Bundesministerium
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und Forschung

AFO 2000

AFO 2000 project

KODYACS

(http://www.pa.op.dlr.de/kodyacs)

(Kopplung von Dynamik und atmosphärischer Chemie in der Stratosphäre)
(Coupling of dynamics and atmospheric chemistry in the stratosphere)

Final report

(Reporting period: April 1st, 2001 to June 30th, 2004)

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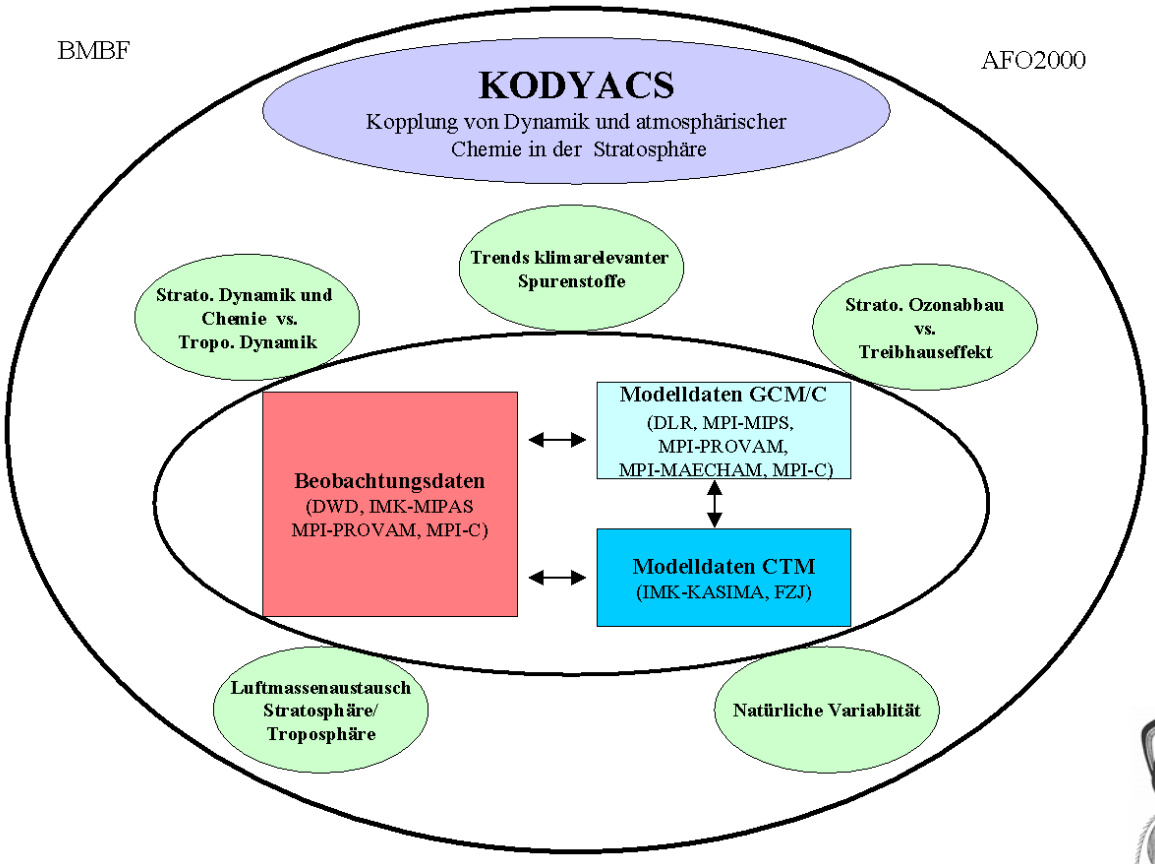

Partners in the project

- DLR: Institut für Physik der Atmosphäre, DLR-Oberpfaffenhofen
- DWD: Deutscher Wetterdienst, Meteorologisches Observatorium Hohenpeißenberg
- FZJ: Institut für Chemie und Dynamik der Geosphäre, ICG-1, Forschungszentrum Jülich
- IMK-KASIMA,
- IMK-MIPAS: Institut für Meteorologie und Klimaforschung, Universität Karlsruhe und Forschungszentrum Karlsruhe
- MPI-MAECHAM,
- MPI-PROVAM,
- MPI-MIPS: Max-Planck-Institut für Meteorologie, Hamburg
- MPI-C: Max-Planck-Institut für Chemie, Mainz

Coordination of the project

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Summary of scientific objectives and general progress

The primary goals of the AFO2000 project KODYACS were to identify and quantify the coupling of dynamical, chemical, and (micro-)physical processes in the upper troposphere / lower stratosphere (UT/LS) and the middle atmosphere (i.e. stratosphere and mesosphere), and to examine the interaction of the different atmospheric layers themselves. Investigations were mainly based on a hierarchy of atmospheric models (e.g. results of long-term simulations using Chemical-Transport Models, CTMs, and Chemistry-Climate Models, CCMs) and multi-year observations derived from ground based stations and satellite instruments.

KODYACS aimed to contribute new results to answer the following questions:

1. How do dynamical and chemical processes and the chemical composition of the stratosphere affect the variability of the troposphere?
2. How do the dynamics of the troposphere affect the chemistry of the stratosphere?
3. What are the reasons for trends in the upper troposphere and lower stratosphere of chemical compounds relevant for climate change?
4. Which interactions exist between stratospheric ozone depletion and the greenhouse effect?
5. How are air masses transported through the tropopause?
6. Which contributions do have natural components of climate variability for the observed changes of chemical compounds and meteorological values?

A considerable amount of new and interesting results have been achieved in the different groups of KODYACS, not least because of the intensive cooperation between these groups. **More than 30 papers appear in peer reviewed journals, which contain significant contributions from KODYACS, two master theses (Diplomarbeiten) and four PhD theses were successfully finished.** A detailed summary of the most important results obtained during the project are presented in this report. Furthermore, the annual reports are available on the KODYACS-web-page.

The results obtained by KODYACS will lead to improved predictions of atmospheric dynamics (climate) and chemical composition of the lower and middle atmosphere. For example, upgraded numerical tools are now available for more reliable estimates of the future development (recovery) of the stratospheric ozone layer because the interactions of changes in climate and chemical composition can be considered. Moreover, the investigations carried out in this project have established a solid basis for seasonal weather forecasts. KODYACS has been instrumental in creating a capacity for state-of-the-art chemistry-climate modelling in Germany. The links and interactions between existing groups have been strengthened and greatly improved. A very close cooperation between modelling and observations groups has been achieved. KODAYCS has helped to create substantial know-how in Germany. It has to be hoped that this potential can be used for further investigations of chemistry-climate coupling in the near future.

General information

KODYACS has been started on April 1st, 2001. A kick-off meeting was held in Hamburg at the Max-Planck-Institute for Meteorology on March 12th and 13th, 2001. This workshop was jointly organised with the AFO-projects MEDEC (MEsospheric Dynamics, Energetics and Chemistry, PI: Brasseur) and ISOTROP (Integration of Satellite Observations with the global chemical transport model MOZART to study the chemical composition in the upper TROPosphere, PI: Rohrer), which also concentrate on modelling work, but with regards to the mesosphere and the troposphere, respectively. The three projects ISOTROP, KODYACS, and MEDEC all contribute to the COMMIT project (COMmunity Modelling

InitiaTive, PI: Brasseur), which aims to develop an advanced community state-of-the-art model of the middle atmosphere from 0 to 250 km. The annual meeting 2002 of the KODYACS participants was held in Oberpfaffenhofen at the Institute for Atmospheric Physics on March 12th, 2002. KODYACS results were presented during the "AFO 2000 Statusseminar" in Schliersee from October 7th to 9th. The annual meeting 2003 of the KODYACS participants was held in Oberpfaffenhofen at the Institute for Atmospheric Physics on January 9th and 10th, 2003. To discuss and coordinate the final steps until the end of the project, a one day meeting of the responsible scientist was held on January 23rd, 2004, again in Oberpfaffenhofen. During the final meeting of AFO 2000 in Bad Tölz (March 22nd to 24th , 2004) the results achieved during KODYACS were presented on posters (all available on the KODYACS-web-page).

Several bilateral meetings were organised during the project to discuss detailed co-operations and the coordination of work.

The results of the project (including poster presentations) as well as protocols of recent events can also be viewed at the "KODYACS-web-page" (http://www.pa.op.dlr.de/kodyacs), where all relevant information is provided to the interested community.