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Max Planck Institute for Meteorology

## Infrastructure for Earth System Research

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### In summer 2002, extended flooding in Eastern Europe

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### In summer 2003, an unprecedented heat wave in Western Europe

International Herald Tribune | 5  
Wednesday, September 10, 2003

## Heat claimed 15,000 in France

### Estimate by funeral director exceeds latest by government

*From news reports*

**PARIS** The number of people who died in France because of the August heat wave is 15,000, the country's largest undertaker estimated Tuesday, placing the death toll about 3,500 higher than the official government figure.

Isabelle Dubois-Costes, a spokeswoman for General Funeral Services, said the revised total includes deaths from the second half of August, after record-breaking temperatures had abated.

Late last month, the government issued its official estimate of 11,435, but the Health Surveillance Institute

died. At the time, the government put the figure at a maximum of 3,000.

The heat wave brought suffocating temperatures of up to 40 degrees Celsius (104 degrees Fahrenheit) in the first two weeks of August in a country where air conditioning is rare. The heat baked many parts of Europe, but nowhere was

families were away on lengthy August vacations. Authorities reportedly had difficulty making contact with survivors who were away on vacation.

A team of medical experts named by the Health Ministry to conduct the first official inquiry into the crisis issued a scathing report Monday that found "an error in anticipation, organization and coordination," and said "the response was not suited" to the situation.

The experts said the "compartmentalization" of services between the health and other ministries and workers in the field prevented a pooling of available information about the scope of the crisis.

**The revised total includes deaths from the second half of August.**

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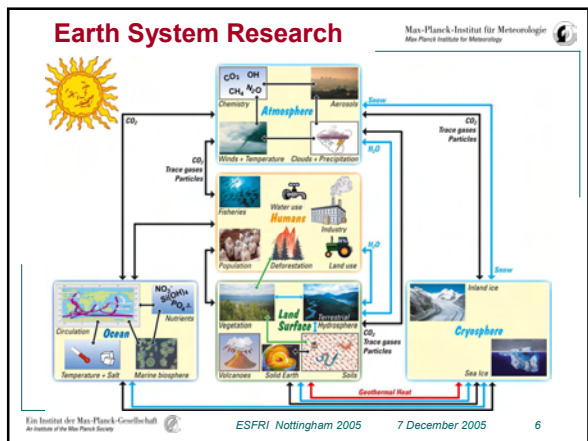
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## Earth System Research: The General Objective

- ◆ To understand how physical, chemical, and biological processes, as well as human behavior contribute to the dynamics of the Earth system, and specifically how they relate to global and regional climate changes.
- ◆ To observe, monitor, analyse, understand, and predict in order to better manage the Earth system.

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## The Earth: A Complex Dynamical System

- ◆ In nonlinear complex systems, minute actions can cause long-term, large-scale changes.
- ◆ These changes can be
  - Abrupt,
  - Devastating,
  - Surprising
  - Unmanageable.

Steady states and hysteresis of the THC

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## Key Questions

- ◆ Are there critical thresholds that cause abrupt climate change?
- ◆ What are the processes that regulate the variability of CO<sub>2</sub> concentration?
- ◆ What controls atmospheric ozone and oxidation processes?
- ◆ Which processes control atmospheric aerosols and aerosol interaction with clouds and climate?
- ◆ Which are the most vulnerable regions and sectors under global change and why?
- ◆ Is the Earth system manageable at all in terms of long-term „climate steering“?

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## Important Foci

- ◆ The understanding of fundamental processes
- ◆ The assessment of the impacts of global and regional climate changes including extreme events
- ◆ The integration of knowledge into comprehensive Earth system models
- ◆ The development of true predictive capabilities for the Earth system, in support of management strategies (mitigation/adaptation)

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## Infrastructures needed to address Earth system questions

- ◆ Research aircraft: process studies, vertical resolution
- ◆ Satellites: global coverage, monitoring
- ◆ Research ships: process studies, vertical resolution
- ◆ Surface instrumentation: Process studies, validation of space observations
- ◆ Surface networks: global data, monitoring, trends
- ◆ Supercomputers: data analysis, modelling, synthesis, and prediction
- ◆ Software infrastructure

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## Research Aircraft

- ◆ Need to coordinate European efforts towards the development of a diverse fleet of research aircraft

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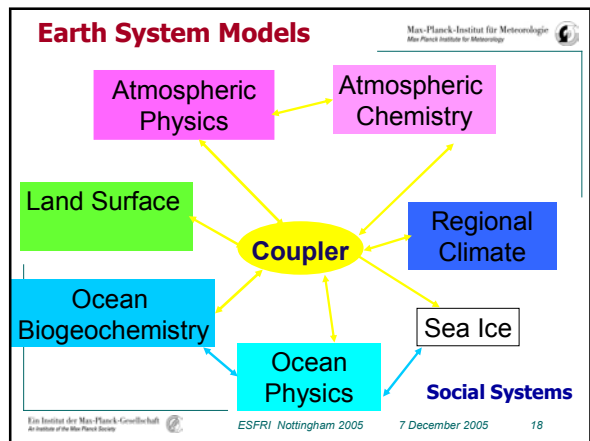
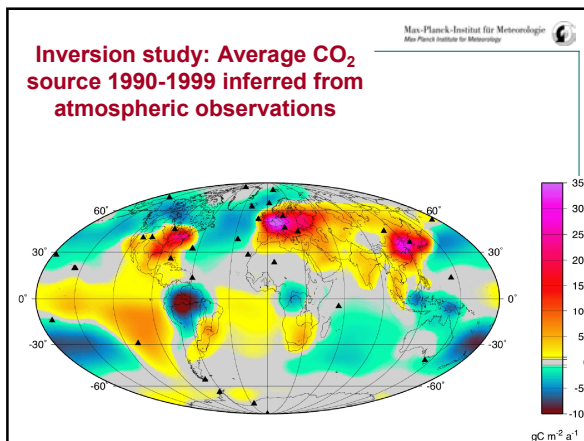
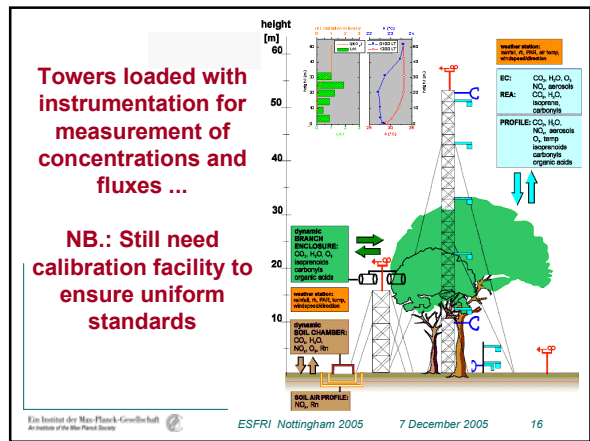
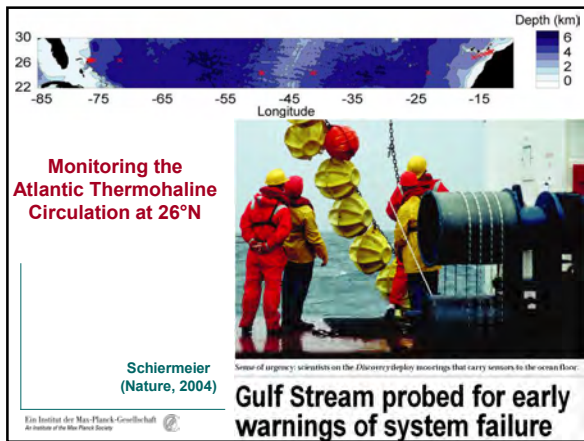
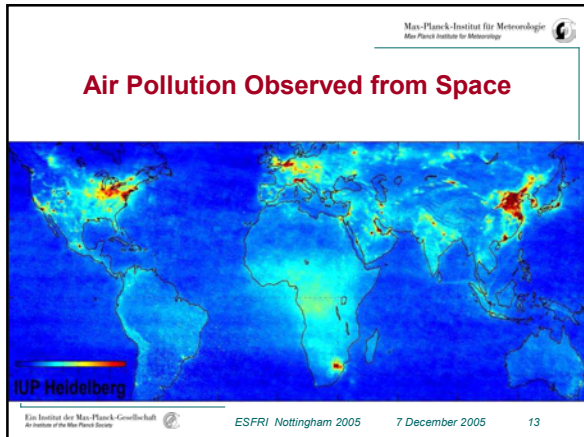
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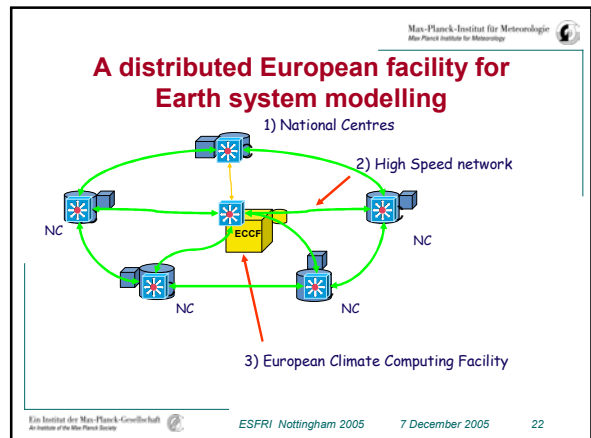
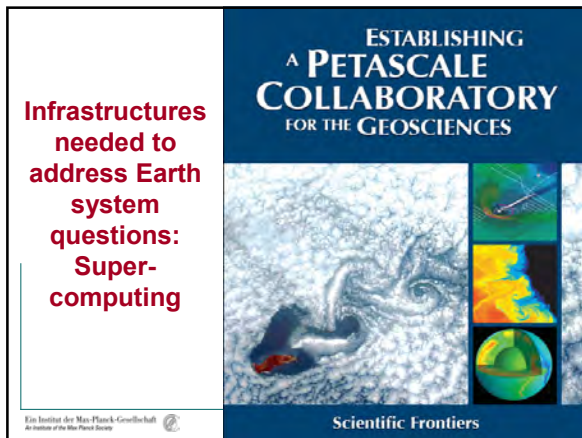
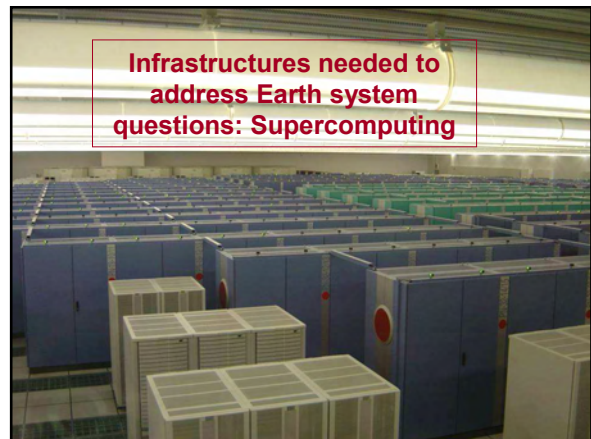
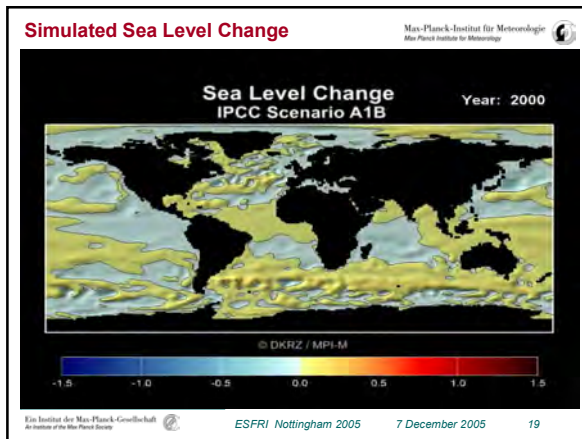
## Earth Observation Satellites

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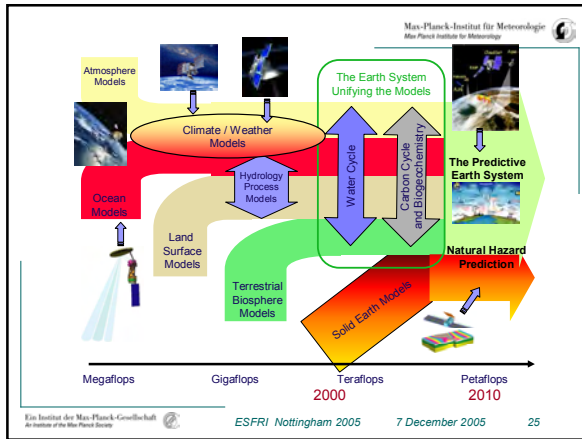






- Software infrastructure for Earth system modelling:** Max-Planck-Institut für Meteorologie  
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- ◆ « Share software infrastructure across community »
  - ◆ To:
    - share development, maintenance and support
    - aid performance on a variety of platforms
    - standardise model environment
    - ease use of different Earth system model components
  - ◆ Hence to:
    - help scientists to spend more time on science
    - help key scientific diversity/efficiency in Earth system modelling
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- Towards Earth system monitoring and prediction** Max-Planck-Institut für Meteorologie  
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- ◆ The scientific community is in a position to start providing operational analyses and predictions of the evolution of the Earth system, and help decision-makers (government, industry) to make the appropriate choices on the basis of sound scientific information.
  - ◆ GMES and WCRP-COPES will contribute to these issues.
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Gulf Stream probed for early warning of system failure

PROGNOSTIC CYCLES

your

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