Biogenic Compounds and the Atmosphere: An European Perspective

Rainer Steinbrecher

- **Air Quality in Europe**
- **From Regional to Local Scales**
- **Forest Air Chemistry**
- **Outlook: Climate and BVOC**

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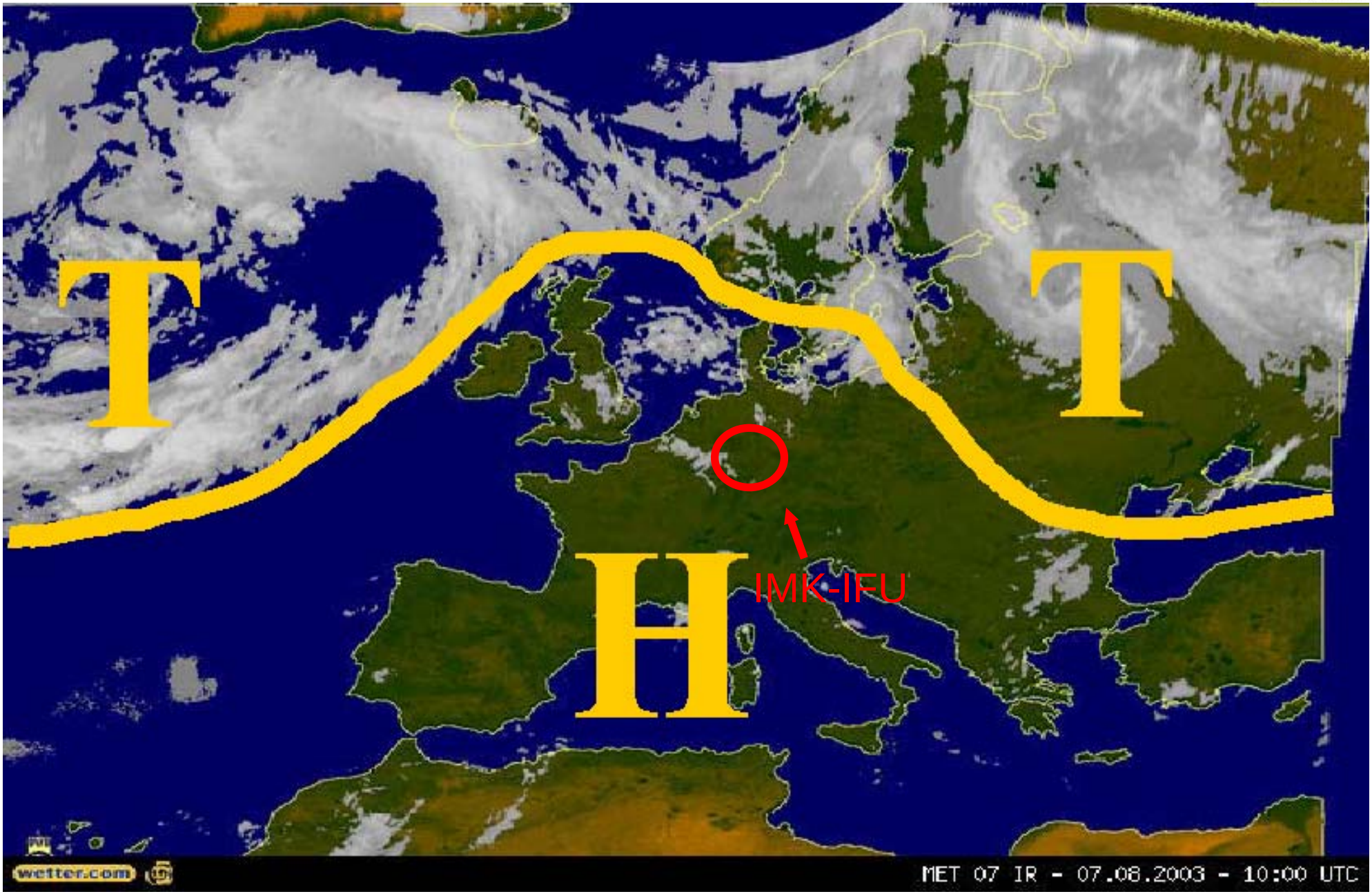
Air Quality in Europe



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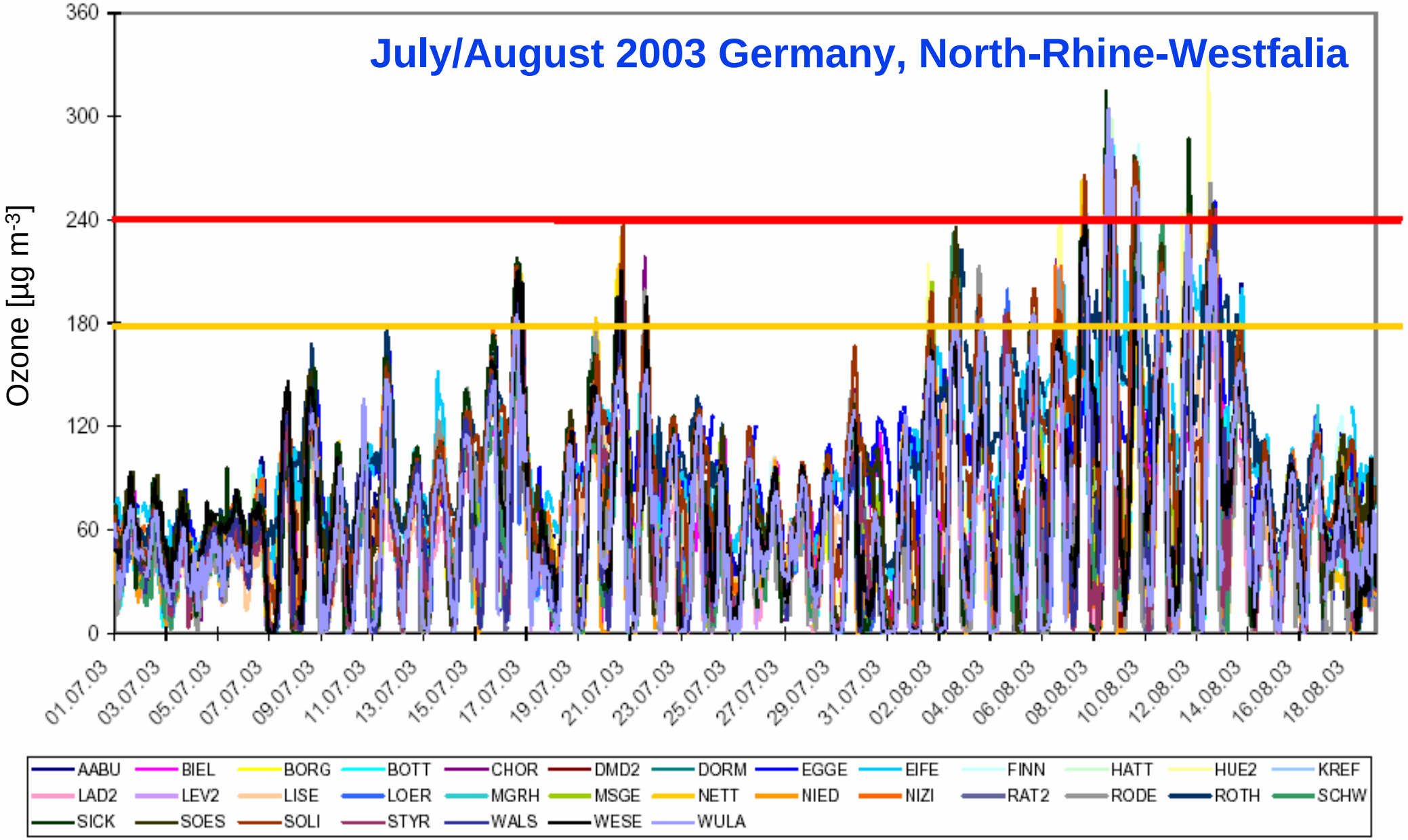
Air Quality in Europe



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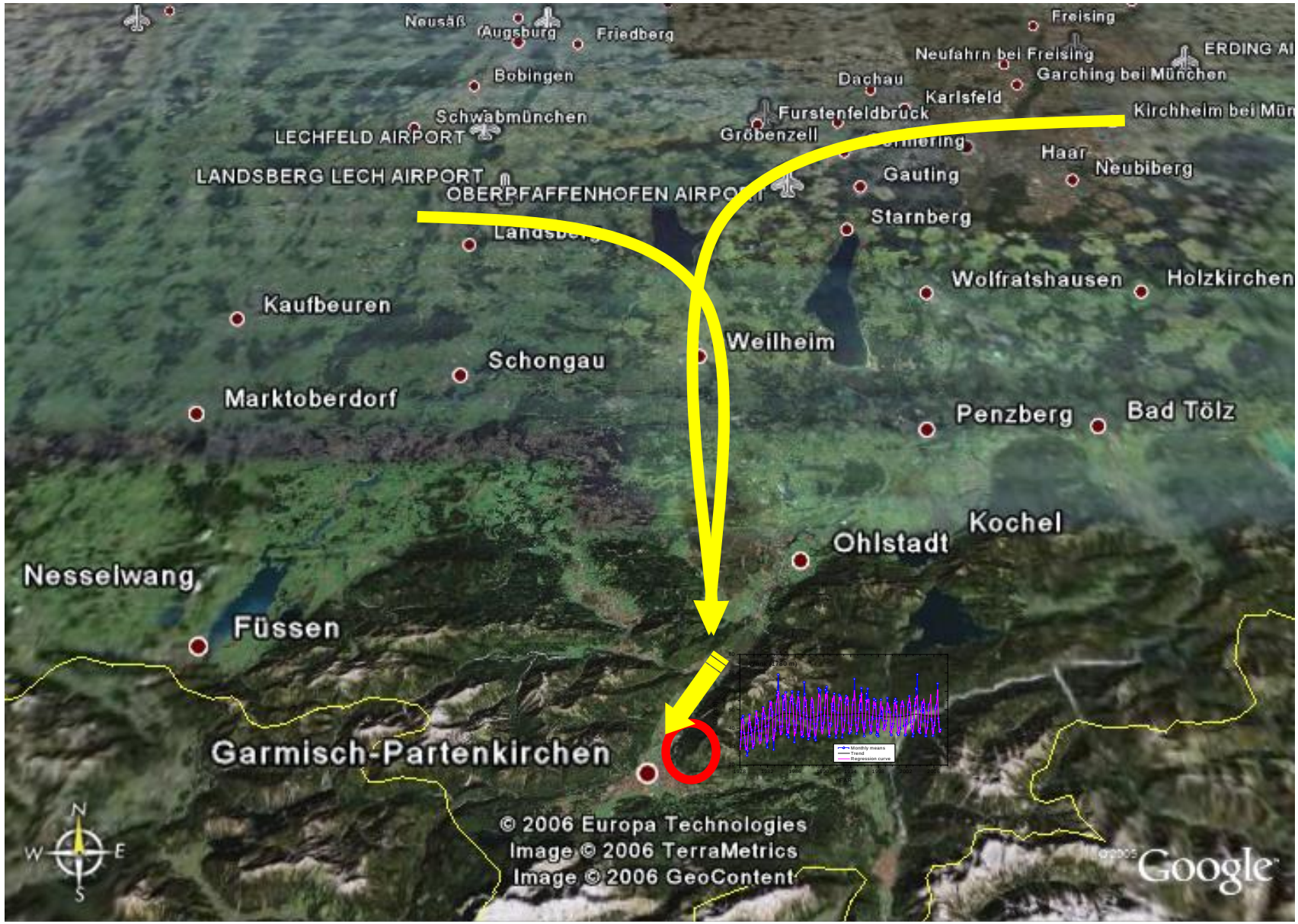
Air Quality in Europe

Ozone Wank (1780 m asl.), Garmisch-Partenkirchen



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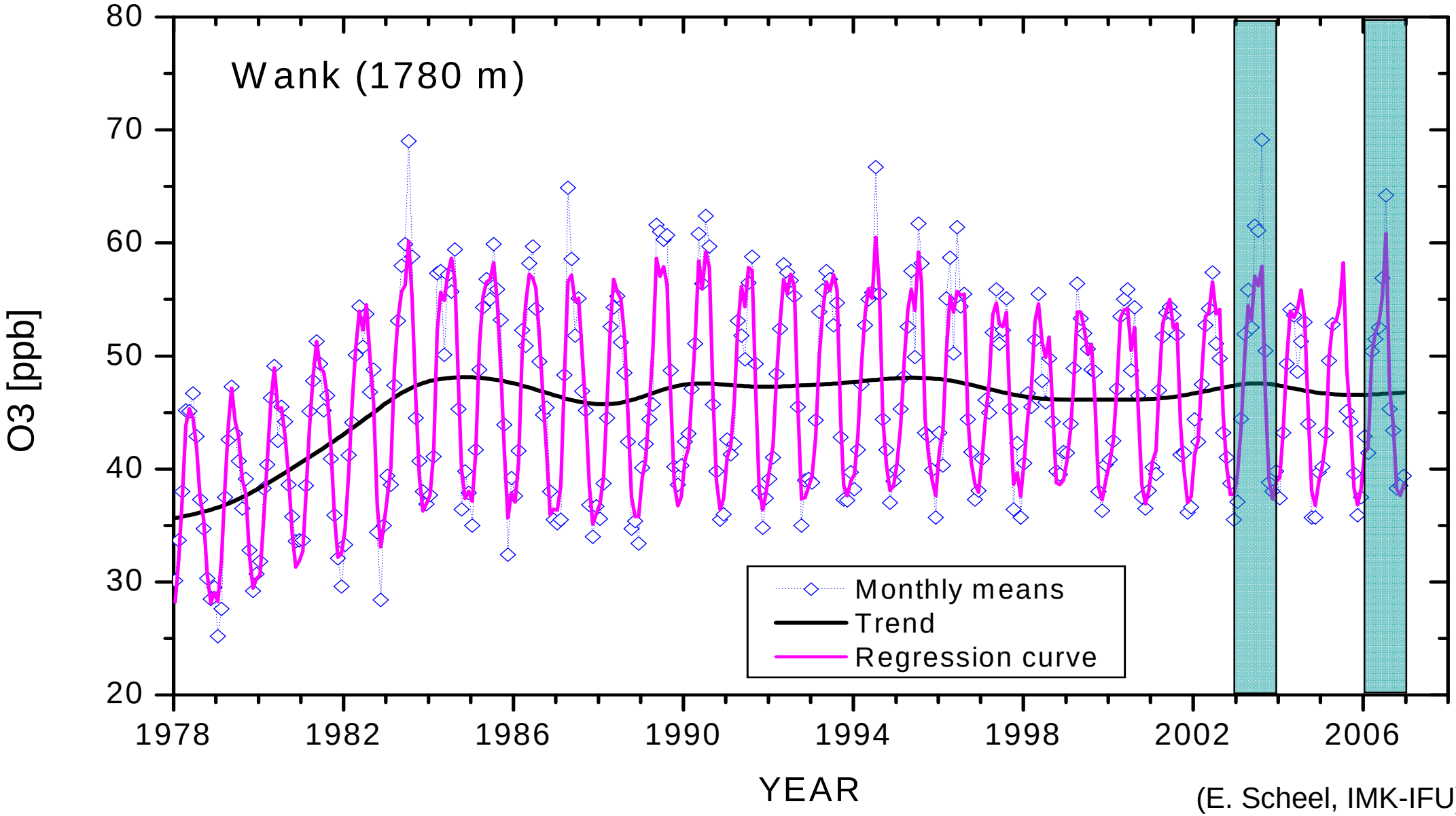

(E. Scheel, IMK-IFU)

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Air Quality in Europe

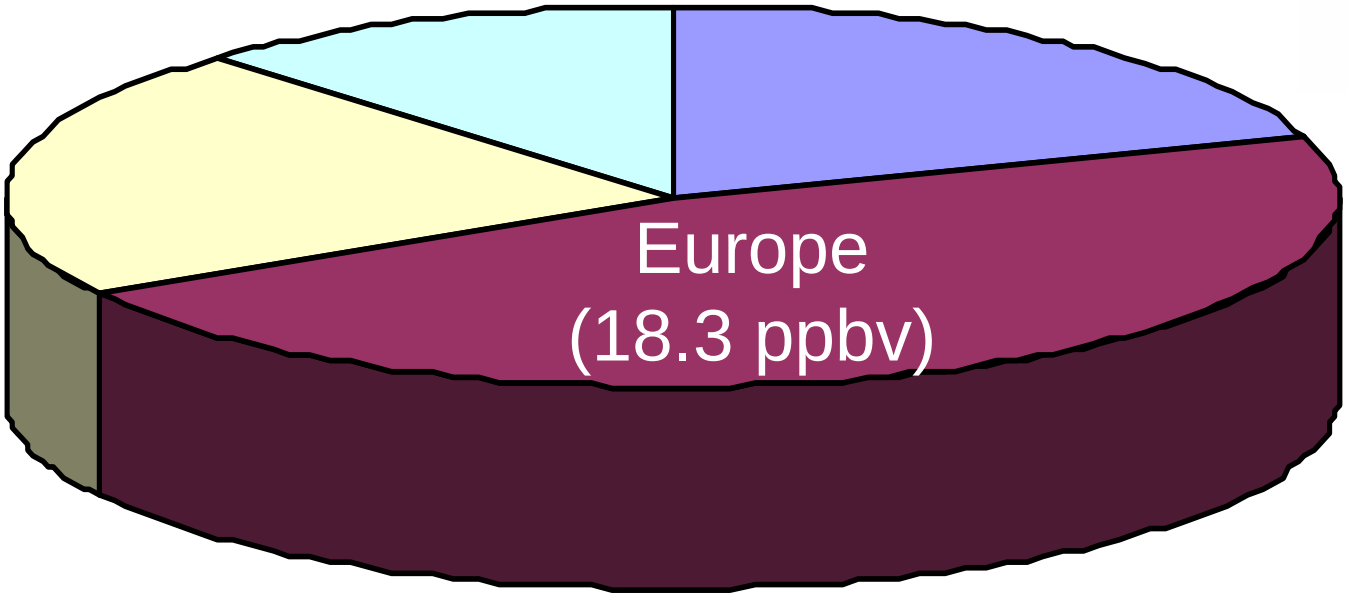
Surface Ozone: Source Analysis

Waldhof, Germany (O_3 background 1998: 39.2 ppbv)

Asia
(4.7 ppbv)

Stratosphere
(7.7 ppbv)

North America
(8.5 ppbv)



Transport *versus* Production?

(Derwent et al., 2004)

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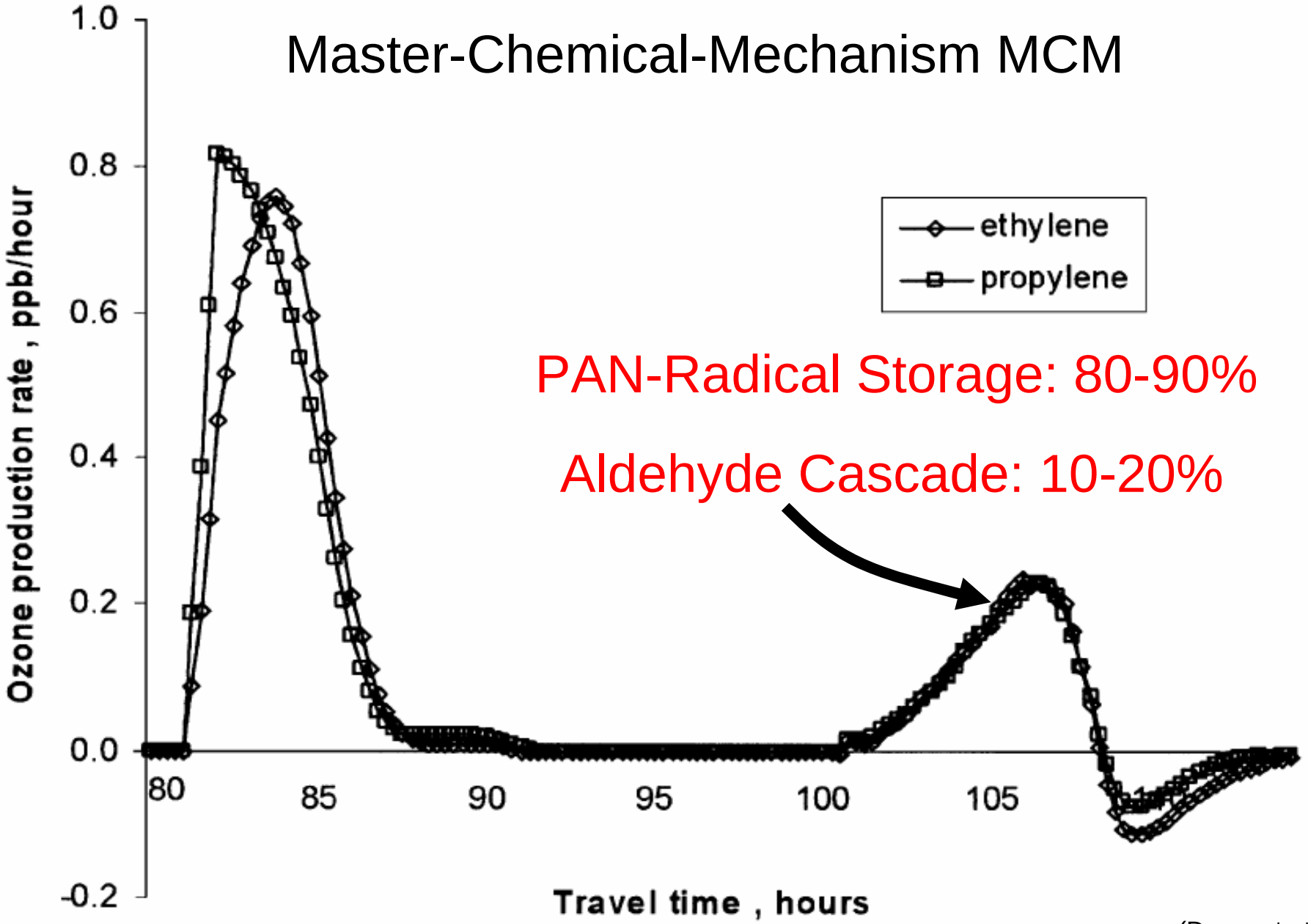
Air Quality in Europe

Master-Chemical-Mechanism MCM



PAN-Radical Storage: 80-90%

Aldehyde Cascade: 10-20%

(Derwent et al., 2005)

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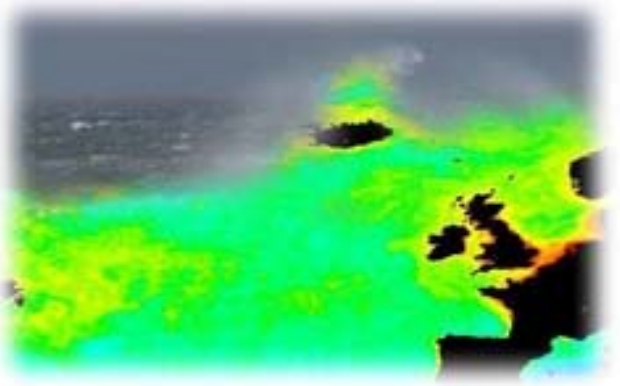
Air Quality in Europe

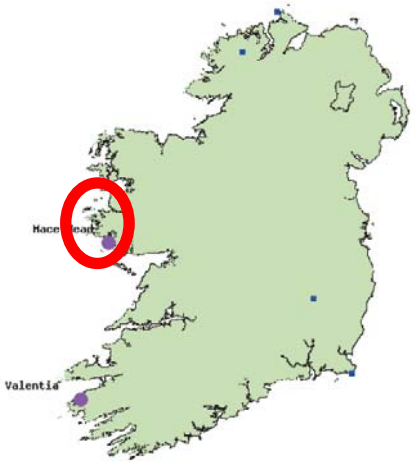
Surface Ozone: Trends

- Mace Head, Irland (background ozone)
- 12-months running mean
- 1990 to 2003



- Increase

+ 0.48 ppbv per year



- Will continue at a similar rate, despite of stringent emission control measures in the past!

What are the Reasons for that?

(Derwent et al., 2006)

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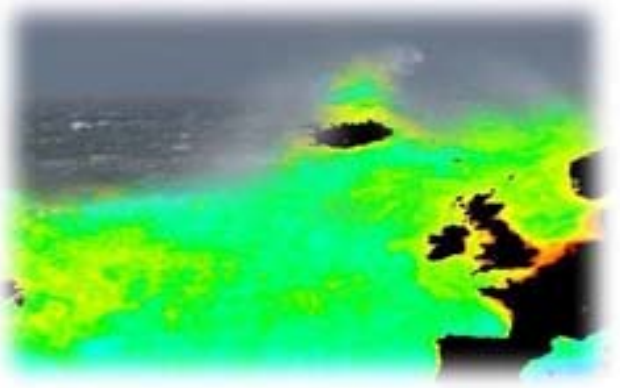
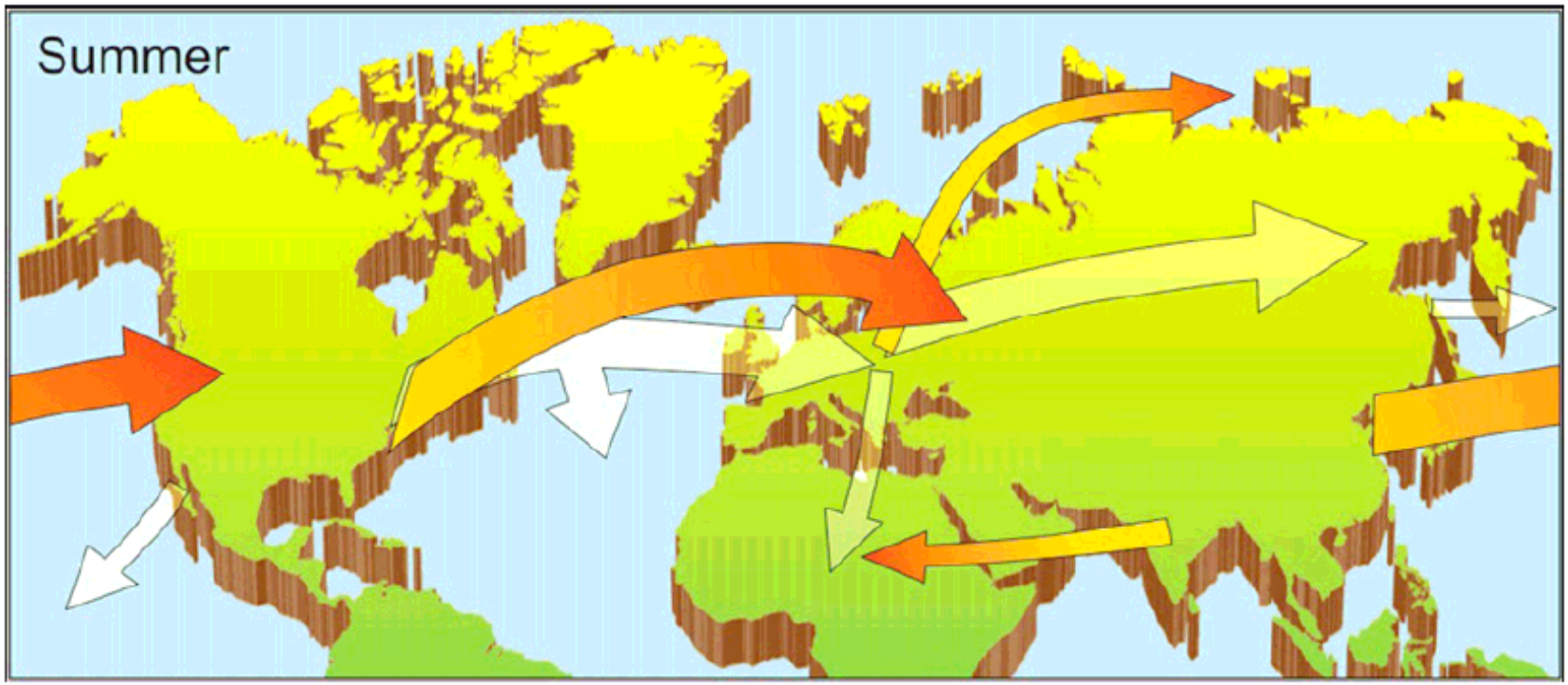
Air Quality in Europe

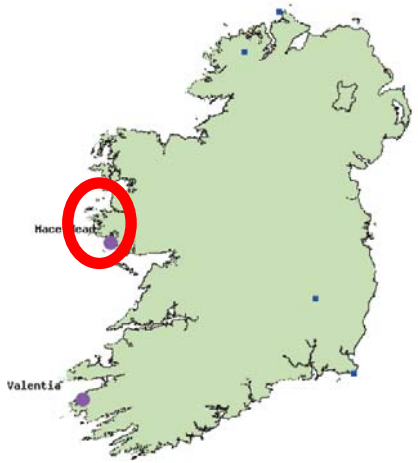
Surface Ozone: Trends

- Mace Head, Irland (background ozone)
- + 0.48 ppbv per year
- Trend 1990 to 2003

What are the Reasons for that?







(Derwent et al., 2006)

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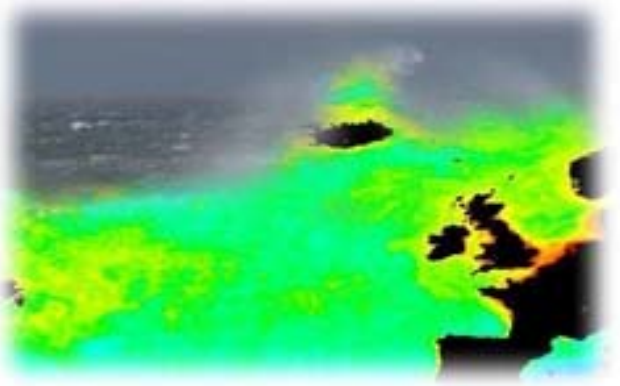
Air Quality in Europe

Surface Ozone: Trends

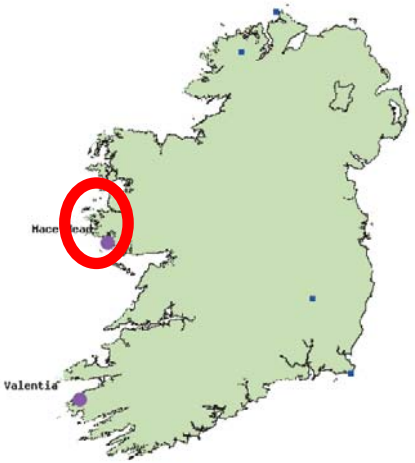
- Mace Head, Irland (background ozone)
- + 0.48 ppbv per year
- Trend 1990 to 2003

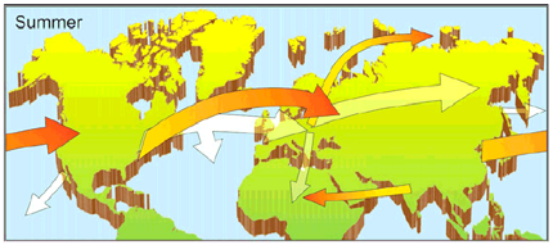
What shall we do?



- **World wide emission control of ozone precursors have to be set in force**
- **Only then we will achieve a reduction in surface ozone in Europe (MFR-Scenario)**
- **Decrease rate of - 0.14 ppbv per year or**

– 4 ppbv in 2030





(Derwent et al., 2006)

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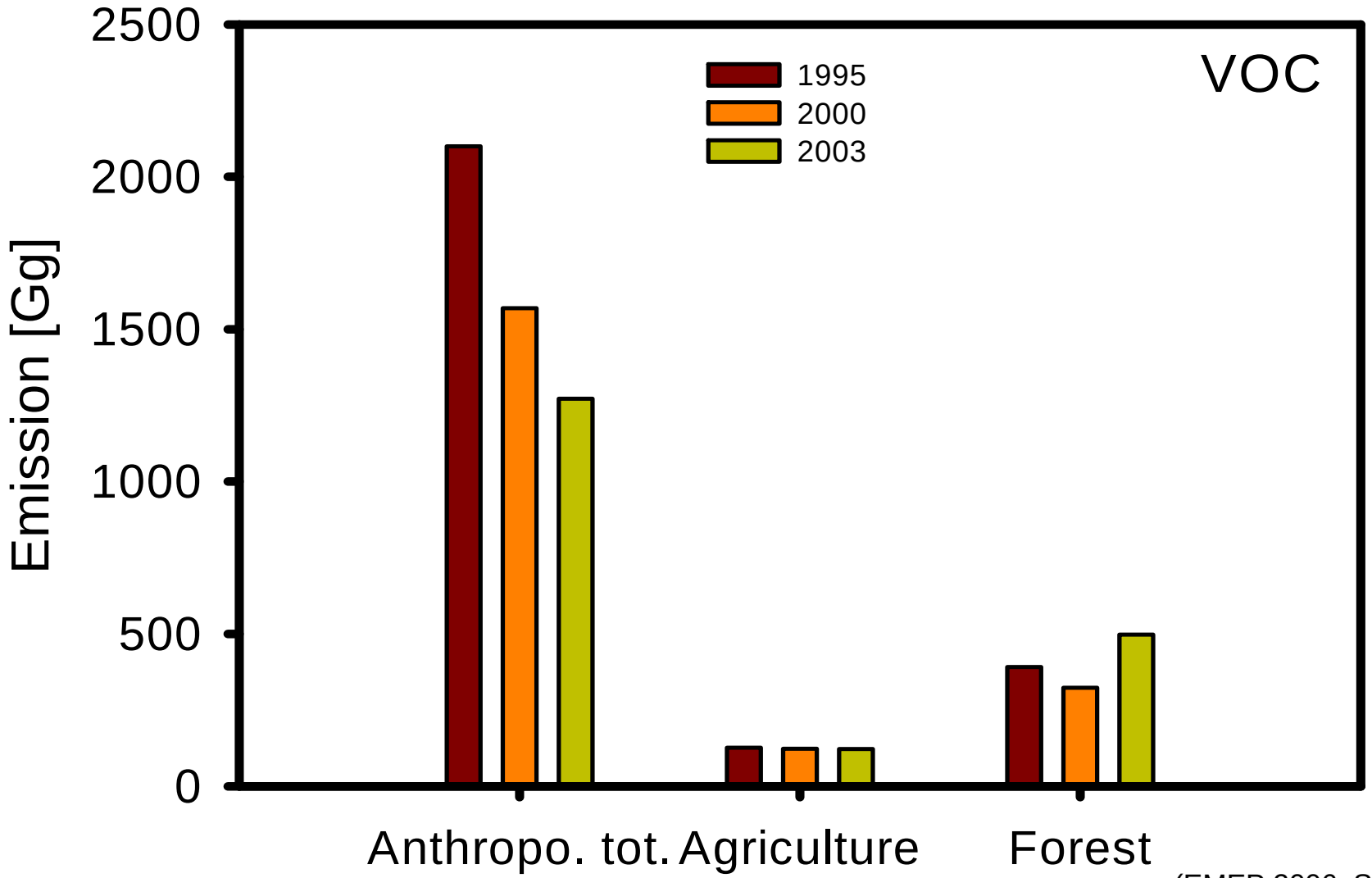
From Regional to Local Scales

Emissions in Germany: Sources and Trends



(EMEP 2006; Smiatek, Steinbrecher 2006)

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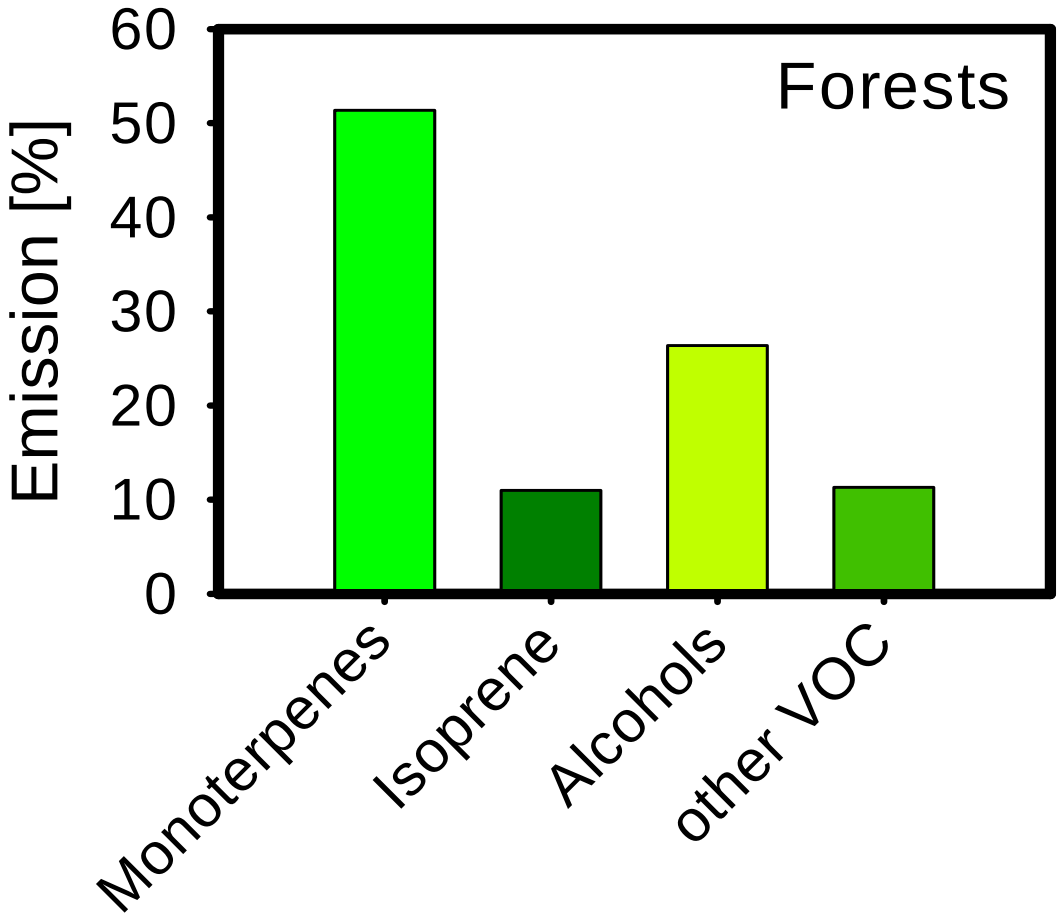
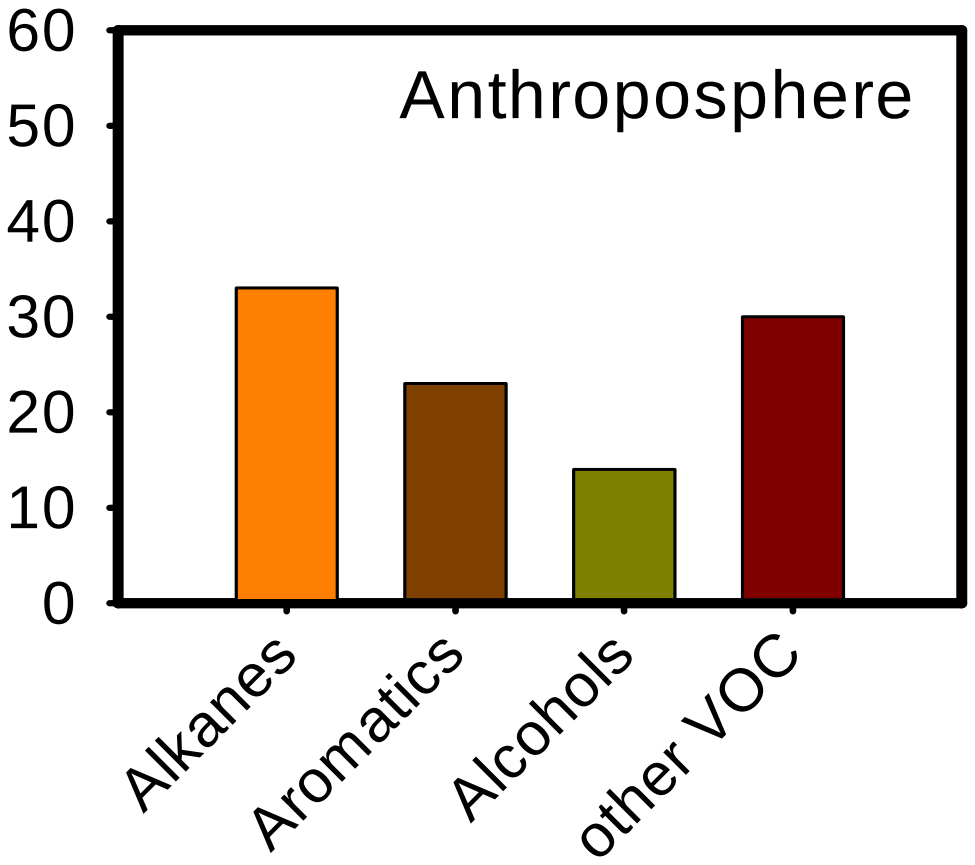
From Regional to Local Scales

Emissions in Germany: Source Split





(Smiatek, Steinbrecher 2006; Theloke, Friedrich 2007)

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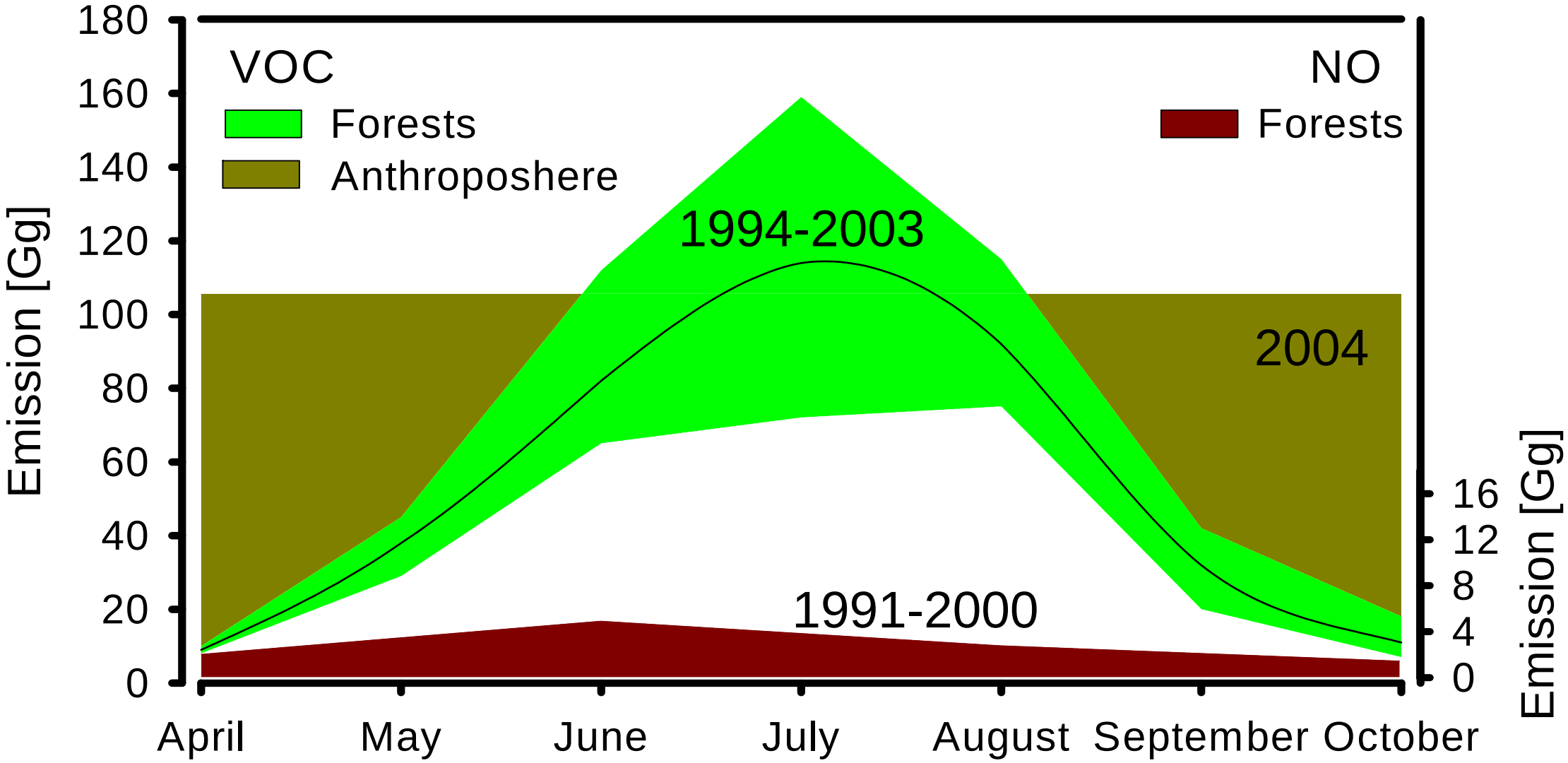
From Regional to Local Scales

Emissions in Germany: Monthly and Annual Variability



(EMEP 2006; Smiatek, Steinbrecher 2006)

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From Regional to Local Scales

Emissions in Germany: Hourly Variability

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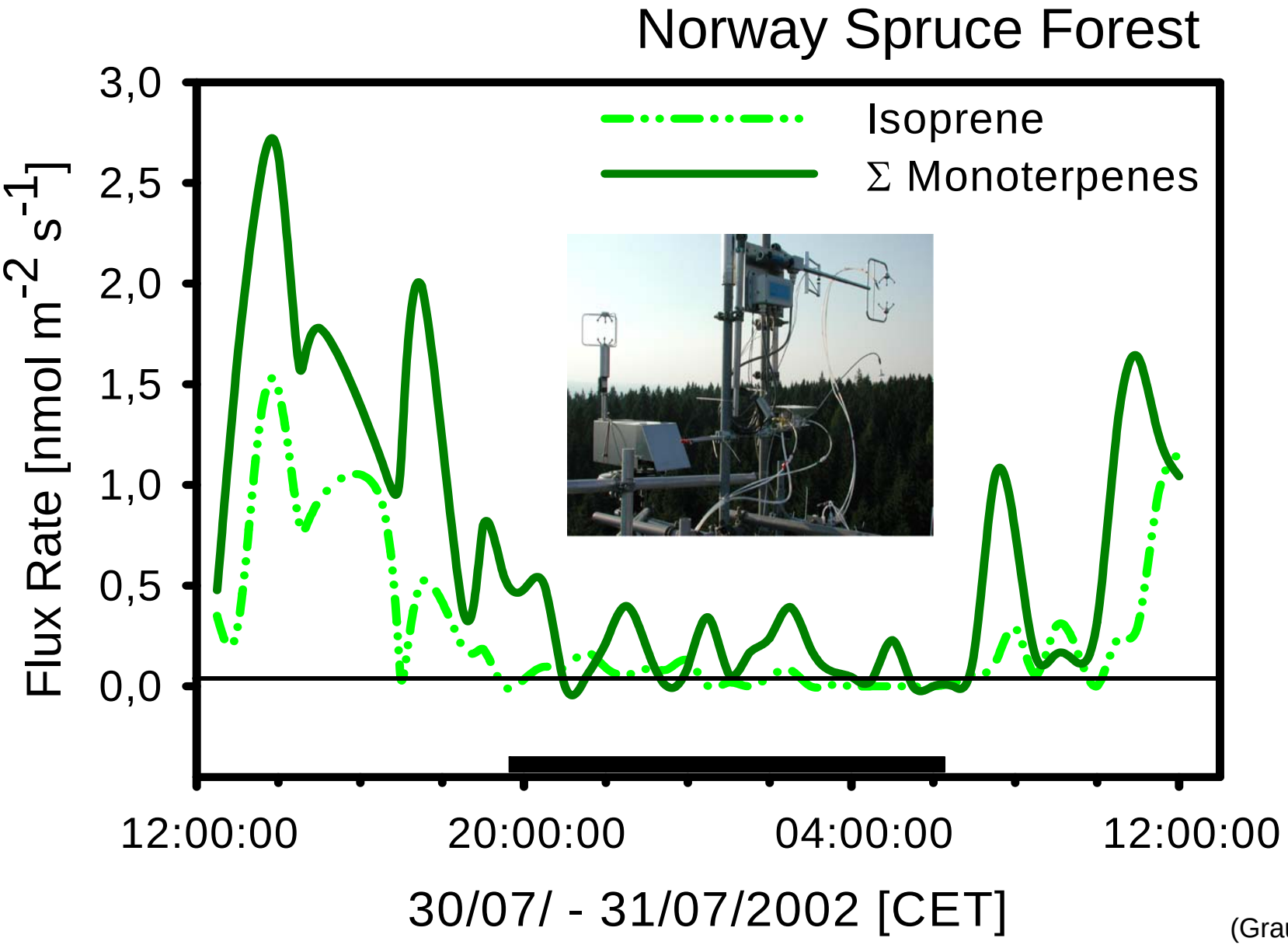
Emissions in Germany: Hourly Variability



(Graus et al. 2006)

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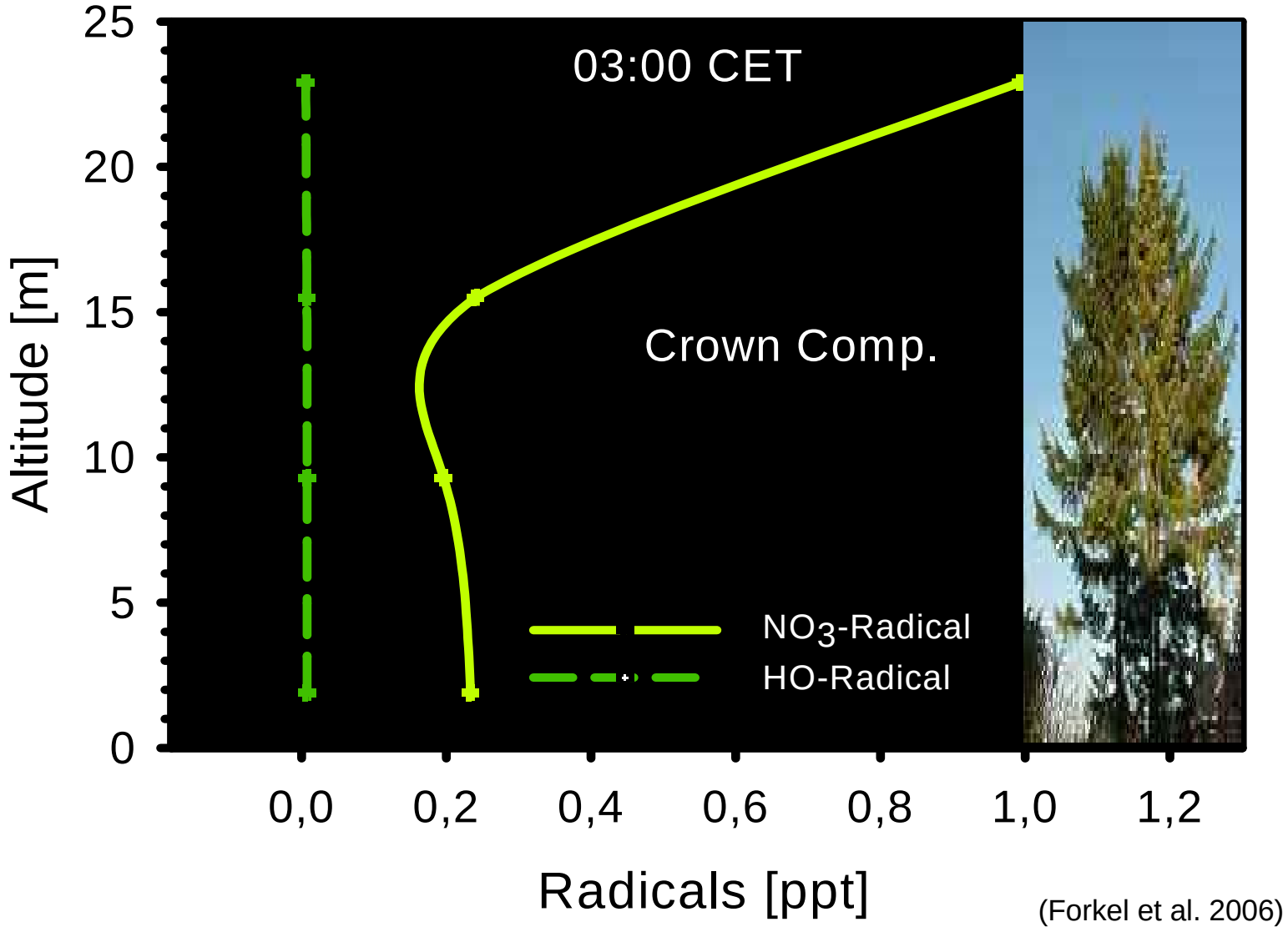
Forest Air Chemistry

Norway Spruce Forest: Night Time



(Forkel et al. 2006)

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Forest Air Chemistry

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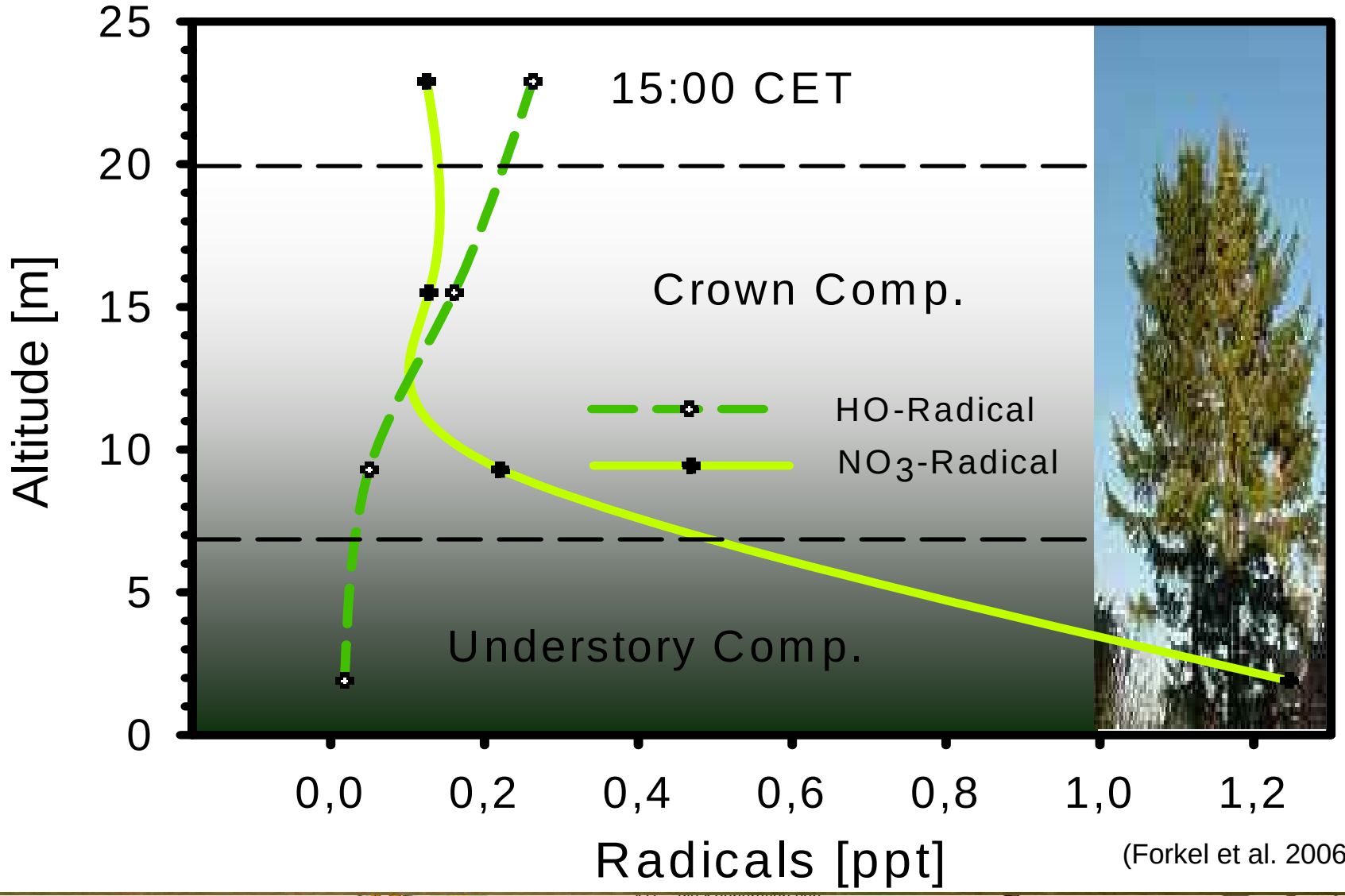

(Forkel et al. 2006)

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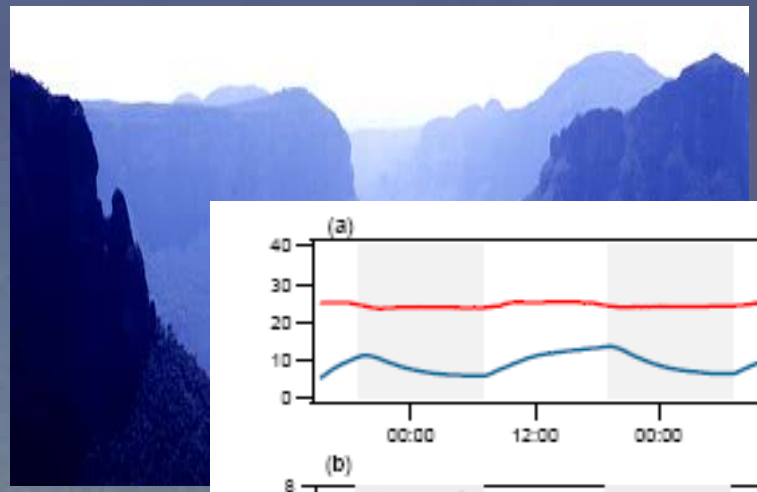
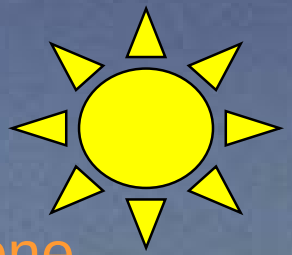
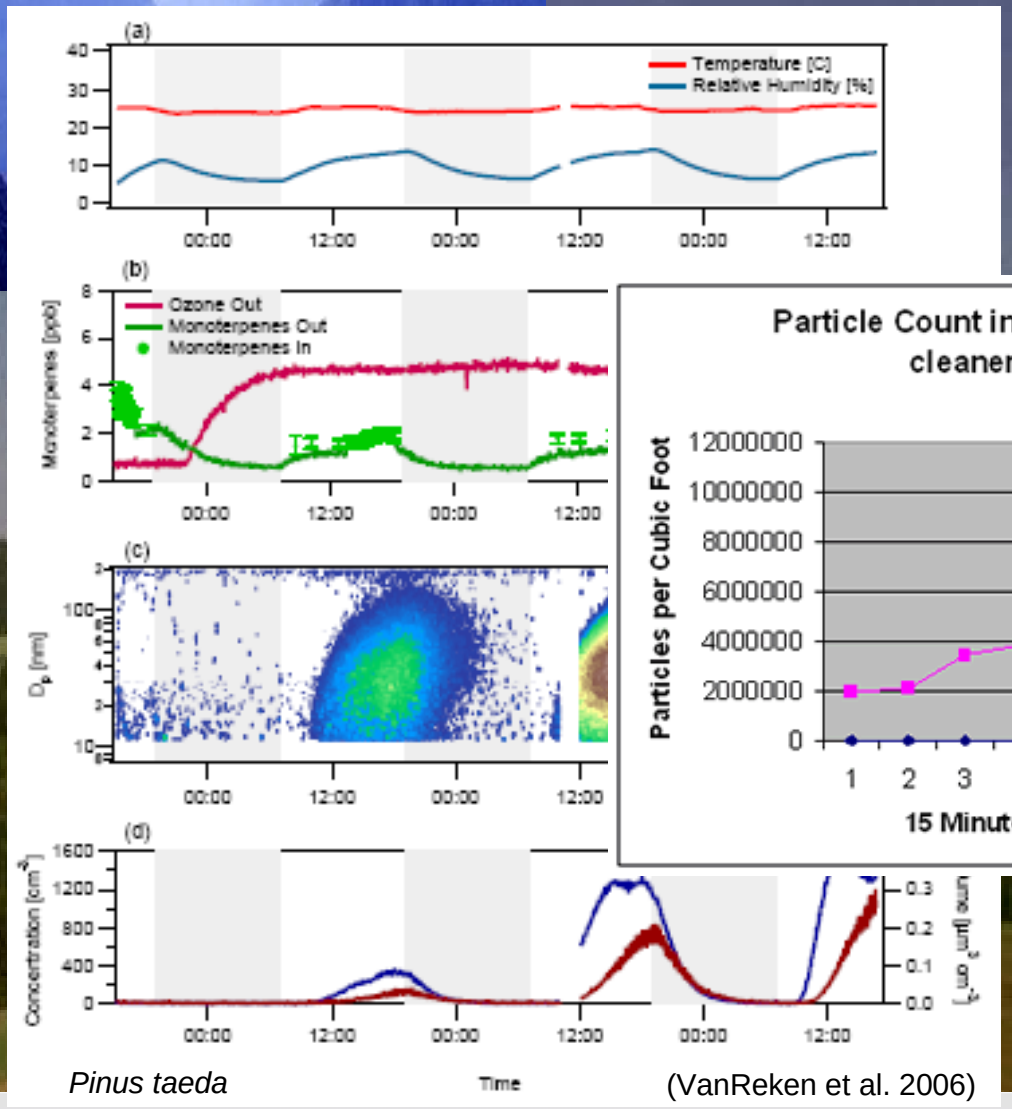


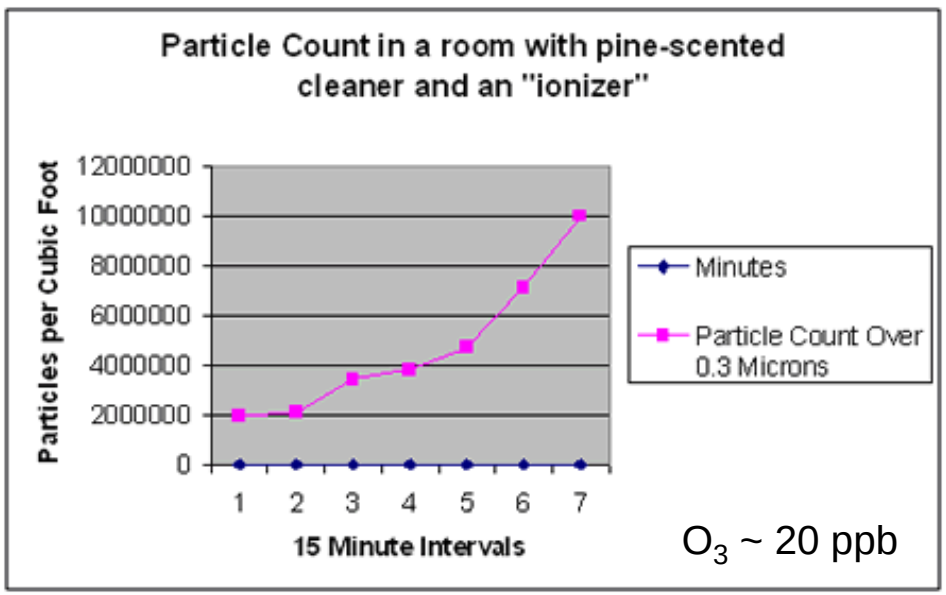


Ozone

BVOC



Pinus taeda



(VanReken et al. 2006)

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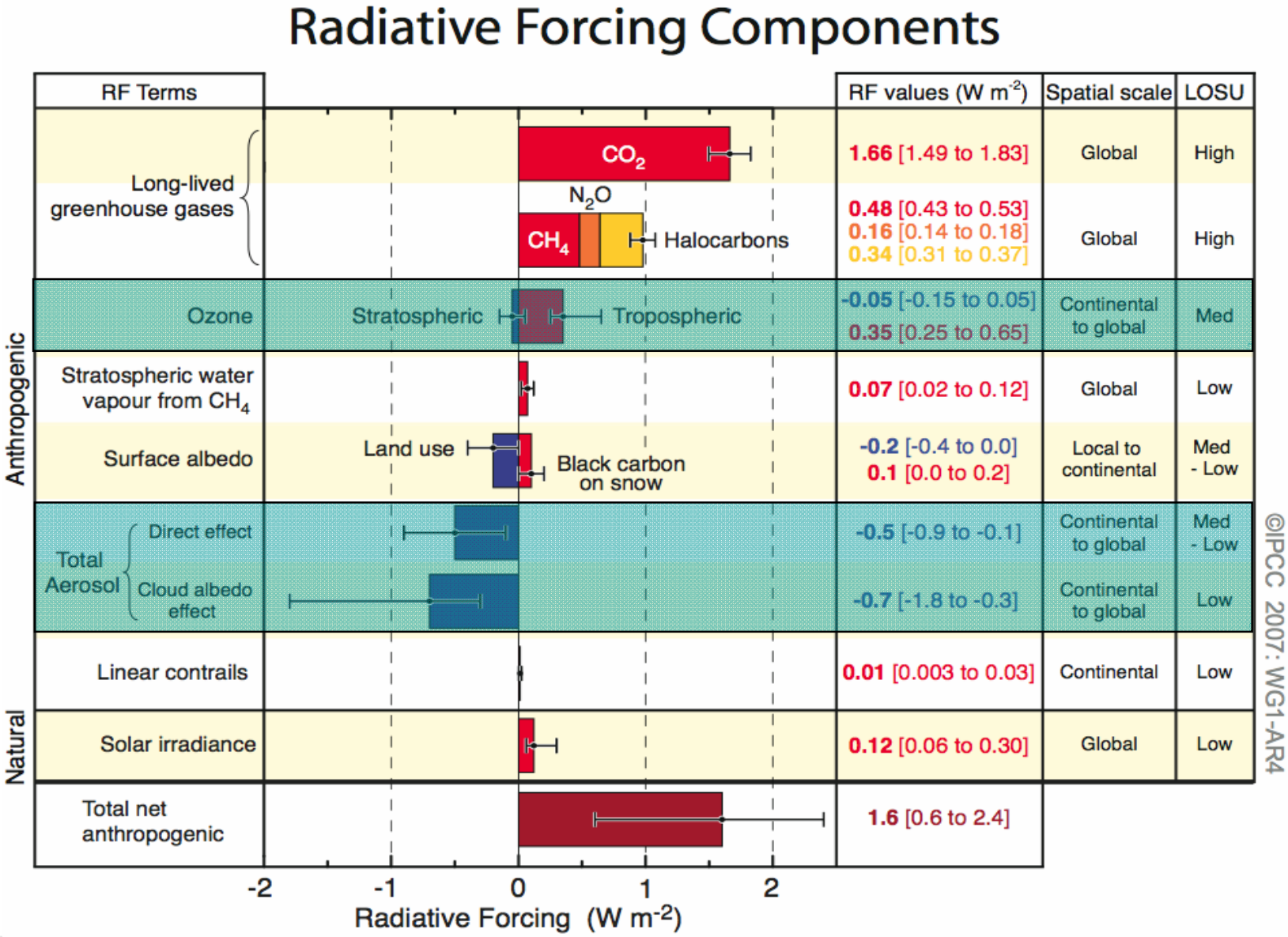
Global Change and VOC

VOC Oxidation in the Atmosphere



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