Atmospheric Composition Change through the ACCENT Network and the contribution of the Belgian Institute for Space Aeronomy (BIRA/IASB)

Period: March 2004 – December 2009, Priority 1.1.6.3 Global Change and Ecosystems
Objectives

✓ Promote a common European strategy for research on atmospheric composition sustainability
✓ Develop & maintain durable means of communication within the European scientific community
✓ Facilitate research through involvement in major international programmes and integration of competencies
✓ Optimize interactions with policy-makers and public
✓ Reinforce EU environmental policy, support Member States and EU in international negotiations
✓ Become the authoritative voice in Europe on issues dealing with atmospheric composition sustainability and societal implications
Partnership

✓ 37 institutions from EU counties (including new member states)
✓ 4 institutions from Associate Countries (Norway & Switzerland)
✓ 1 international Organisation (IIASA, Austria)
✓ JRC/EU
✓ two calls for Associates: 128 institutions, also from outside Europe, benefit from co-ordination, workshops, access to data, etc.)

Coordination: Dr. S. Fuzzi (CNR, Italy)

Project Office: Prof. M. Maione (Univ. Urbino, Italy)
Joint research programme:

- the importance of aerosols for air quality and climate
- the biosphere-atmosphere exchange as source-receptor of atmospheric chemical species
- the transport/transformation of atmospheric constituents at different spatial/regional scales
- linkages between economics, policy-making, and atmospheric composition change research

A strategy for integration:

- coordination of EU contributions in international programmes (IGAC, GAW, EMEP, IPCC)
- research activities in atmospheric modelling
- emission inventories (GEIA, emissions from 9 inventories, 45 species), data from monitoring networks, experimental campaigns, lab.experiments
- promotion of the use of satellite data for tropospheric research
- instrument intercomparison workshops, instruments checked for defects & cross-sensitivities
**Outreach tasks:**

- development of web-based e-learning training modules (NO2, trace gas fluxes from soil, aerosols)
- interactive multilingual “Global Change Magazines”
- teacher workshops, high education courses
- Urban Exposure Modelling Tool → daily pollution uptake
- Synthesis reports

**All activities benefit from a web portal** [www.accent-network.org](http://www.accent-network.org)

- maintain communication within the consortium
- disseminate knowledge outside the Network
- provide a platform for dialogue between research and society
Research, Policy, public

✓ 1st ACCENT Symposium, Urbino, July 2005
✓ 2nd ACCENT Symposium, Urbino, July 2007
✓ attended by more than 300 scientists
✓ final phase of the book with the scientific contributions
✓ National ACCENT days
✓ set up of the Urbino dialogue in the 2nd ACCENT Symposium

- How much and for what reasons have background ozone levels in Europe changed during the last decades?
- What are the most important precursors for background ozone and how they will change in the next 20-30 years?
- What are the contributions of natural aerosols and gaseous species to levels of particulate matter, ozone and other pollutants over Europe?
- How well can we separate the natural aerosol and gaseous species from the anthropogenic ones?
- Which anthropogenic and natural sources contribute to the formation of SOA?
ACCENT in numbers

- **Year 1**
  - Workshops: [Bar Chart]
  - Journal articles: [Bar Chart]
  - Conference pres.: [Bar Chart]

- **Year 2**
  - Workshops: [Bar Chart]
  - Journal articles: [Bar Chart]
  - Conference pres.: [Bar Chart]

- **Year 3**
  - Workshops: [Bar Chart]
  - Journal articles: [Bar Chart]
  - Conference pres.: [Bar Chart]

- **Year 4**
  - Workshops: [Bar Chart]
  - Journal articles: [Bar Chart]
  - Conference pres.: [Bar Chart]
Belgian Institute for Space Aeronomy (IASB/BIRA)

Aeronomy studies planetary atmospheres and magnetospheres

- 1939: Aeronomy service within the Royal Meteorological Institute of Belgium (IRM/KMI)
- 1964: Aeronomy service detached from IRM/KMI → New federal scientific institute

- Activity volume: 120 MEuro (1/3 from the Federal Government, 2/3 external (ESA, EU,others))
- Staff: 129 (79 scientific, 60 statutory)

3 Departments: “Space physics”, “Atmospheres”, “Services and valorisation”
Major Scientific Themes of “Atmospheres”

- **Sources and sinks of trace gases** study of the interaction between the Earth’s atmosphere and the biosphere, anthroposphere: emissions and fate of trace gases
  - BVOCs, Secondary aerosol formation, Greenhouse gases
  - Emission inventories, Source-receptor relationships & long-range transport

- **Atmospheric reactive gases** study of the composition of the atmosphere as a result of the chemical and dynamical processes
  - Stratospheric ozone depletion & recovery
  - PSC and ozone-related chemistry, Long-term trend analyses
  - Air quality (CO, NOx, formaldehyde), impact of volcanism: SO2, aerosol

- **Solar radiation** study of the spectral characteristics of the solar electromagnetic radiation, and how it interacts with the Earth and planetary atmospheres
  - Radiative transfer, aerosol/dust in planerary atmospheres
  - Composition of Mars and Venus atmospheres
Tropospheric Chemistry Studies at

Objective: understand the processes controlling the abundance of reactive gases, with focus on ozone, OH Radicals, and aerosols and on the emissions of precursor gases influencing these key compounds.

Part of the international effort to determine changes in the composition of the troposphere.
IMAGES
Global 3-d CTM, daily distribution of 80 trace gases between the Surface and 50 hPa
NMVOCs: short-lived species, emitted by fires, plants and anthropogenic activities
Large variety of species (isoprene, alkanes, aromatics, etc.)

Impact of NMVOCs on $O_3$ mixing ratios
(INVEM) Global 3-d, adjoint of IMAGES
Used to improve emission estimates of pollutants

✓ the most powerful tool to perform inversions of reactive species
✓ combine model output and satellite data (NO₂, HCHO, CO, etc.) in order to infer improved emission estimates
✓ feasibility studies performed & applied for different species

NOx emissions

Anthropogenic emissions 1997-2006

North America

Far East

Europe (excl. F.S.U.)
Atmospheric campaigns measure atmospheric composition change

Jungfraujoch (French Alps)
✓ high altitude research station (3580 m)
✓ operational since 1950 by ULg and since 1990 by IASB/BIRA
✓ long-term datasets of greenhouse gas measurements
✓ trend analyses
✓ support for validation of satellite measurements
UNFCCC, Bonn, November 2008

emissions from 40 industrialized countries remained in 2006 below the 1990 level by ~5%
BUT rise by 2.3% in 2000-2006

initial decrease is related to economic decline of eastern & Central European countries, now rise by 7.4%

UNCCC, Poznan, December 2008

Europe launched the idea of reducing lost forested area in the Tropics by half of the current levels by 2020, half global forest loss by 2030, reward developing countries through “Global Forest Carbon Mechanism”

UNCCC, Copenhagen, December 2009
Learn more about our activities?

www.aeronomie.be/tropo

Thank you for your attention

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