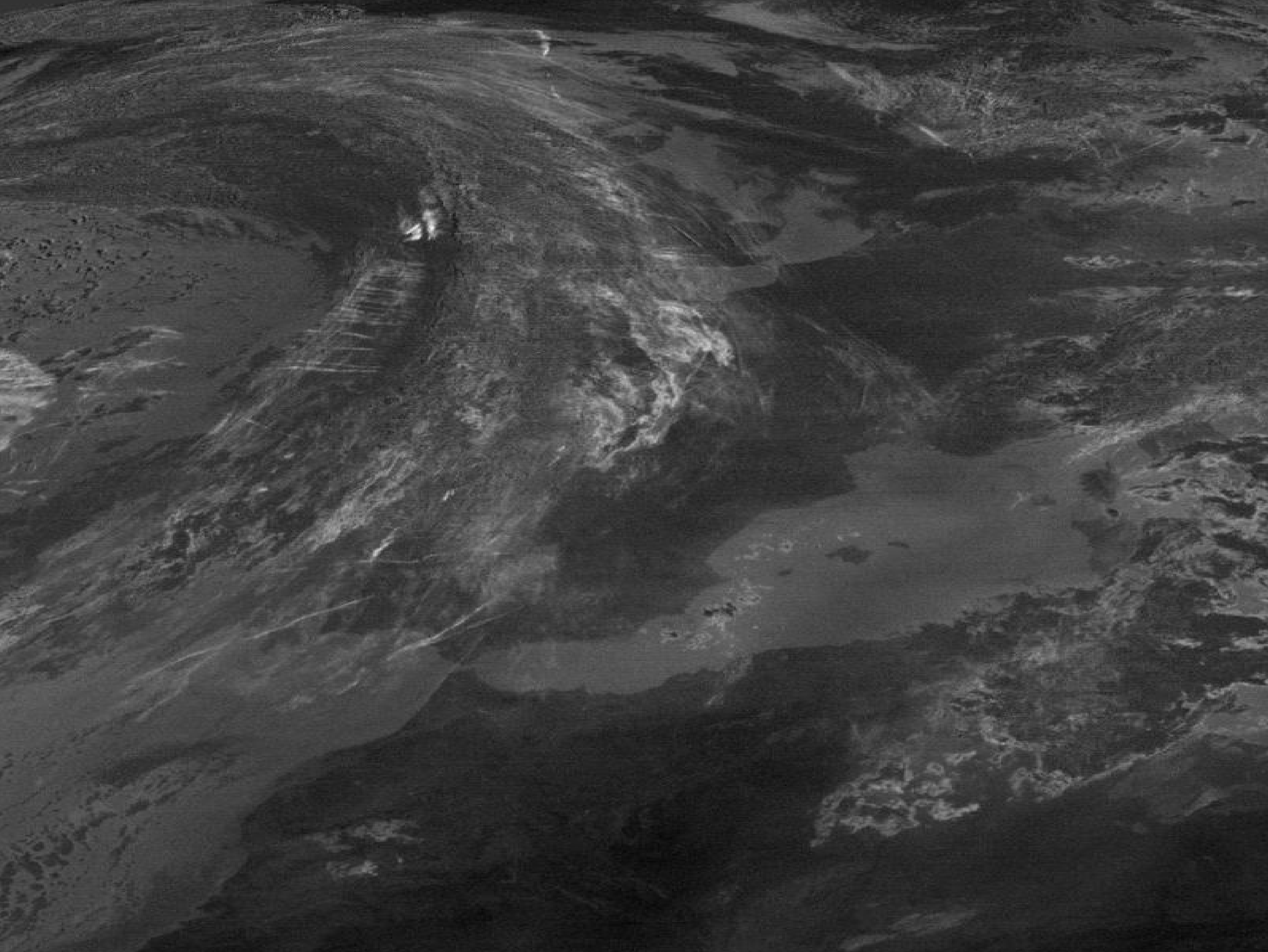
air traffic density [km/(km^{2}h)] within 1 hour before ENVISAT overpass

40% of global air traffic
11% of global area
global estimate:

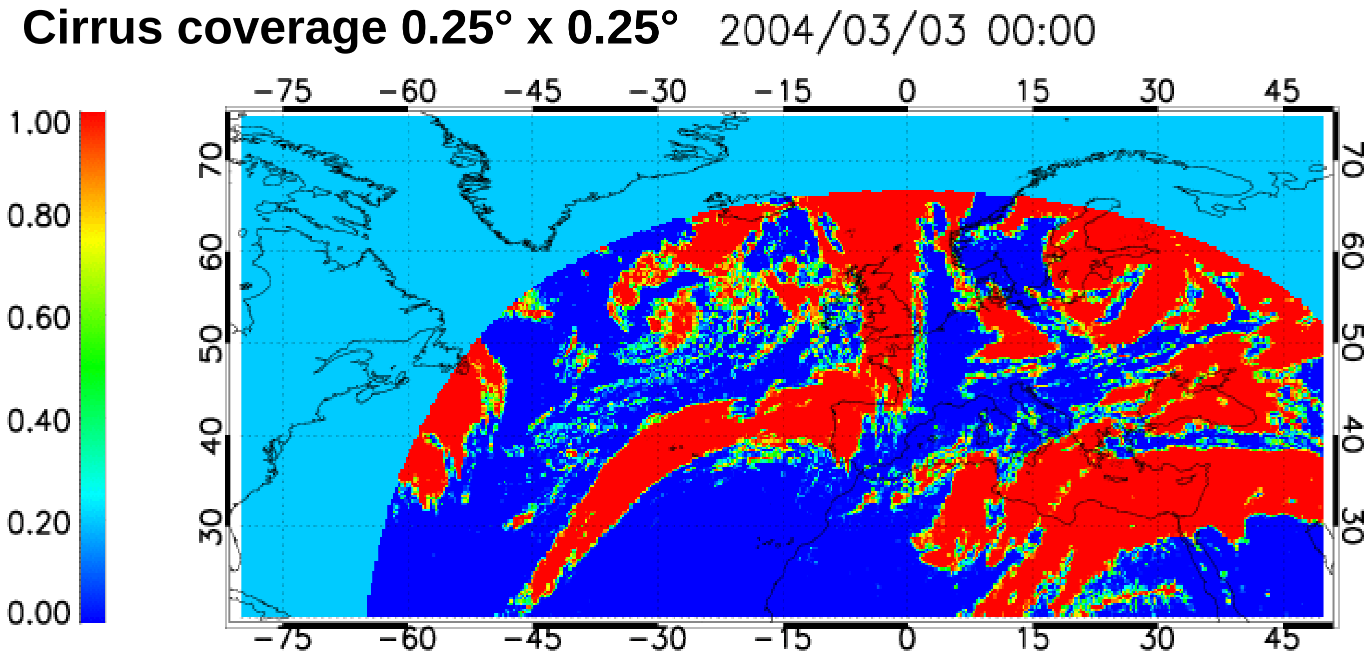
0.03% contrails




MET-8 2004/05/28 10:00 UTC

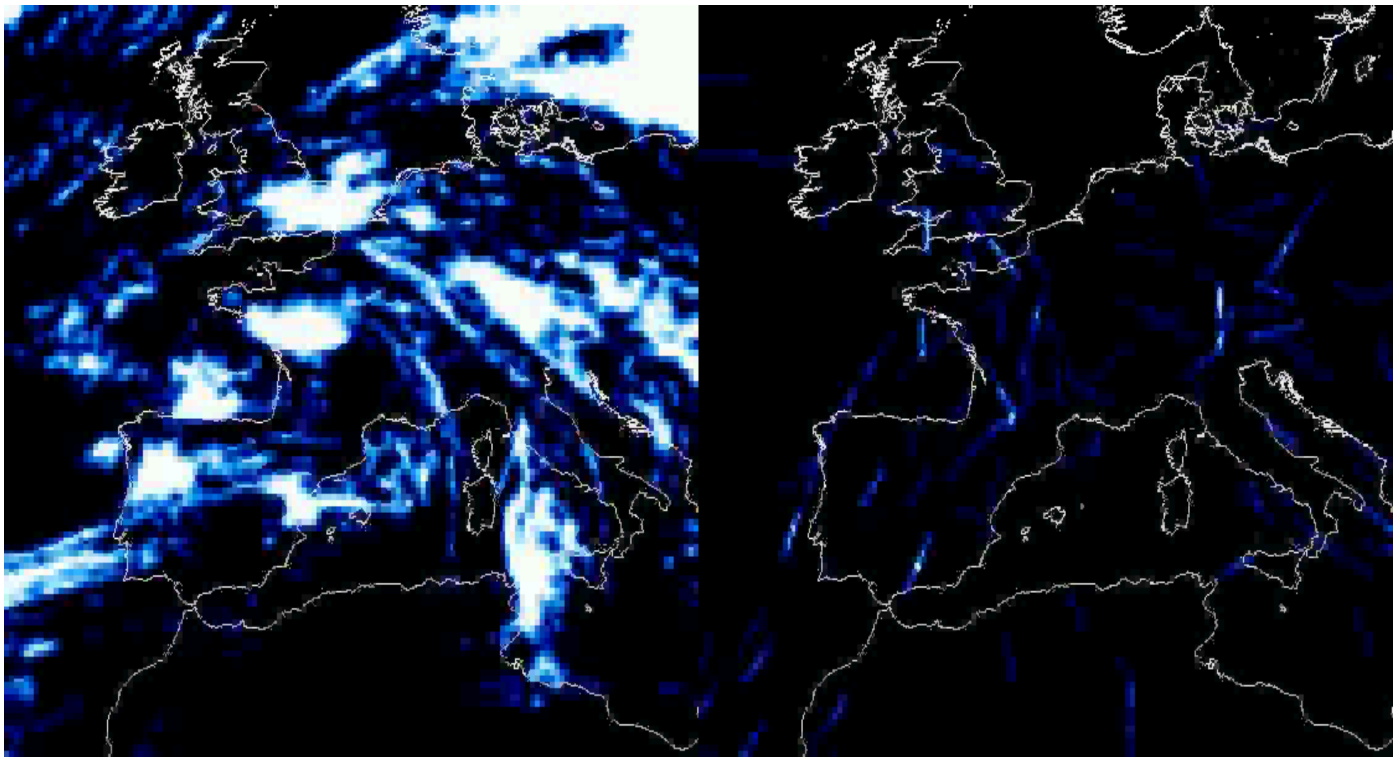


Cirrus coverage 0.25° x 0.25°



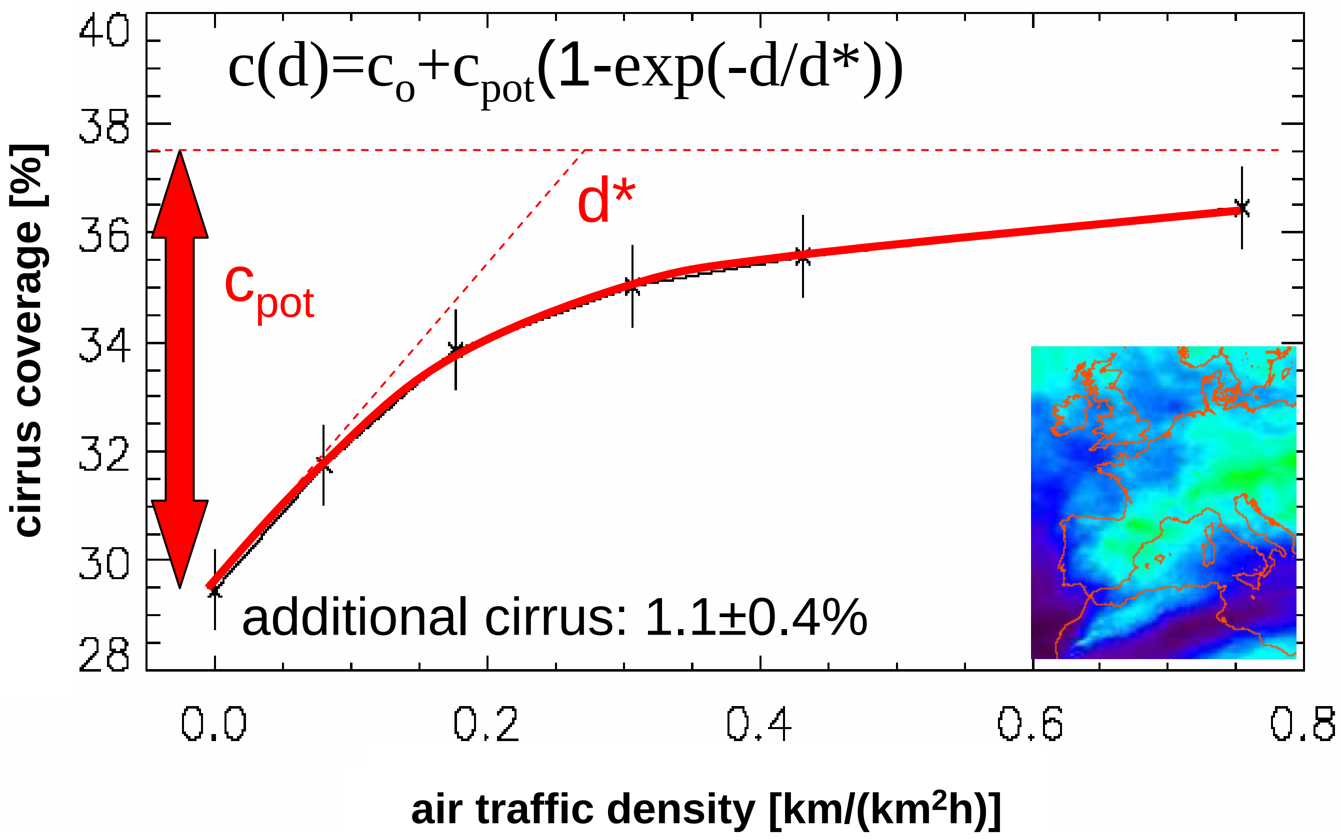
MSG CIRRUS AIR TRAFFIC DENSITY

flight levels: 200 hfeet - 450 hfeet



equidistant cyllindrical co-ordinates, 15W - 20E, 30N - 60N, 0.25° x 0.25°

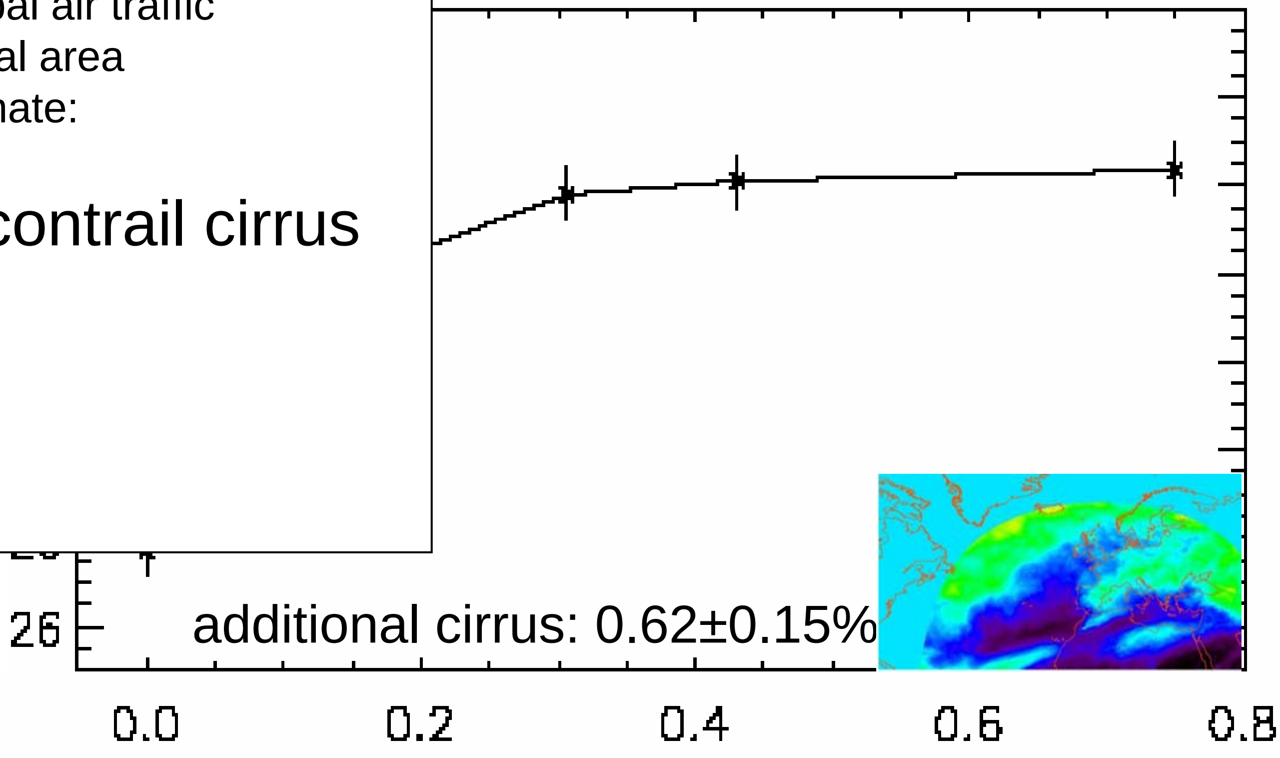
cirrus coverage vs. air traffic density
Feb - Dec 2004



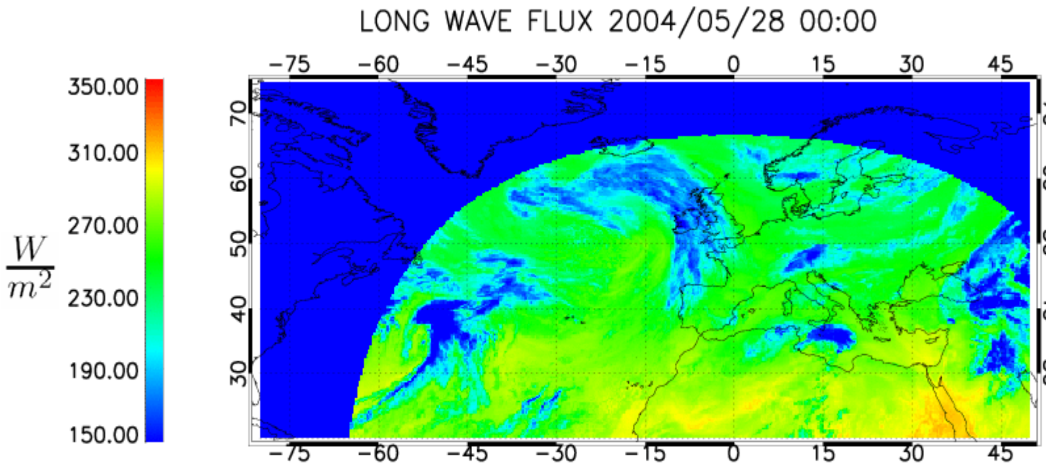
cirrus coverage vs. air traffic density
Feb - Dec 2004

30% of global air traffic
8% of global area
global estimate:

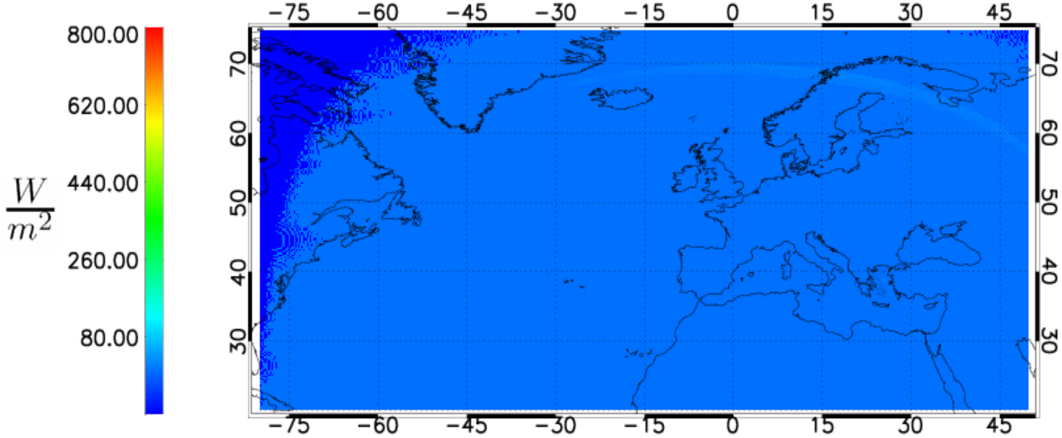
0.17% contrail cirrus



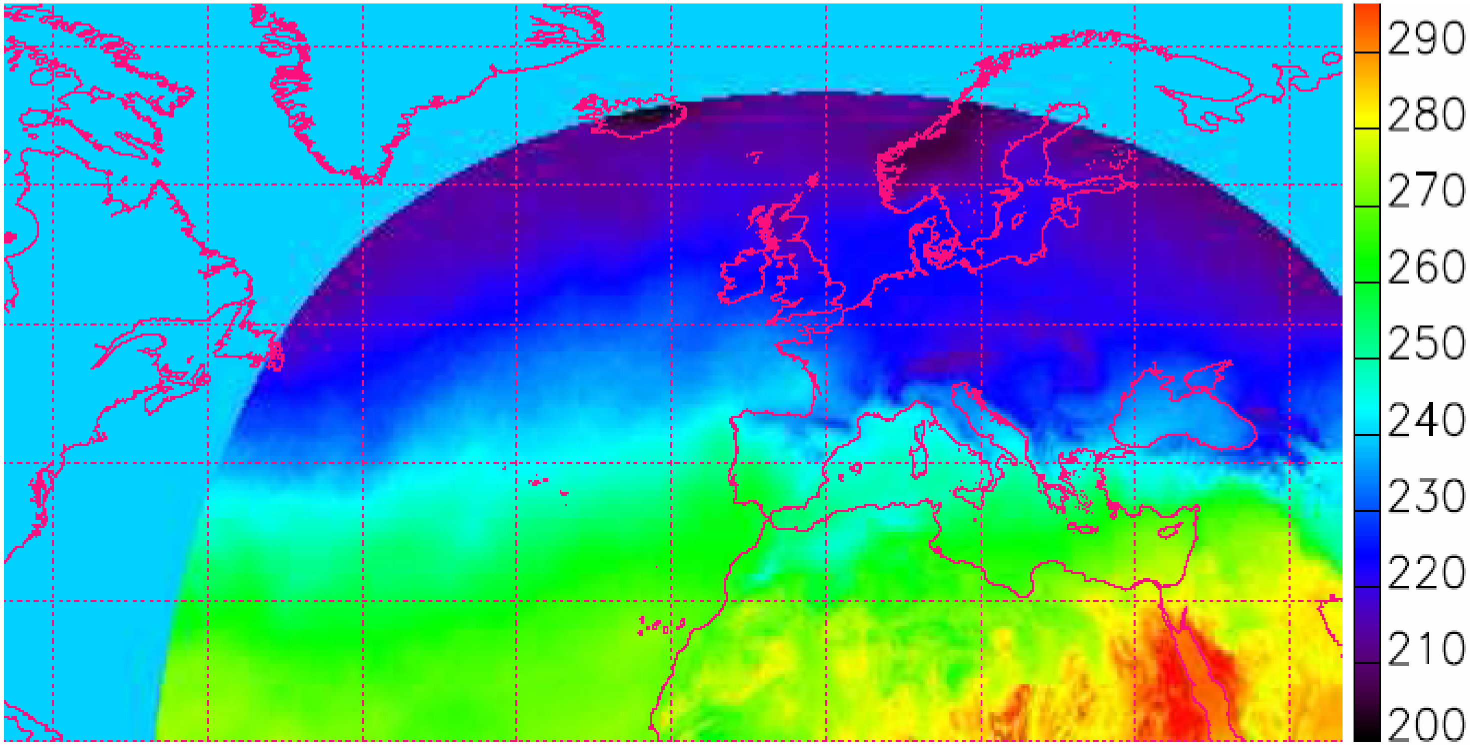
MSG/SEVIRI **terrestrial**
outgoing flux density
Top of atmosphere



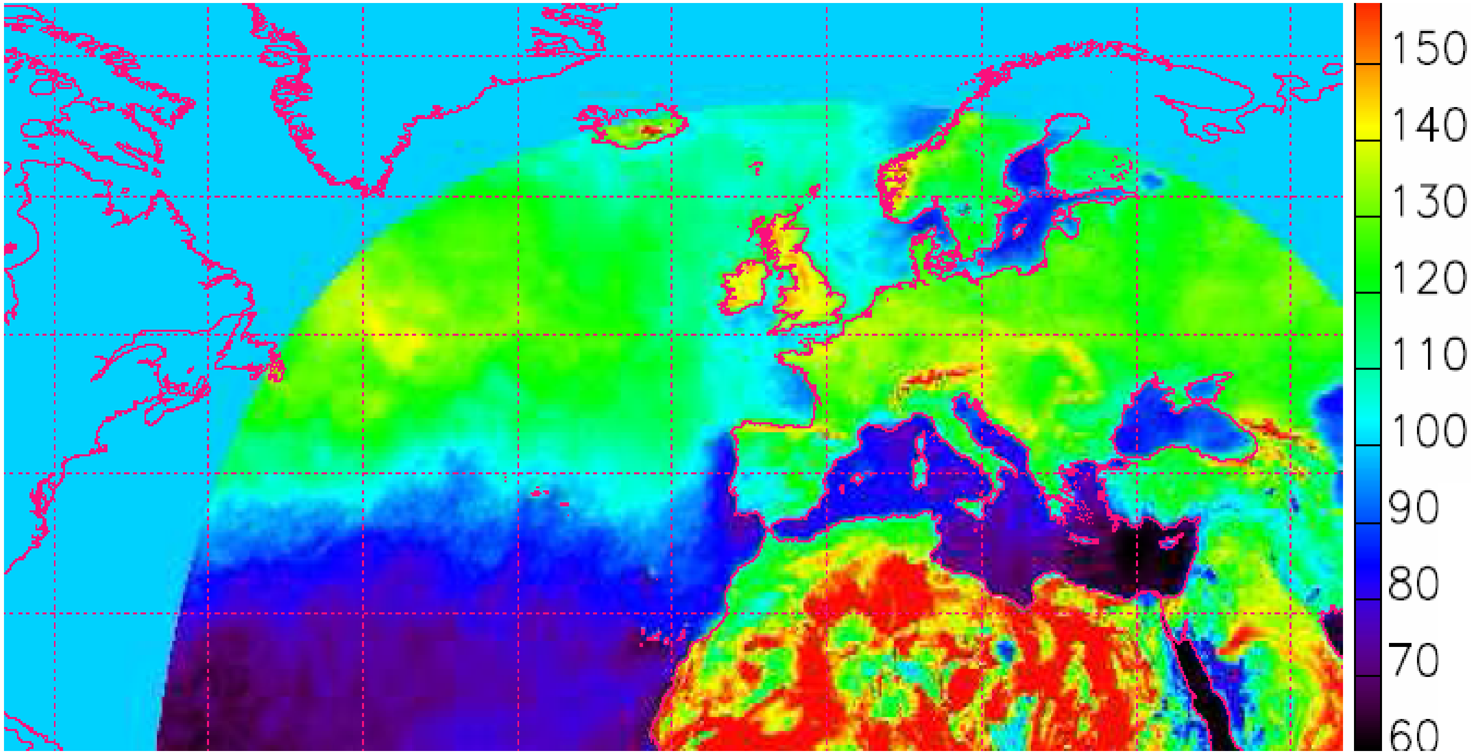
MSG/SEVIRI **reflected**
outgoing flux density
Top of atmosphere



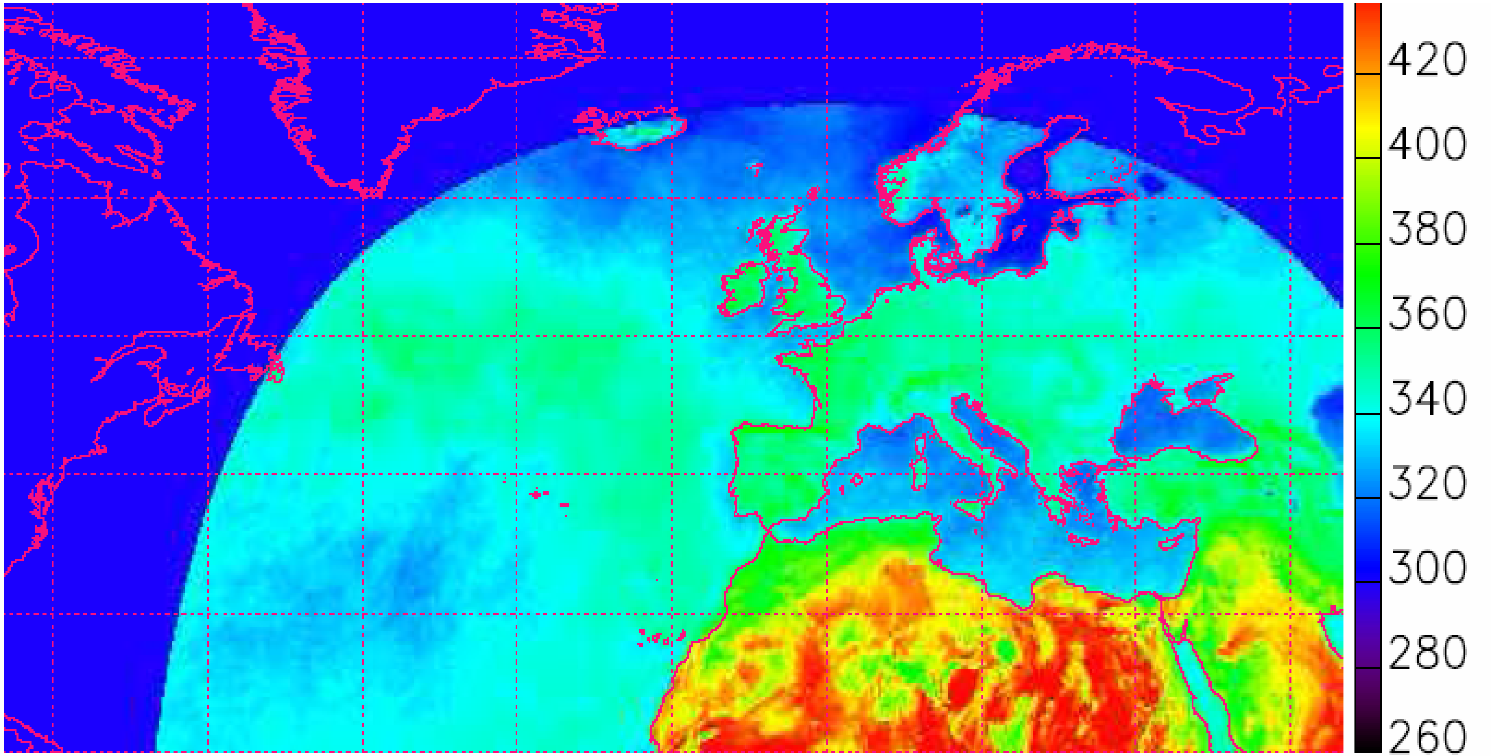
MSG/SEVIRI **terrestrial** outgoing flux density [W/m2] Top of atmosphere



MSG/SEVIRI **reflected** outgoing flux density [W/m2]
Top of atmosphere



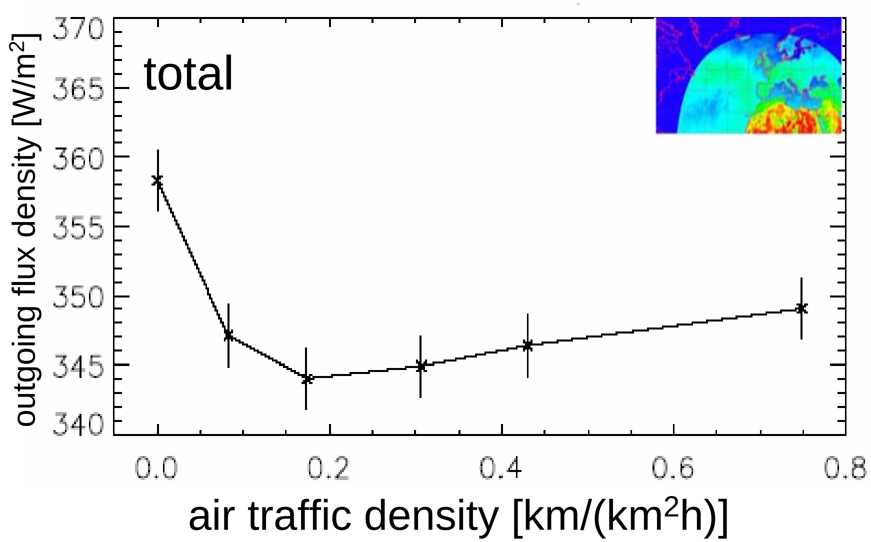
MSG/SEVIRI **total** outgoing flux density [W/m2] Top of atmosphere



Outgoing flux density Feb-Dec 2004 vs. air traffic density

difference w/o air traffic

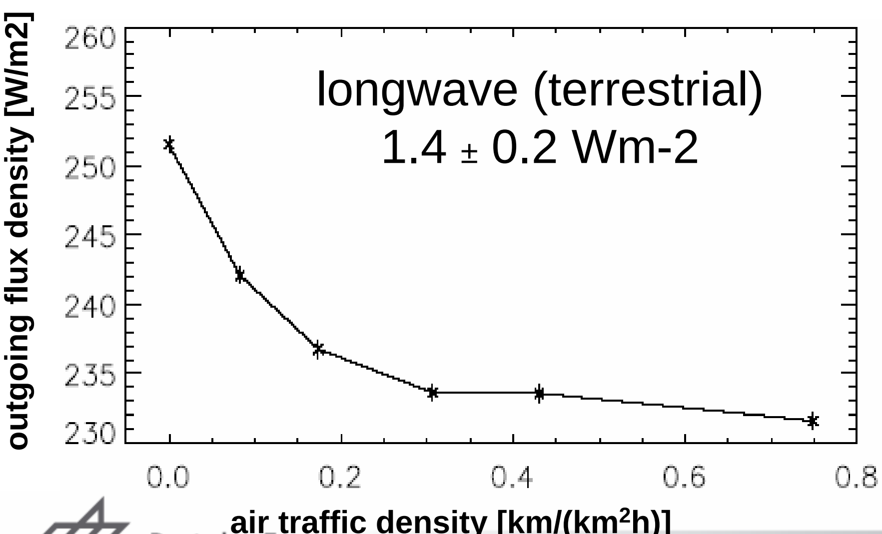
1.1 ± 0.8 Wm^{-2}

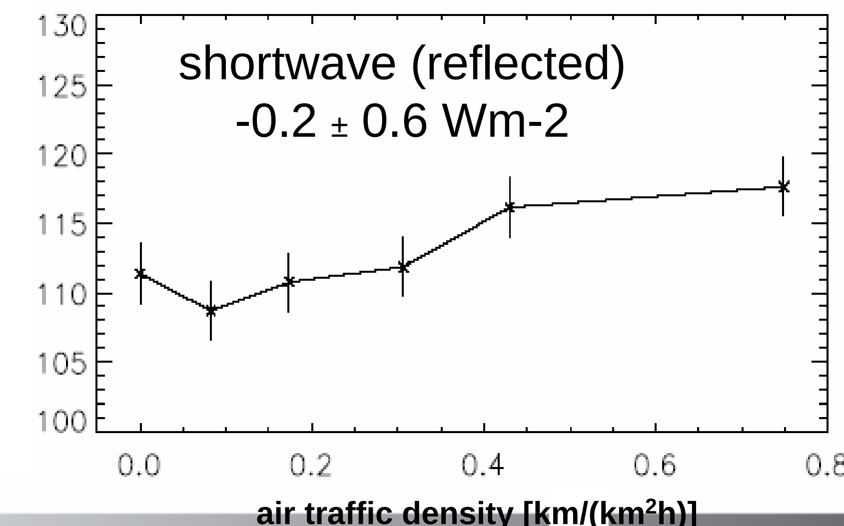


30% of global air traffic
8% of global area
global estimate:

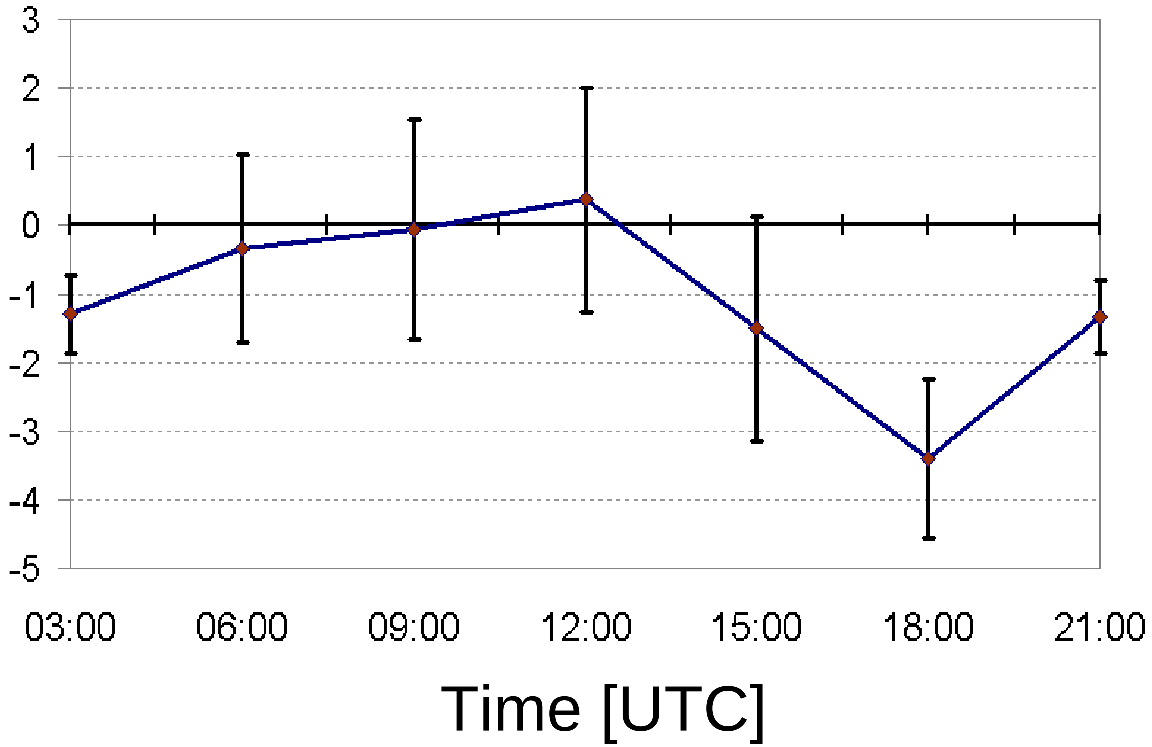
0.3 ± 0.3 Wm^{-2}

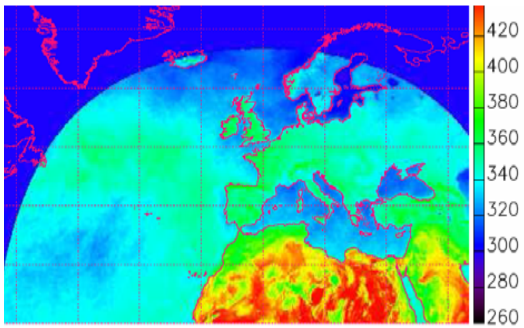
0.4 ± 0.1 Wm-2 (LW)
-0.1 ± 0.3 Wm-2(SW)

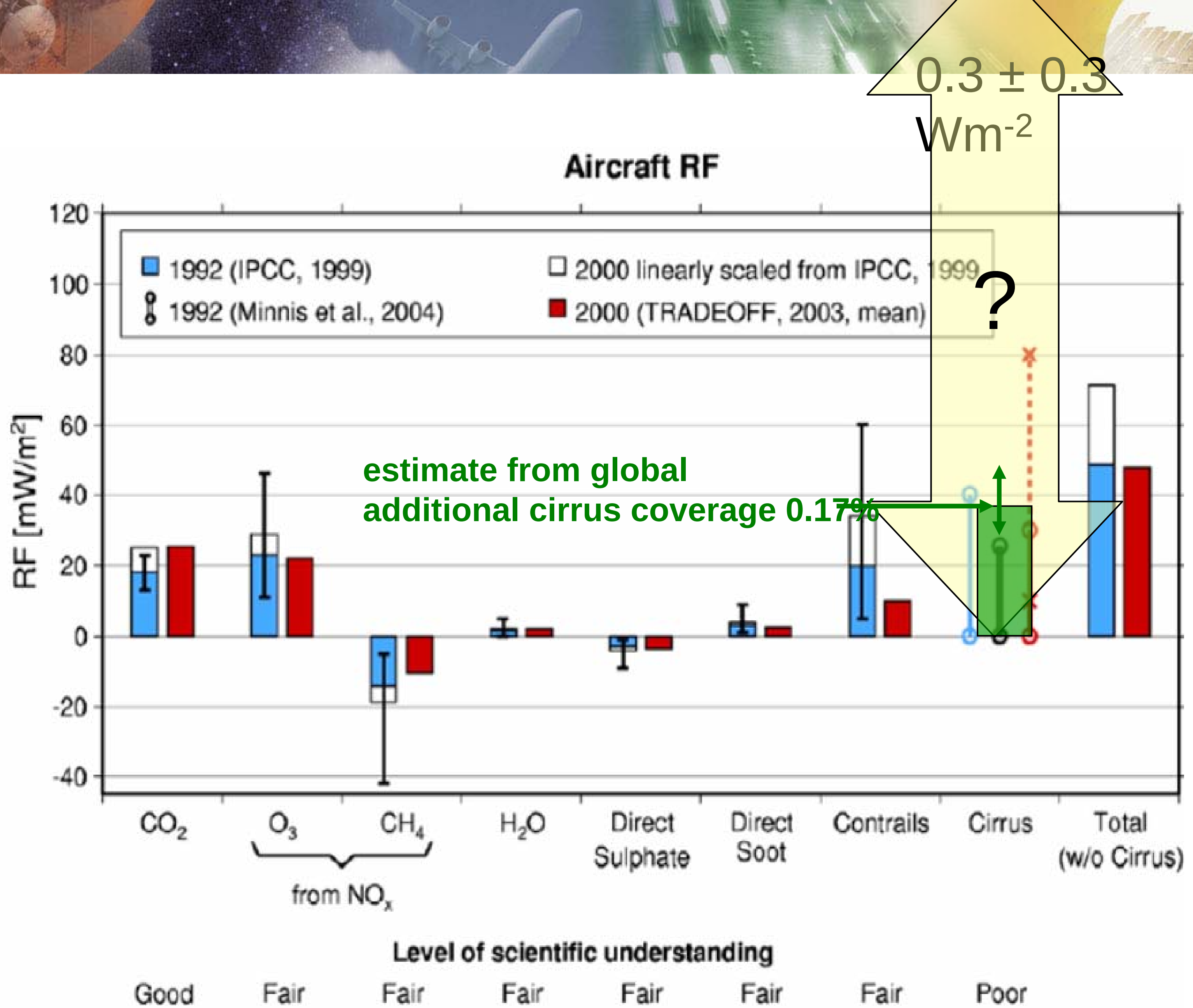




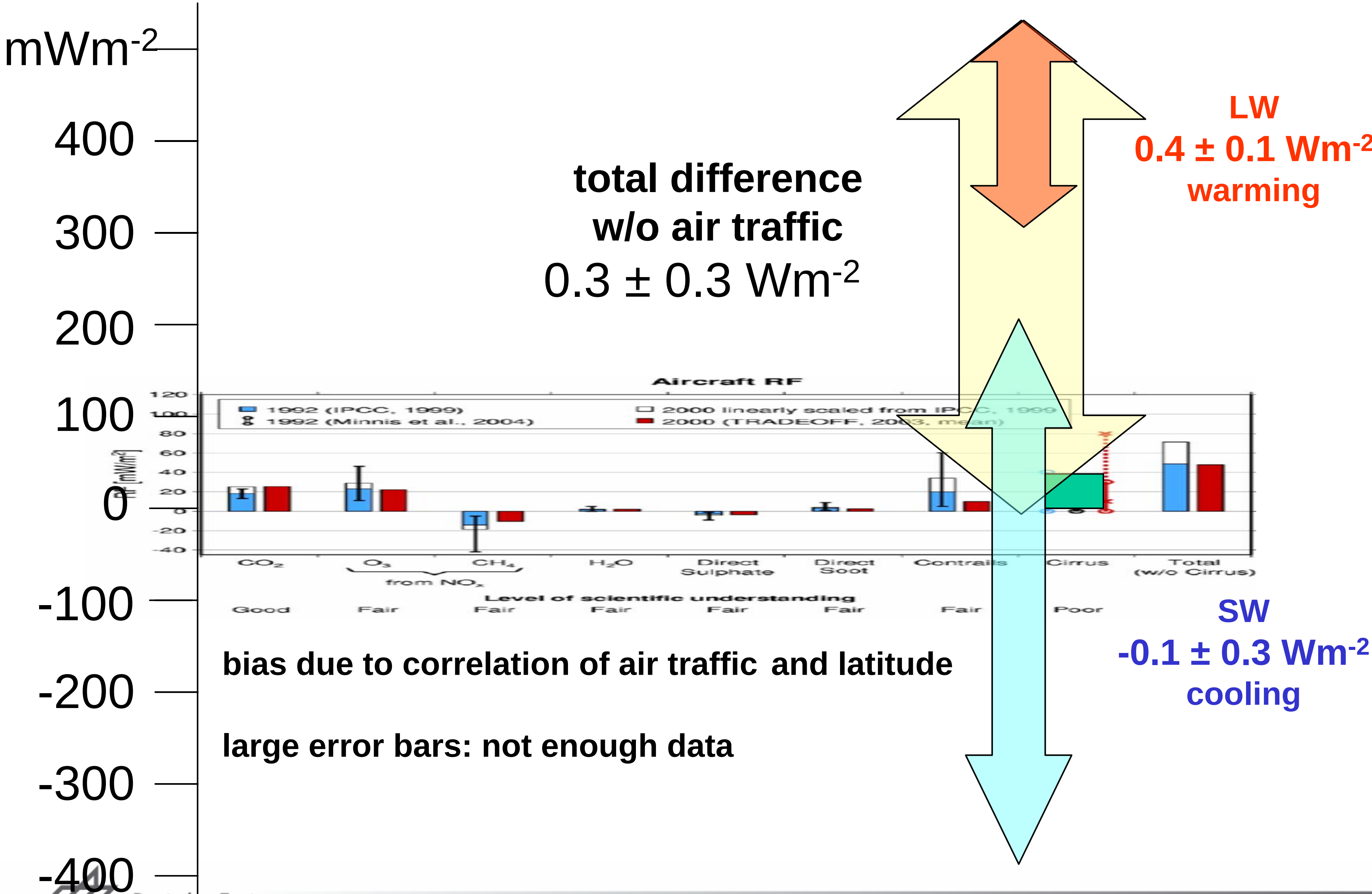
Diurnal variation: difference outgoing radiation [W/m^2]







0.3 ± 0.3 Wm-2
Aircraft RF
1992 (IPCC, 1999)
1992 (Minnis et al., 2004)
2000 linearly scaled from IPCC, 1999
2000 (TRADEOFF, 2003, mean)
?
estimate from global
additional cirrus coverage 0.17%
RF [mW/m2]
120
100
80
60
40
20
0
-20
-40
CO2
O3
CH4
from NOx
H2O
Direct Sulphate
Direct Soot
Contrails
Cirrus
Total (w/o Cirrus)
Level of scientific understanding
Good
Fair
Fair
Fair
Fair
Fair
Fair
Poor



total difference w/o air traffic

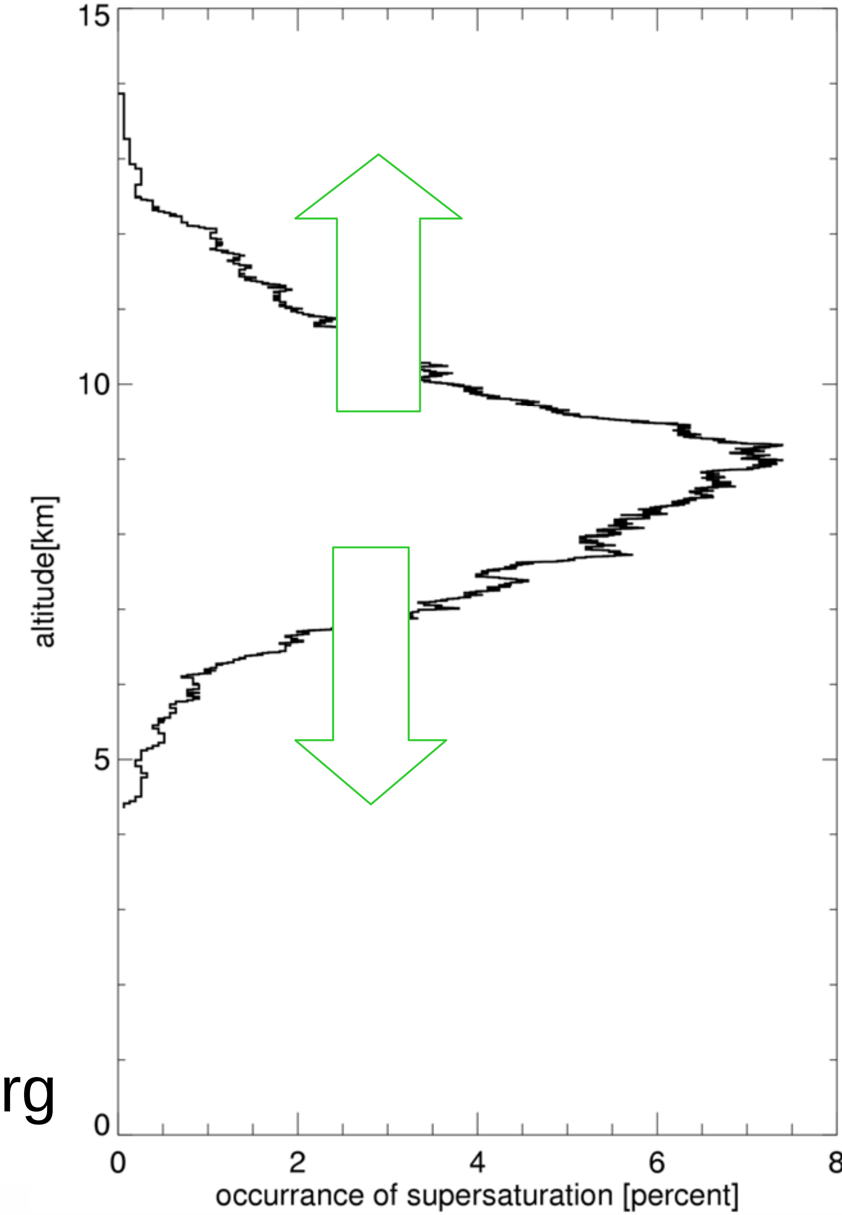
$0.3 \pm 0.3\ Wm^{-2}$

bias due to correlation of air traffic and latitude

large error bars: not enough data

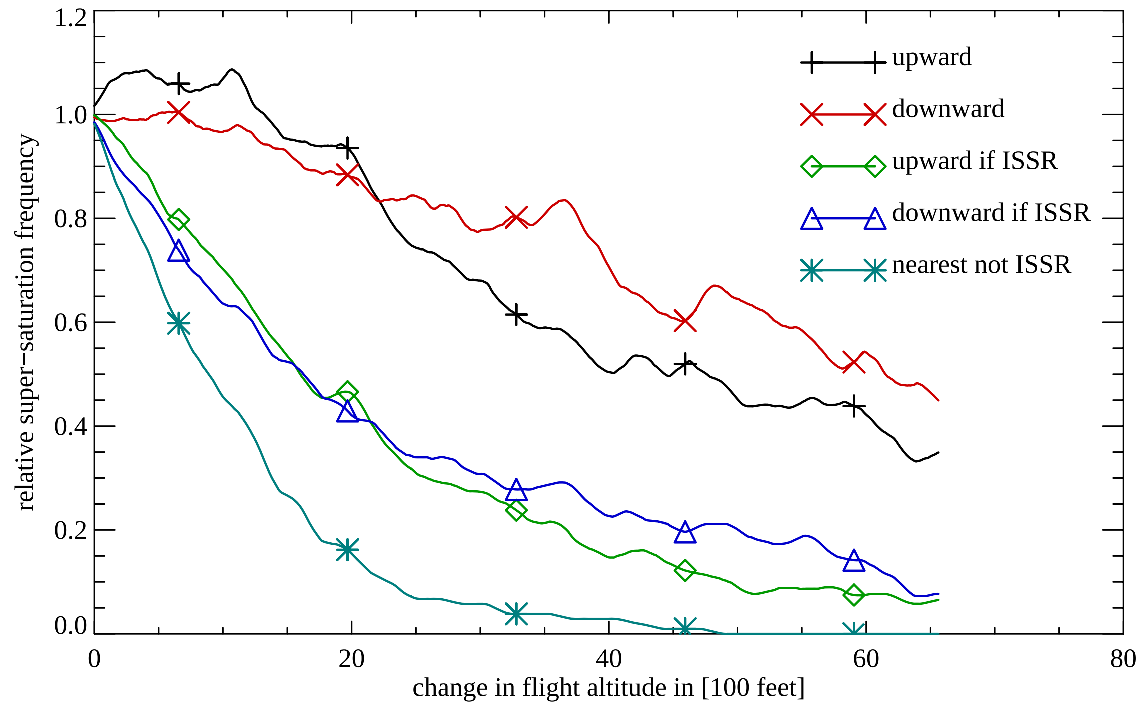
Option 1: 'Flying higher'

Option 2: 'Flying lower'



Ice supersaturated regions (ISSRs)
from
1556 radiosoundings over Lindenberg

Option 3: 'Flying smarter'



+ concentrate on the warming contrail cirrus

CU you at the poster