
EVIVA
ENVISAT Value Adding for Continuous
Monitoring of Atmospheric
Trace Gases and Aerosols
DLR

2.1.Cover Page

2.1.1 Title

EVIVA – **E**N**VI**SAT **V**alue **A**dding for Continuous Monitoring of Atmospheric Trace Gases and Aerosols

2.1.2 Application domains and Location

Atmosphere
- Systematic Trace Gas Assimilation, Chemical Transport Modelling
- Aerosols and Clouds

2.1.3 Principal Investigator information

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2.1.4 Authority

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2.1.5 Co-investigators

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2.2. Team Composition, Experience, Innovation And Contribution To Mission Objectives

2.2.1 Team composition

Thilo Erbertseder, TE
Thomas Holzer-Popp, THP
Frank Baier, FB
Beate Hildenbrand, BH
Marion Schroedter, MS
Gerhard Gesell, GG
Manfred Bollner, MBO

2.2.2 Experience of the team

The team has experience in the fields of operational atmospheric satellite data processing, assimilation, validation, aerosol retrieval and data archiving.
A processing chain for value adding of ERS-2 GOME data has been running operationally in NRT since 1996 (http://auc.dfd.dlr.de/GOME_NRT) (Erbertseder et al. 2000, Thomas et al. 2000). In the framework of scientific co-operation with the Max-Planck-Institut Hamburg and the National Center for Atmospheric Research (NCAR, Guy Brasseur), a dynamical chemistry transport model, the 3D-NCAR-ROSE-CTM has been applied for operational assimilation of ERS-2-GOME ozone data (Baier et al. 2002). The team together with its partners has demonstrated that it is possible to retrieve vertically resolved ozone profiles from GOME total columns by means of the NCAR-ROSE-CTM (Bittner et al. 2002) and participates in the ESA GOME Ozone Profiling Working Group. Within the German AFO2000 projects SACADA and INVERT a 4D-Var assimilation system is currently being developed together with the University of Cologne and the National Research Center for Information Technology (GMD).
Further focus is on the development of a new synergetic aerosol retrieval method over land and ocean (optical depth and type) (Holzer-Popp et al. 2002[1,2]). Here the ESA-AO ERS-2/ENVISAT projects PAGODA (AO2-D107.1, 1995-1998), PAGODA-2 (AO3-218, 1998-2000), and SENECA (AO-ID 106; 2000-2002) are placed (PI: THP).
TE was deputy coordinator of the EC Project STREAMER (ENV-CT98-0756) and is responsible for the ENVISAT value adding atmosphere processing chain also contributing to the ESA-AO ENVISAT projects BIOMAPS (AO-ID 328) and VAMP (AO-ID 127). MBO is DLR DFD ENVISAT project PI and responsible for the D-PAC.

References:

Baier, F, Bittner, M, Schroedter, M, Erbertseder, T, Hess, M: Near Real Time Ozone Profiles from GOME Column Data using ROSE CTM, EGS General Assembly 2002, Nice 25.04.2002

Bittner, M, Erbertseder, T, et al, STREAMER Final Report (ENV4-CT98-0756), 2001

Erbertseder, T, M. Bittner, T. Holzer-Popp, M. Schroedter, S. Dech Small scale variations in atmospheric ozone, water vapor and aerosol and its implication for atmospheric correction,

Proceedings of the EUMETSAT 2000 Conference 29.05-02.06, 512-519, Bologna, Italy, 2000

Holzer-Popp, T, Schroedter, M, Gesell, G: Retrieving aerosol optical depth and type in the boundary layer over land and ocean from simultaneous GOME spectrometer and ATSR-2 radiometermeasurements. Part 1: Method description, accepted for publication, JGR, 2002

Holzer-Popp, T, Schroedter, M, Gesell, Retrieving aerosol optical depth and type in the boundary layer over land and ocean from simultaneous GOME spectrometer and ATSR-2 radiometer measurements. Part 2: Case study application and validation, accepted for publication, JGR, 2002

Thomas, W, Loyola, D, Aberle, B, von Bargen, A, Balzer, W, Hegels, E, Slijkhuis, S, Bittner, M, Erbertseder, T, Meisner, R, Muehle, H, Ruppert, T, Chance, KV, Spurr, RJD: Five years GOME/ERS-2 in space review of operational trace gas retrieval, and perspectives for GOME-2/METOP, Proceedings of the EUMETSAT 2000 Conference 29.05-02.06, 336-343, Bologna, Italy, 2000

Thomas, W; Baier, F; Erbertseder, *T*; Kästner, M: The Algeria severe weather event of November 1999 and its impact on ozone and NO2 distributions, submitted to Tellus B

2.2.3 Innovative character of the proposal

Within the ERS2-GOME value adding activities at DLR DFD a processor was developed to derive global ozone profiles from GOME column data operationally in near-real-time. It consists of a global chemical-transport model (CTM) and an optimal-interpolation (OI) data assimilation scheme. The quality of the resulting ozone profile data was demonstrated by several validation campaigns with ground based and satellite data from SAGE-II, MLS and CRISTA (Bittner, M, Erbertseder, T, et al, STREAMER Final Report (ENV4-CT98-0756), 2001). In the mid-latitudes the yearly mean relative differences above 100 hPa are within $\pm$ 5%, with standard deviations of $\pm$ 10%. That means that above 100 hPa where the bulk of ozone mass is found the assimilated GOME profiles are in very good agreement with the ground-based measurements, although only GOME total column data was assimilated. We propose to make full use of all ENVISAT data products related to ozone to gain global 3D distributions for the stratosphere. So this promising approach will be applied to profile measurements of SCIAMACHY, MIPAS and GOMOS. In addition to this approach a 4D-Var data assimilation system is currently being developed within the AFO 2000 Project SACADA.
By means of the CTM approach even distributions of species can be derived that are not measured by a sensor directly. Global analyses of ERS-2 GOME total column data, derived vertically resolved distributions, ClOx, NAT PSC, temperature and ozone depletion rates (chemical ozone loss) are available daily via http://auc.dfd.dlr.de/ROSE. Currently a web site is available for monitoring the Antarctic Ozone Hole by ERS-2 GOME and ROSE model (auc.dfd.dlr.de/GOME_NRT/ozonehole.html).

The gained global analyses will be an excellent data source for studying atmospheric dynamics, chemistry and trends. They will contribute to monitor international treaties and

conventions and will build a basis for establishing and fostering health services. Here parameters like Aerosols, UV-Radiation and Nitrogen Dioxide will be delivered.

Since DLR-DFD´s ATMOS User Center was officially nominated by the International Council for Scientific Union as "World Data Center for Remote Sensing of the Atmosphere" the derived data products will be easily accessible by a big user community.

2.2.4 Contribution to the mission objectives

EVIVA will contribute to the main objectives of the ENVISAT program, since it focuses on exploiting new capabilities for an enhanced continuous synoptic monitoring system for atmospheric trace gases and aerosols. The project will continue the work that has been successfully carried out since 1996 in deriving value added atmospheric products from ERS2/GOME (and ATSR) mainly in near-real-time.
By deriving operational global synoptic 3D trace gas analyses in NRT from heterogeneously distributed SCIAMACHY and MIPAS measurements both in time and space as well as aerosol parameters from SCIAMACHY and AATSR it makes a significant contribution to environmental studies with the focus on atmospheric chemistry. ENVISAT satellite data will be assimilated into the 3D Chemical Transport Model ROSE and the 4D Var assimilation system SACADA, considering all relevant chemical and dynamical processes. The data products further enable to gain time series of the Dynamic Activity of the atmosphere, a 3D mini ozone-hole climatology and routine analyses of species of interest that are not directly measured by any sensor.
By combining the new sensors with the assimilation technique together with powerful CTMs the range of unknown parameters describing the system can considerably be reduced. So the need to enhance the knowledge of the factors determining the environment can better be met.
The products will help to better understand, detect and assess global change. The outcome will support the quantification of natural variability and atmospheric composition change.
EVIVA delivers operational, continuous and coherent global data sets and analyses that are needed by the scientific and application community in order to better understand climatic processes and to improve climate models.
The EVIVA data products will be freely available via the WWW –offline and in near-real-time and so following ESA policies foster the further use of ENVISAT data.

2.3. Executive Summary And Schedule

2.3.1 Executive summary

According to pan-European research results, policies, international conventions and requests by users and stakeholders the main scientific objective of EVIVA is the development and validation of ENVISAT value added products for continuous monitoring of atmospheric trace gases and aerosols.

The EVIVA objectives are:

- Global 3D analyses of SCIAMACHY and MIPAS limb trace gas measurements with focus on stratospheric ozone and ozone related species (chlorine, bromine, hydrogenic and nitrogenic components) including all relevant dynamical and chemical processes by means of Satellite Data Assimilation and Chemical Transport Modelling.

- Global 3D ozone analyses by inverting SCIAMACHY vertical column densities by means of Assimilation into the 3D Chemical Transport Model ROSE, which was proven with GOME data.

- Global synoptic analyses from conservative SCIAMACHY vertical column densities by means of assimilating with a Kalman Filter approach.

- Global analyses of trace gases by means of synergistic use of SCIAMACHY, MIPAS and GOMOS measurements and the 4D-Var data assimilation system SACADA.

- Derivation of aerosol parameters using synergy effects from SCIAMACHY and AATSR for air pollution monitoring and UV quantification.

- Compilation of a 3D ozone-hole/streamer "climatology" based on assimilated SCIAMACHY data.

- The Dynamic Actitvity Index (DAI) will be derived daily from SCIAMACHY level 3 ozone vertical column densities. For DAI time series analysis Wavelet spectrograms will be calculated.

- Prototyping and rigorous validation using quality controlled data with emphasis on the contribution to ESA policies.

- All processors will be integrated into the Data and Information Management System DIMS – a new standard for data processing and archiving developed at DLR DFD.

- A Toolbox will be freely available for data visualisation and exploration of all EVIVA data products.

EVIVA will be funded by DLR.

2.3.2 Schedule

Project period 11/2002 to 11/2005
(systematic processing will continue as long as ENVISAT data is available)

Final Results 10/2005
Preliminary Results 05/2003, 05/2004, 05/2005

Offline data acquisition
As soon as products are available

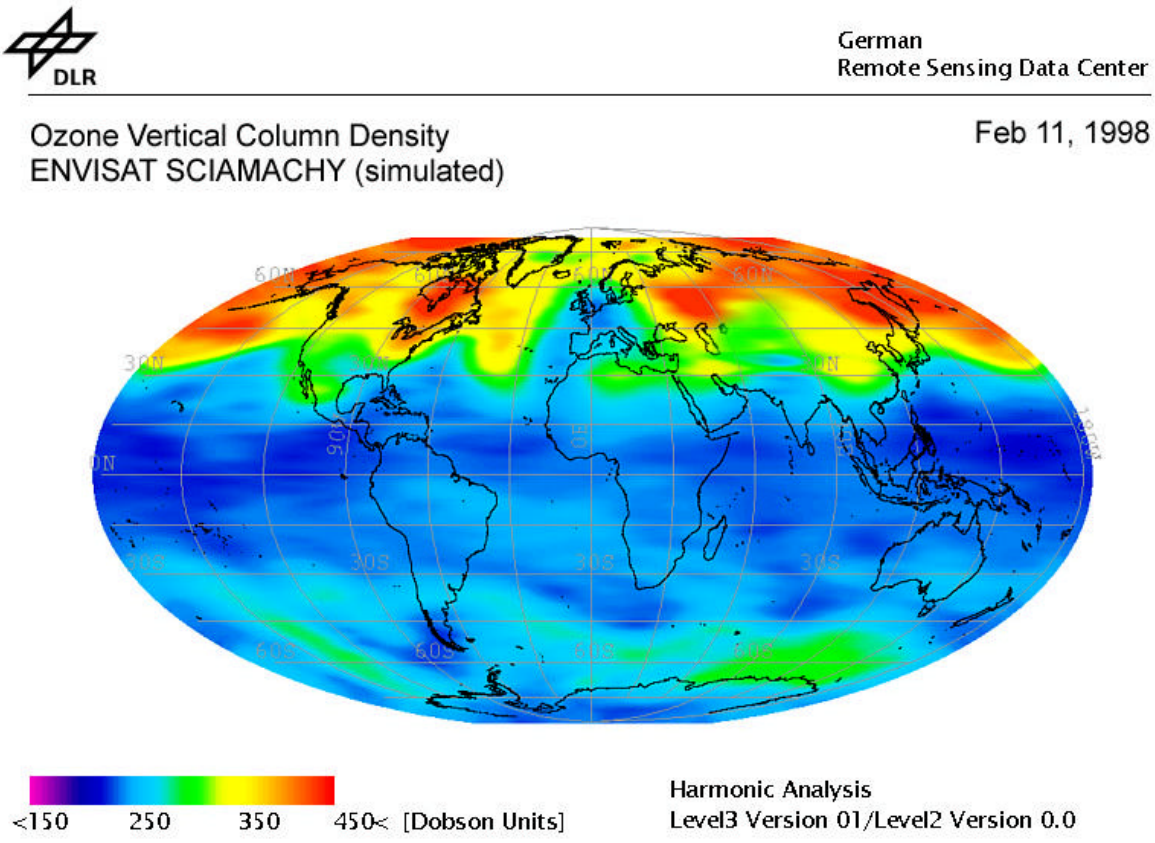
NRT data acquisition
As soon as products are available

WP 10	Proto 11/2002	Syst 01/2003	Val as of 12/2002	Avail as of 02/2003
WP 20	Proto 11/2002	Syst 01/2003	Val as of 12/2002	Avail as of 02/2003
WP 30	Proto 01/2003	Syst 03/2003	Val as of 02/2003	Avail as of 04/2003
WP 40	Proto 01/2003	Syst 03/2003	Val as of 02/2003	Avail as of 04/2003
WP 50	Proto 11/2003	Syst 01/2004	Val as of 12/2003	Avail as of 04/2004
WP 60	Proto 05/2003	Syst 06/2003		Avail as of 08/2003
WP 70	Proto 06/2003	Syst 07/2003		Avail as of 09/2003
WP 80	Proto 07/2003	Syst 08/2003		Avail as of 10/2003
WP 90	Study 01/2005			Avail as of 07/2005
WP 100	Proto 12/2002	Syst 03/2003	Val as of 01/2003	Avail as of 05/2003
WP 110	Proto 03/2003	Syst 05/2003		Avail as of 07/2003
WP 120				Avail as of 11/2002

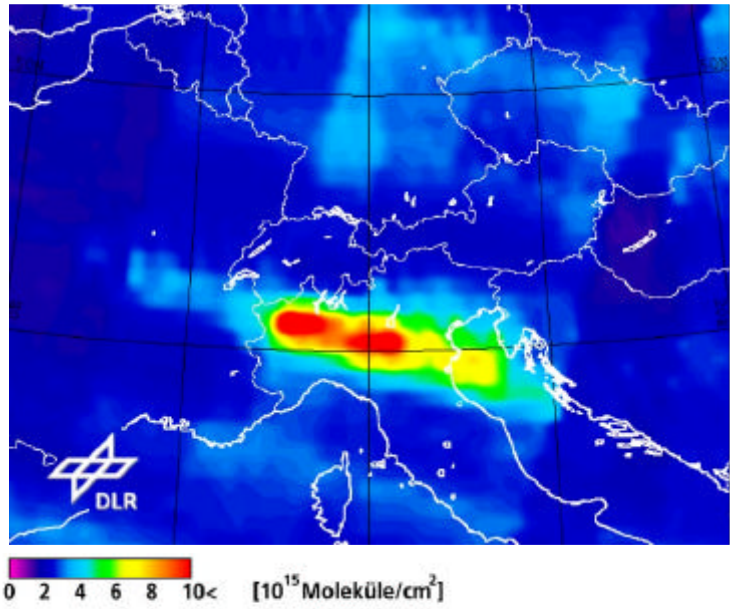
(Abbrevations: Prototype, Systematic Processing, Validation, Systematic Availability)

2.4.Detailed Description of WP´s and Deliverables

WORKPACKAGE 10	
PRODUCT ID	SCIAMACHY.L3.VCD
NAME	**SCIAMACHY assimilated and interpolated vertical column density maps**
DESCRIPTION	Value added product Species considered (depending on Level 2 data availability): O_3, N_2O, CH_4, HNO_3, H_2O, NO_2, BrO, CO, OClO , SO_2 Assimilation: The data assimilation technique Kalman-Filtering provides globally gridded vertical column density distributions for conservative species by synoptic analysis for any time. The standard product output is every 6 hours Interpolation: The spectral statistical technique Harmonic Analysis provides globally gridded vertical column density distributions for conservative species by 24h least-square-fitting. Compositing: The reactive species (NO_2, BrO, CO, OClO, SO_2) are projected to a global grid by data compositing on a daily base. Motivation: Due to the orbital parameters and scanning geometry of SCIAMACHY the measurements are distributed heterogeneously in time and space. Global coverage is achieved only after 3 days. Highly dynamic phenomena, however, like the total ozone concentration, may vary strongly within hours on their spatial and temporal scale. To model a quasi-daily global mean of the conservative species, the Harmonic Analysis will be applied. In order to determine rapid changes in the atmospheric system, it is required to derive trace gas distributions more frequently then on a daily basis. Therefore, the Kalman Filter approach is used. It allows the consideration of both time and space dependency of the SCIAMACHY Level 2 data. Finally, the Kalman Filter based data assimilation technology produces an estimate on the state of the system, say the distribution of a trace gas, at a given time.
INPUT DATA	SCIAMACHY Level 2 data
OUTPUT DATA (COMPONENTS)	Globally gridded vertical column density distributions (HDF 4.1) Quicklooks (Maps: Global, Europe, Northern Hemisphere, Southern Hemisphere
COVERAGE	Global 30-240 km x 30 km (depending on measurement mode)
PROCESSING TYPE	Operational, daily (depending on data availability)
AVAILABILITY	Offline, FD (http://auc.dfd.dlr.de, EOWEB)
Product available as of	Offline: February 2003 (Ozone) FD: tbd Availability depending on species

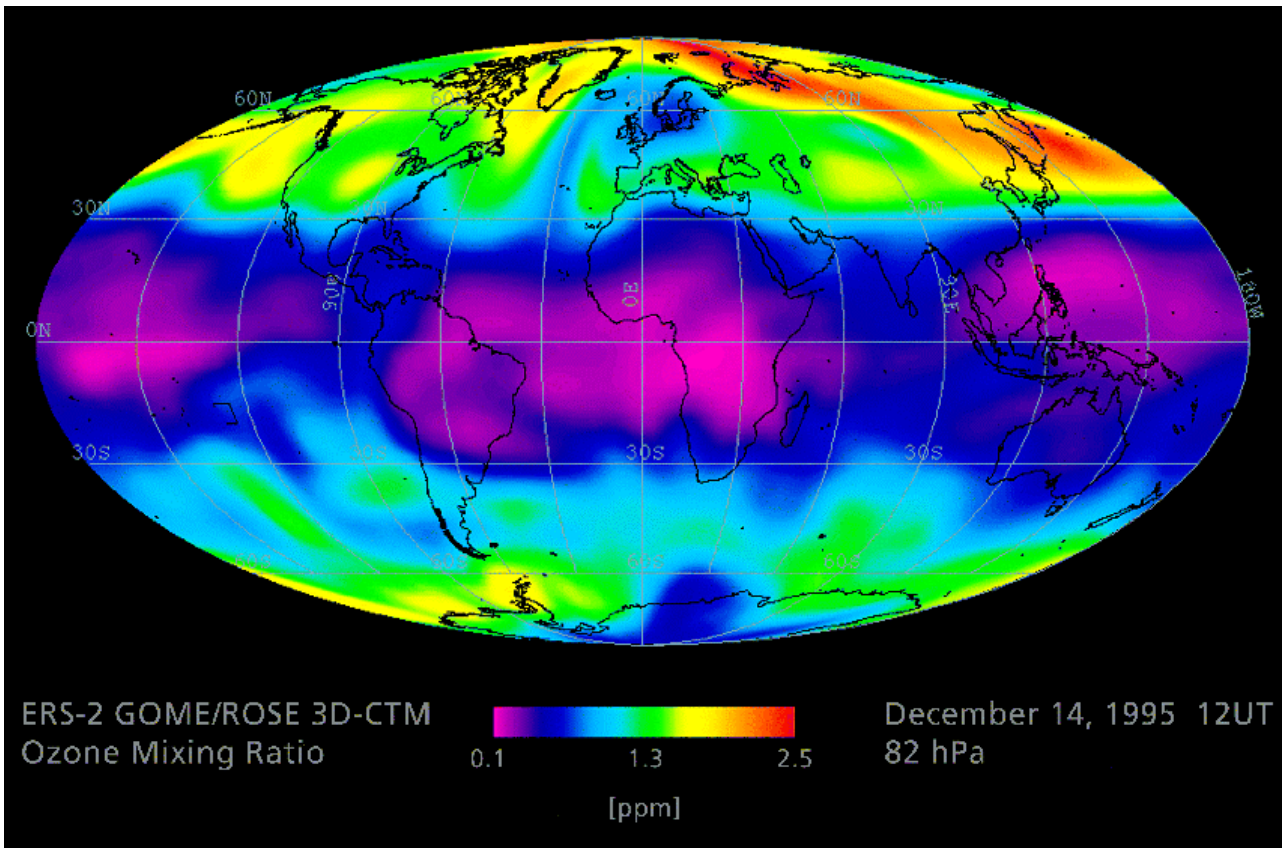


Example: Quicklook for Ozone Vertical Column Densities as derived from simulated SCIAMACHY data (based on GOME) by Harmonic Analysis for February 11, 1998.

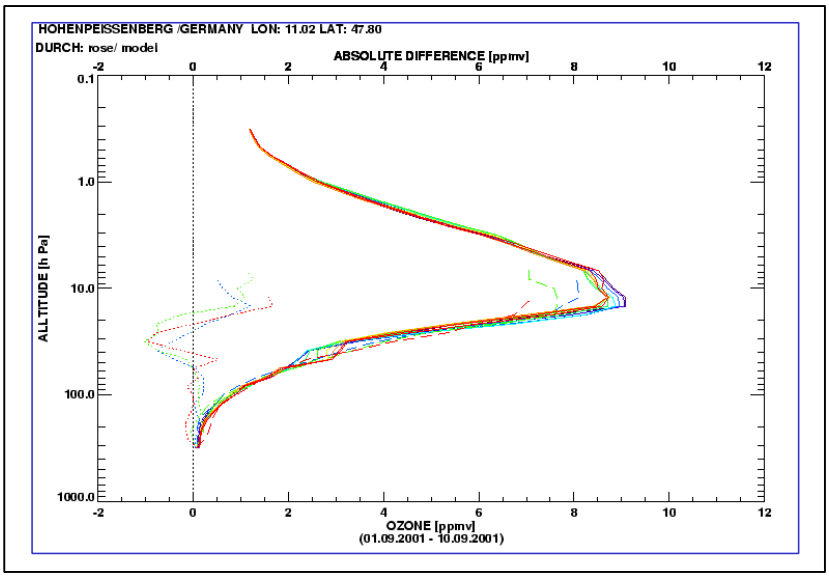


Example: Severe air pollution in the Po basin, Italy, as indicated by GOME Nitrogen Dioxide measurements from November 17 to 21, 2001.

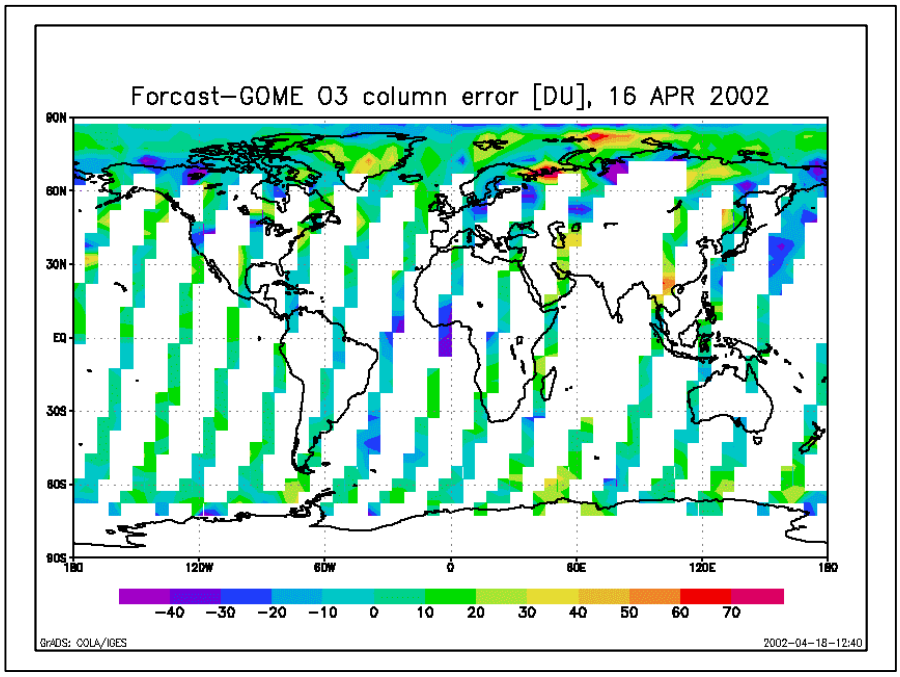
WORKPACKAGE 20	
PRODUCT ID	SCIAMACHY.L3.VCD2VP
NAME	**SCIAMACHY vertical profiles by assimilating vertical cloumns**
DESCRIPTION	Value added product Species considered: O_3 Inverting SCIAMACHY ozone columns by assimilation into the 3D CTM ROSE: Up to the availability of ENVISAT SCIAMACHY total column ozone data a processor was developed using the NCAR ROSE chemistry transport model (CTM) operated routinely at DFD on basis of GOME ozone column data. As a standard method for the assimilation of observations into the CTM "optimal interpolation" is used. The model prognosticates ozone profiles that are consistent with the available column observations. This GOME-ROSE processor delivers operational analyses which are already available online (http://auc.dfd.dlr.de/ROSE) . The final product is delivered as 3D global ozone fields with a time resolution of 6h in the form of HDF 4.1 files. For the assessment of the different chemical dynamical contributions, in addition, analyses of the reactive species like ClO and the main reservoir gasses linked to ozone are made. Extensive comparisons with probes and satellite data which have been carried out for the year 1996 permit a first quantitative estimate of the model errors. At first the systematic error part can well be isolated. The examined differences between ROSE and SAGE II ozone concentrations show primarily a clear seasonal dependence in high latitudes. Maximum values appear in the lower stratosphere of the winter hemisphere as well as near the tropical and subtropical tropopause region. From the available SAGE II data an annual climatology were generated for 1996 by calculating three-monthly average values. After subtraction of the "climatological" error a systematic discrepancy of only 6% remains. The mean variance between observed ozone values and simulated quantities is below 15 % for altitudes above 100 hPa.
INPUT DATA	SCIAMACHY Level 2 data
OUTPUT DATA (COMPONENTS)	Globally gridded volume mixing ratio distributions (HDF 4.1) Quicklooks (Global Maps for several selected altitudes).
COVERAGE	Global ROSE-CTM: 2.8° x 2.5° lon.-lat. 37 levels between 9 and 60 km altitude, vertical step size of 1.3 km.
PROCESSING TYPE	ROSE-CTM: Operational, daily, on request every hour
AVAILABILITY	Offline, FD (http://auc.dfd.dlr.de)
Product available as of	Offline: February 2003 FD: tbd Depending on Level 2 data availability



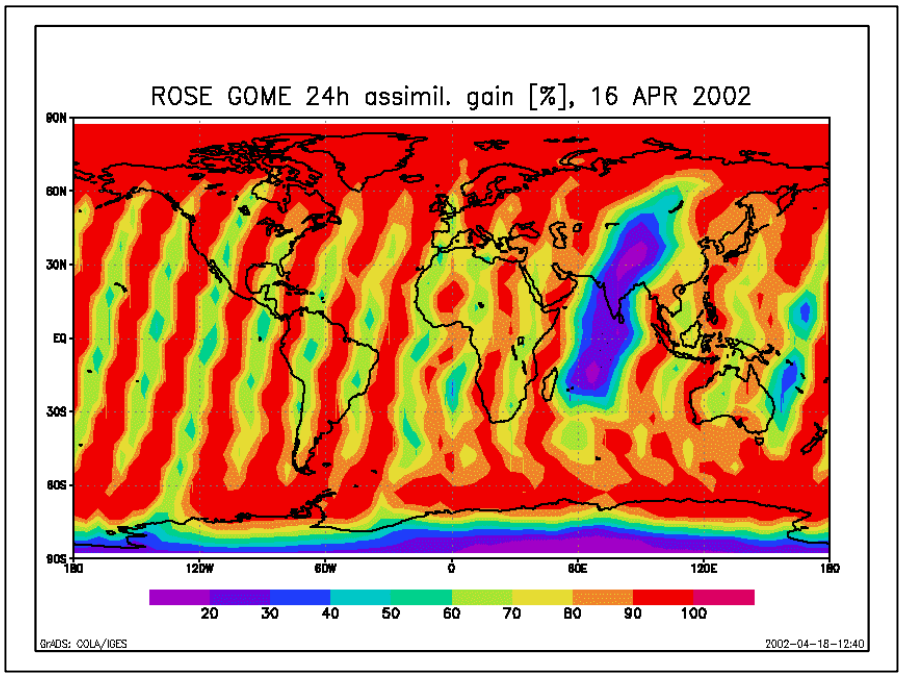
Example: Ozone Volume Mixing Ratios for December14, 1995 at 82 hPa (~17 lm). The ozone field was derived by assimilating GOME total column ozone data into the 3D Chemical Transport Model ROSE



Example: The assimilated ENVISAT data products will continuously be validated against radiosoundings and LIDAR measurements as well as against other satellite measurements like SAGE. Here ROSE-GOME ozone profiles are compared with four radiosoundings of Hohenpeissenberg (DWD).



Example for a key figure of ENVISAT data assimilation and quality control. Plotted are 24h column differences Model Forecast – Satellite Observation (ERS2 GOME) in Dobson Units for April 16, 2002.

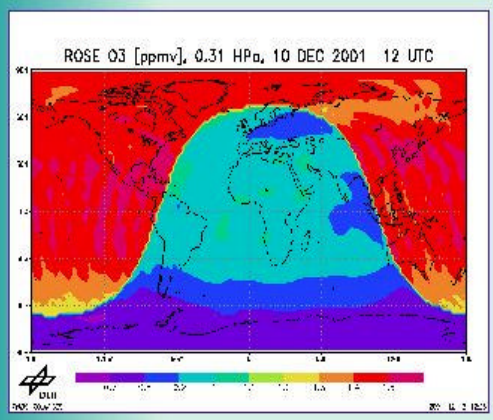


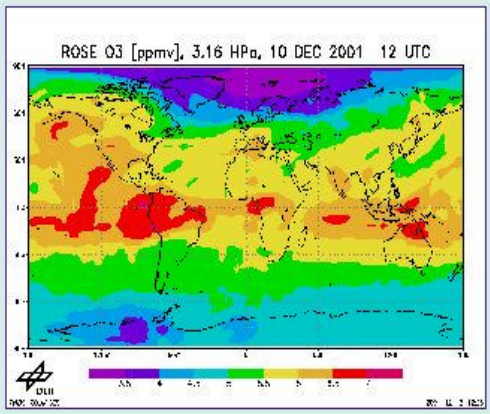
Example for a key figure of ENVISAT data assimilation and quality control. Plotted is the 24h gain of information by assimilating satellite data (ERS-2 GOME) into the model in percent for April 16, 2002. 100% percent stands for complete information gain and update. Values below 20% indicate the lack of observational data within the last 24 hours.

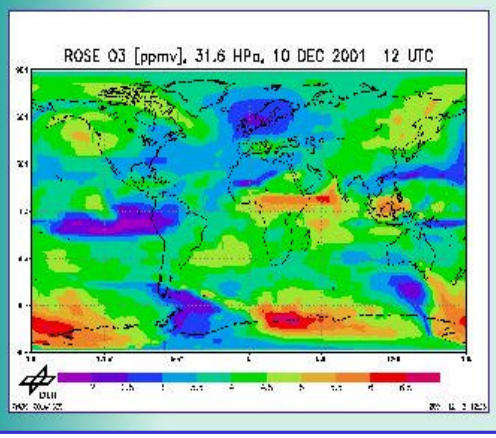
Vertically Resolved Ozone Distribution (Pathfinder Product)

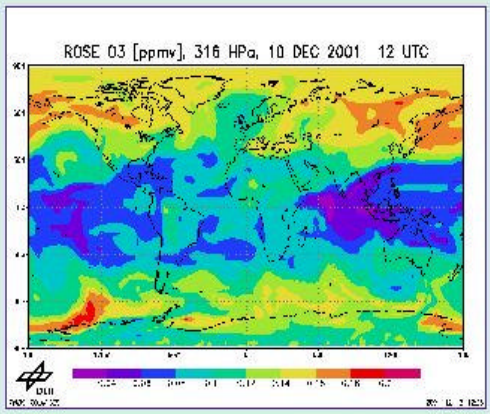
Ozone concentration in [ppmv]
globally in a 2.8° x 2.5° grid resolution
on 37 levels between 0.31 hPa and 316 hPa

A daily updated subset of 4 levels at 0.31 hPa (upper model boundary), 3.16 hPa, 31.6 hPa, and 316 hPa (lower model boundary) at 12 UTC and







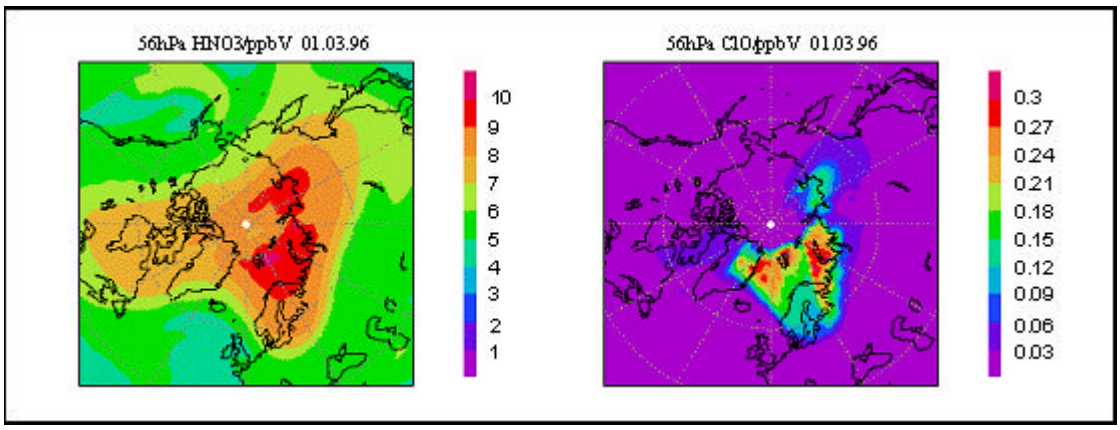


Example: Height resolved ozone distributions will be gained by assimilating SCIAMACHY and MIPAS vertical profiles into the 3D CTM ROSE. An example is depicted using ERS-2 GOME data for December 10, 2001 for 0,31 hPa (upper left), 3,16 hPa (upper right), 31,6 hPa (lower left) and 316 hPa (lower right) (simulated by GOME column inversion) as available via http://auc.dfd.dlr.de.

WORKPACKAGE 30	
PRODUCT ID	SCIAMACHY.L3.VP
NAME	**SCIAMACHY assimilated vertical profiles**
DESCRIPTION	Value added product Species considered (depending on Level 2 data availability): O_3, N_2O, CH_4, HNO_3, H_2O, NO_2, BrO, CO, OClO , SO_2 Assimilation into 3D CTM ROSE: The SCIAMACHY data will be assimilated by optimal interpolation (OI). Globally gridded 3D fields will be available every 6 hours. We use the 3D global chemical-transport-model NCAR-ROSE as described in detail in Rose and Brasseur (1989) and Riese et al. (1999). The model covers the relevant gas-phase stratospheric chemical processes. Heterogeneous processes are also included in the model. It accounts for about 100 reactions, including oxygen, hydrogen, carbon, nitrogen chlorine, and bromine species. The basic chemical time-step is 15 min. All species are transported every 90 minutes using a semi-Lagrangian scheme. Wind and temperature fields are derived from 24h UKMO global analyses. This data set defines a consistent synoptic state using satellite-based temperature soundings and radiosonde observations assimilated in a global circulation model (GCM). The spatial discretization of the DFD ROSE version uses a 2.8° x 2.5° lon.-lat. spherical grid and 37 log-pressure levels between 9 and 60 km altitude (316. to 0.316 hPa) resulting in a vertical step size of 1.3 km. Assimilation by Kalman Filtering: The data assimilation technique Kalman-Filtering provides globally gridded vertically resolved volume mixing ratios for conservative species by synoptic analysis for any time. The standard product output is every 6 hours on defined altitude levels (every 3km). This is an experimental product. Motivation: Due to the orbital parameters and scanning geometry of SCIAMACHY the measurements are distributed heterogeneously in time and space. To model three dimensional synoptic distributions including all relevant chemical and dynamical processes the data is assimilated into the 3D Chemical Transport Model ROSE (or by the Kalman Filter for conservative species)
INPUT DATA	SCIAMACHY Level 2 data
OUTPUT DATA (COMPONENTS)	Globally gridded volume mixing ratio distributions (HDF 4.1) Quicklooks (Global Maps for several selected altitudes).
COVERAGE	Global ROSE-CTM: 2.8° x 2.5° lon.-lat. 37 levels between 9 and 60 km altitude, vertical step size of 1.3 km. Kalman Filtering: 120x400km, vertical step size of 3 km
PROCESSING TYPE	ROSE-CTM: Operational, daily, on request every hour Kalman Filter: Operational, daily, on request every hour
AVAILABILITY	Offline, FD (http://auc.dfd.dlr.de)
Product available as of	Offline: April 2003 (Ozone) FD: tbd Depending on Level 2 data availability and species

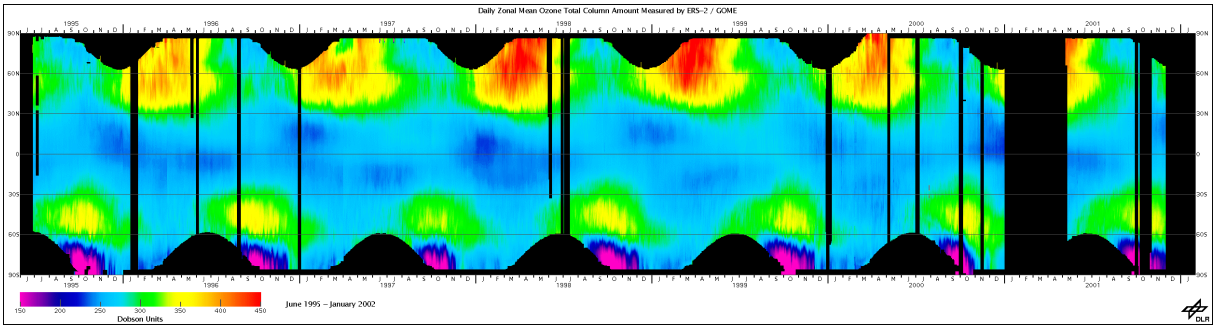
WORKPACKAGE-40	
PRODUCT ID	MIPAS.L3.VP
NAME	**MIPAS assimilated vertical profiles**
DESCRIPTION	See description of workpackage 30
INPUT DATA	MIPAS Level 2 data
OUTPUT DATA (COMPONENTS)	Globally gridded volume mixing ratio distributions (HDF 4.1) Quicklooks (Global Map for several selected altitudes).
COVERAGE	Global ROSE-CTM: 2.8° x 2.5° lon.-lat. Between 9 and 60 km in a vertical step size of 1.3 km. Kalman Filtering: 120x400km, 3 km
PROCESSING TYPE	ROSE-CTM: Operational, daily, on request every hour Kalman Filter: Operational, daily, on request every hour
AVAILABILITY	Offline, FD (http://auc.dfd.dlr.de)
Product available as of	Offline :April 2003 (Ozone) FD: tbd Depending on Level 2 data availability and species

WORKPACKAGE 50	
PRODUCT ID	SYNATMOS.L3.VP
NAME	**Synergistic assimilated vertical profiles from SCIAMACHY, MIPAS and GOMOS**
DESCRIPTION	Value added product Assimilation into SACADA: Advanced spatio-temporal data assimilation methods will provide a powerful technique to combine observations, statistical information, and three-dimensional chemistry models. With the inclusion of the respective error estimates, all sources of information can be synthesised to obtain a "Best Linear Unbiased Estimate" (BLUE) of the chemical state and ist evolution. SCIAMACHY, MIPAS and GOMOS data will be synergistically assimilated into the 4D-Var system SACADA. The system is currently being developed within the BMBF AFO 2000 Project SACADA.
INPUT DATA	SCIAMACHY, MIPAS and GOMOS Level 2 data
OUTPUT DATA (COMPONENTS)	Globally gridded volume mixing ratio distributions (HDF 4.1) Quicklooks (Global Map for several selected altitudes).
COVERAGE	Global tbd x tbd lon.-lat (icosaedric grid) between 0 and 80 km in a vertical step size of 5 km.
PROCESSING TYPE	Operational
AVAILABILITY	Offline, FD
Product available as of	April 2004



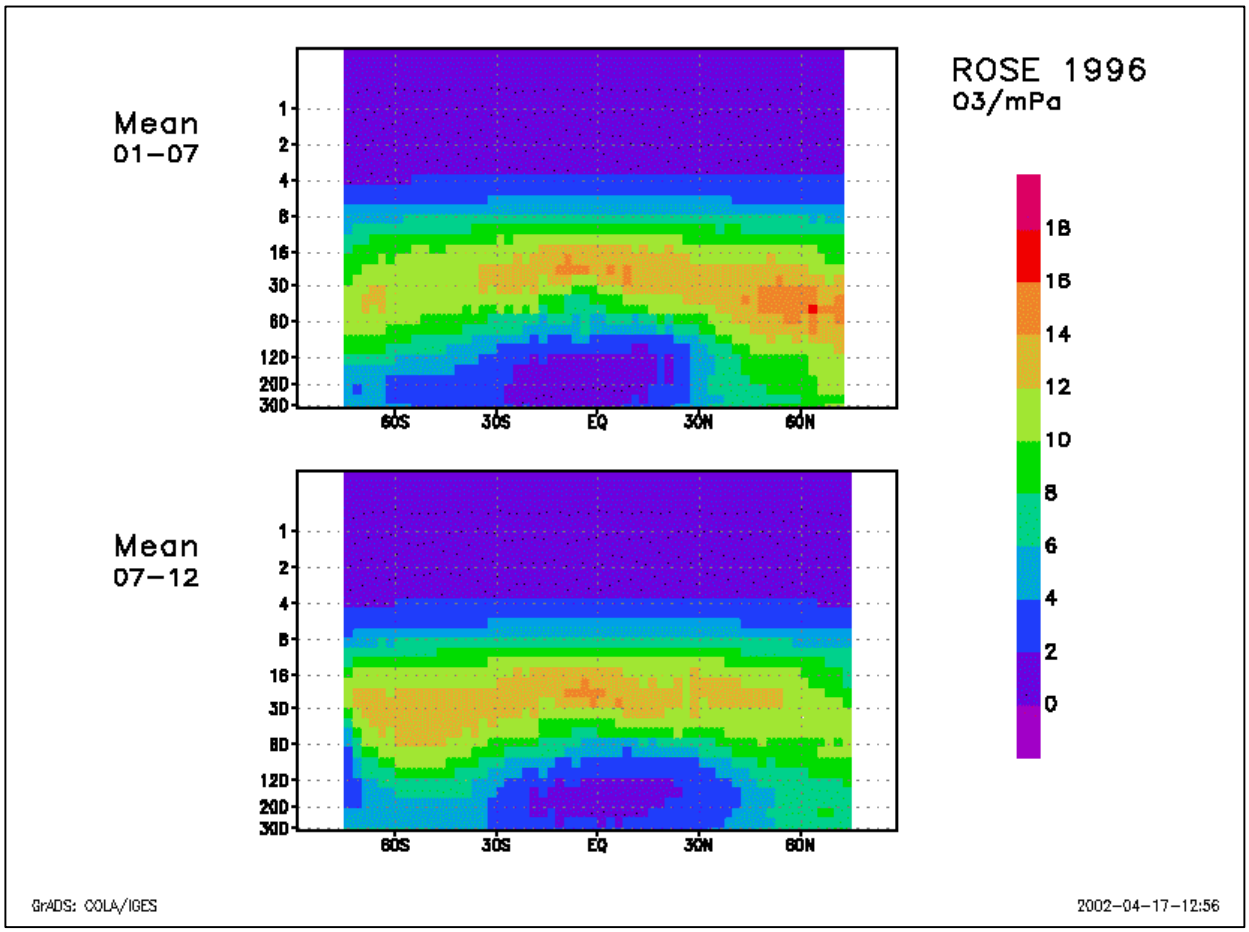
Example: Deriviation of ozone relevant species by assimilating satellite data (here: GOME) into the 3D CTM the precursor of SACADA. The figure shows distributions of HNO3 and ClO for the northern hemisphere for March 1, 1996 at 56 hPa. The conservative dynamical tracer HNO3 (left) illuminates the polar vortex, the ClO data (right) shows strong Chlorine activation which indicates chemical ozone depletion. Comparisons of the modelled data with MLS measurements show an accuracy of 10%.

WORKPACKAGE 60	
PRODUCT ID	SCIAMACHY.L3.VCD.MEAN
NAME	**Monthly and daily zonal means of SCIAMACHY vertical column densities**
DESCRIPTION	Value added product Monthly mean: SCIAMACHY assimilated and interpolated vertical column density maps are averaged on a monthly base Daily zonal mean SCIAMACHY assimilated and interpolated daily vertical column density maps are averaged for each latitude.
INPUT DATA	SCIAMACHY Level 3 data
OUTPUT DATA (COMPONENTS)	Globally gridded monthly averaged vertical column densities (HDF 4.1) Quicklooks (Global Map). Data set and plot of daily zonal means
COVERAGE	Global
PROCESSING TYPE	Operational, monthly
AVAILABILITY	Offline (http://auc.dfd.dlr.de)
Product available as of	August 2003



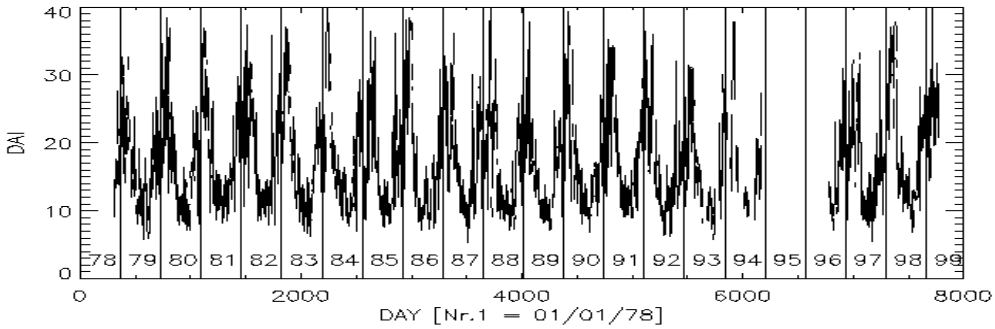
Example: Daily zonal mean from GOME Total Column Ozone Measurements (Level 3) since January 1996.

WORKPACKAGE 70	
PRODUCT ID	SCIAMACHY.L3.VP.MEAN, MIPAS.L3.VP.MEAN
NAME	**Monthly and daily zonal means of SCIAMACHY and MIPAS volume mixing ratios**
DESCRIPTION	Value added product Monthly mean: SCIAMACHY and MIPAS assimilated volume mixing ratio distributions are averaged on a monthly base Daily and monthly zonal means SCIAMACHY and MIPAS assimilated daily volume mixing ratio distributions are averaged for each latitude
INPUT DATA	SCIAMACHY Level 3 data
OUTPUT DATA (COMPONENTS)	Globally gridded monthly averaged vertical column densities (HDF 4.1) Quicklooks (Global Map). Data set and plot (for selected altitudes) of daily and monthly zonal means
COVERAGE	Global
PROCESSING TYPE	Operational, monthly
AVAILABILITY	Offline (http://auc.dfd.dlr.de)
Product available as of	September 2003

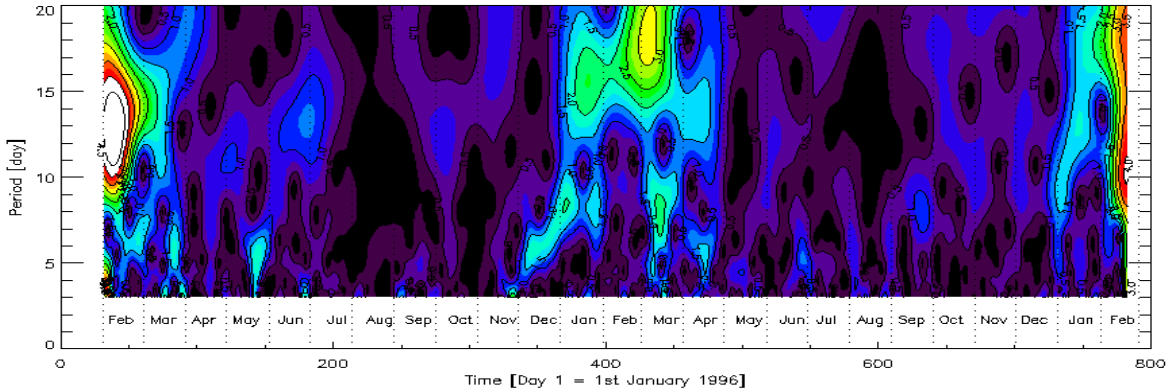


Example: Zonal Half Yearly Mean of ozone partial pressure [mPa] as derived by assimilating GOME data into the 3D CTM ROSE. The data is plotted for each latitude for altitudes from 316 to 0,1 hPa (9-60 km)

WORKPACKAGE 80	
PRODUCT ID	SCIAMACHY.L3.VCD.DAI
NAME	**Dynamic Activity Index from SCIAMACHY vertical column densities**
DESCRIPTION	Value added product The Dynamic Activity Index (DAI) is defined as the hemispherical averaged amplitude of the planetary wave number one. Thus, it is a key parameter quantifying the atmospheric dynamic activity of the lower stratosphere. The DAI will be derived daily from SCIAMACHY Level 3 vertical column density distributions. These are acting as a tracer for illuminating wave structures of the lower stratosphere Time series and wavelet spectrograms will be derived
INPUT DATA	SCIAMACHY Level 3 data
OUTPUT DATA (COMPONENTS)	Value for Dynamic Activity Index for Southern and Northern Hemisphere, time series and wavelet spectrograms
COVERAGE	-
PROCESSING TYPE	Operationally, daily Time series and wavelet spectrograms for studies
AVAILABILITY	Offline (http://auc.dfd.dlr.de)
Product available as of	October 2003



Example: Daily Dynamic Activity Index (DAI) as derived from Total Ozone Mapping Spectrometer (TOMS) data from 1978 to 1999.

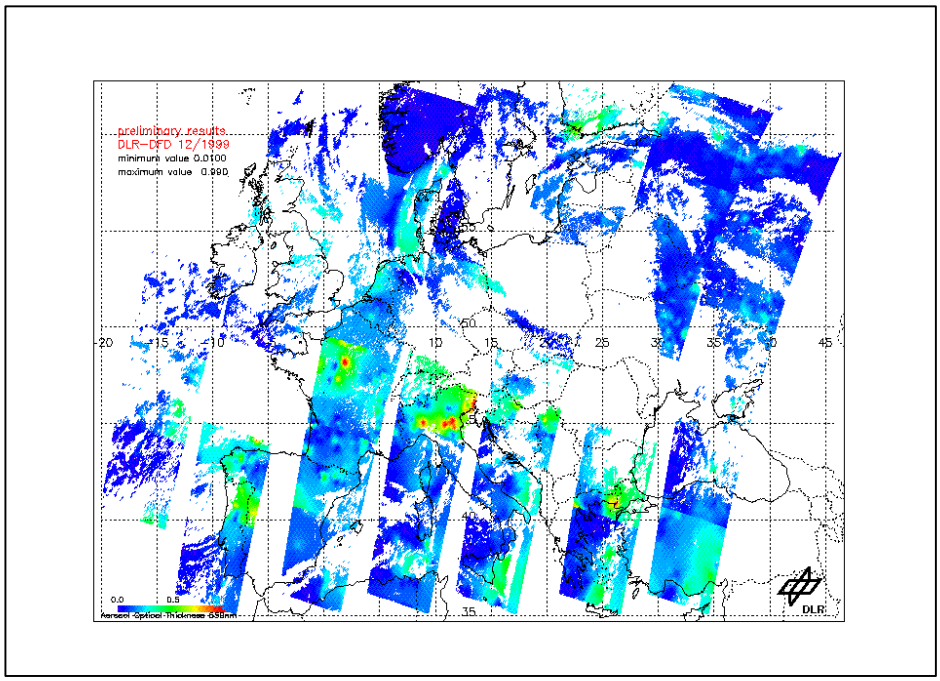


Example: Spectrogram of the DAI time series for the Northern Hemisphere from Jan 96 to Dec 97. Black color stands for low, red and white color for high amplitudes, respectively.

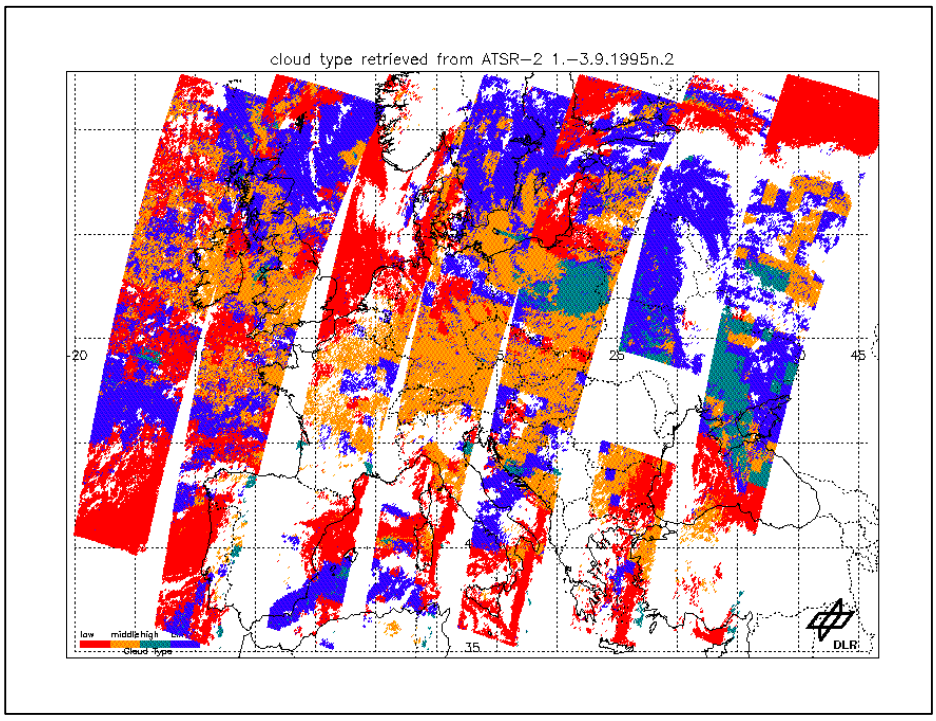
WORKPACKAGE 90	
PRODUCT ID	SCIAMACHY.OZONE.MINI.HOLE.CLIM
NAME	**Ozone Mini Hole Climatology from SCIAMACHY global analyses**
DESCRIPTION	Compilation of a 3D ozone-hole/streamer "climatology" based on assimilated SCIAMACHY data by physical and statistical means
INPUT DATA	SCIAMACHY Level 3 data – global ozone analyses
OUTPUT DATA (COMPONENTS)	Frequency of occurrence and location
COVERAGE	Global
PROCESSING TYPE	Study
AVAILABILITY	Publication
Product available as of	July 2005

WORKPACKAGE 100	
PRODUCT ID	AEROCLOUD.L2
NAME	**Aerosol and Cloud Parameters derived by using synergy effects of AATSR and SCIAMACHY data**
DESCRIPTION	Value added product Aerosol parameters will be retrieved with the method SYNAER (*Holzer-Popp et al. 2002, submitted to JGR*) from a combination of simultaneous AATSR and SCIAMACHY measurements. The high spectral resolution of SCIAMACHY supplements ideally the high spatial resolution of AATSR. First of all a cloud detection is performed for all AATSR pixels. Boundary layer aerosol optical thickness (BLAOT) values are derived from automatically selected dark AATSR nadir pixels (dark forest, water bodies) for which the surface albedo can be estimated with good accuracy. Using the atmospheric correction scheme EXACT (*Popp 1995*) which has been validated with Landsat-TM and NOAA-AVHRR data, BLAOT can be estimated for the dark fields and interpolated to all cloudfree AATSR nadir pixels. Then the surface albedo values for the 3 wavelengths 560 nm, 670 nm and 870 nm are obtained for all pixels. The AATSR derived data are co-located to SCIAMACHY pixels and interpolated spectrally. Using the AATSR calculated values of optical thickness and surface albedo, SCIAMACHY spectra for different mixtures are simulated at 10 selected wavelengths. A least square fit of the simulations to the measured SCIAMACHY spectrum selects the most plausible type of aerosol and its corresponding BLAOT value in a SCIAMACHY pixel. Finally, an ambiguity test is applied.
INPUT DATA	SCIAMACHY Level 1 data, AATSR Level 1b data
OUTPUT DATA (COMPONENTS)	Aerosol and Cloud parameters (Type, Optical Depth) for each ENVISAT Orbit
COVERAGE	Product along ENVISAT orbits
PROCESSING TYPE	Operational, each available orbit
AVAILABILITY	Offline
Product available as of	May 2003

WORKPACKAGE 110	
PRODUCT ID	AEROCLOUD.L3
NAME	**Aerosol and Cloud Parameters derived by using synergy effects of AATSR and SCIAMACHY data**
DESCRIPTION	Value added product Daily composites consisting of all AEROCLOUD.L2 data will be derived on a daily base. No interpolation will be applied to the data.
INPUT DATA	SCIAMACHY Level 1 data, AATSR Level 1b data
OUTPUT DATA (COMPONENTS)	Aerosol and Cloud parameters (Type, Optical Depth) on a global grid
COVERAGE	Global
PROCESSING TYPE	Operational, daily
AVAILABILITY	Offline (http://auc.dfd.dlr.de)
Product available as of	July 2003

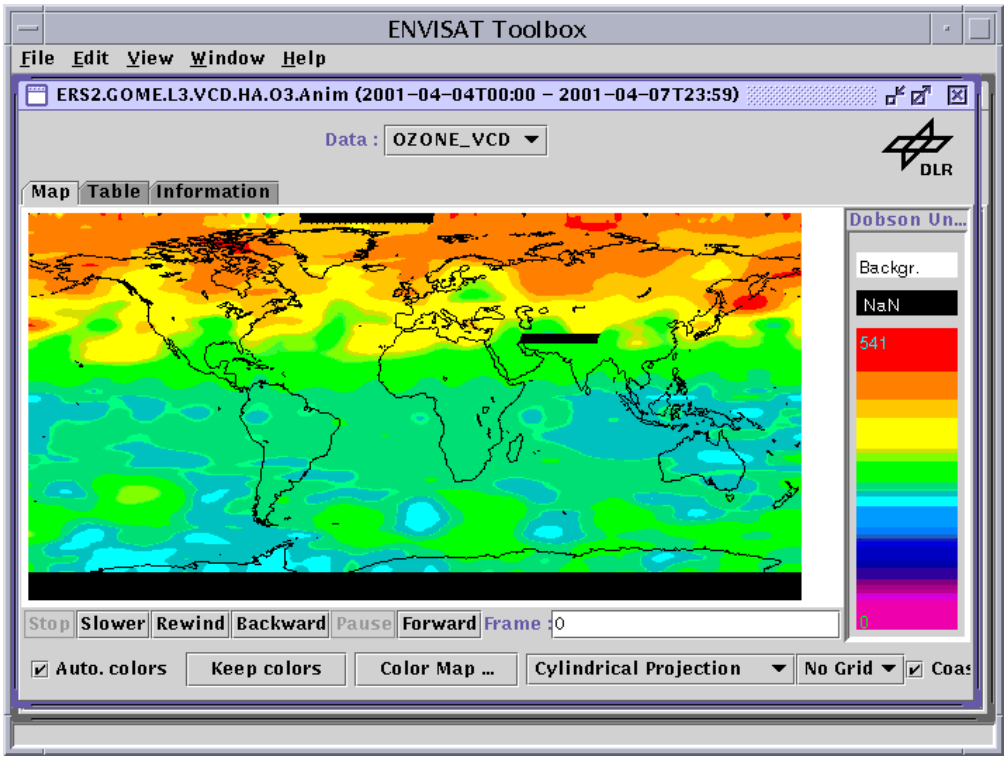


Example: High resolution aerosol map over Europe Aerosol optical thickness at 550 nm for all daytime ATSR-2 frames acquired over Europe during the period 1.-3. September 1995 with 1 km horizontal resolution. Cloud covered pixels are left blank.

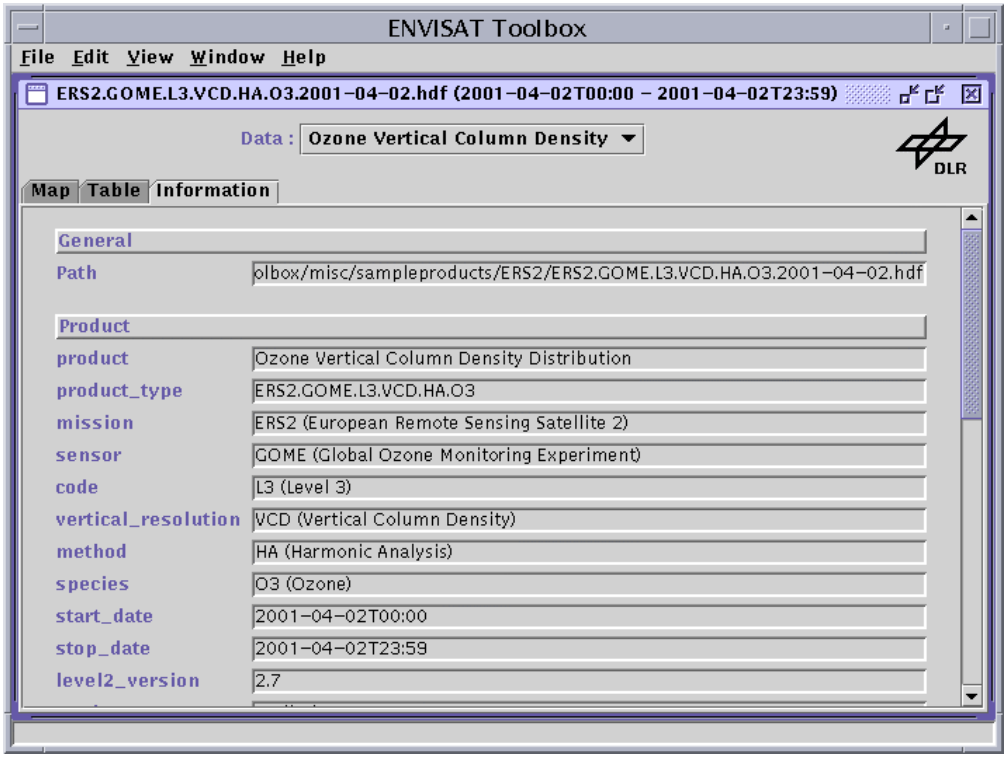


Example: Cloud type map for Europe for all daytime ATSR-2 frames acquired over Europe during the period 1.-3. September 1995 with 1 km horizontal resolution.

WORKPACKAGE 120	
PRODUCT ID	ENVISAT ATMOS TOOLBOX
NAME	**Monthly and daily zonal means of SCIAMACHY and MIPAS volume mixing ratios**
DESCRIPTION	Software Tool (available for free) The ENVISAT Toolbox is a data display and basic data analysis tool for ENVISAT atmospheric products. It is designed to support the ENVISAT products provided by the DLR. The main functionality of the ENVISAT Toolbox comprises • Display of the product both graphical and as tabulated numeric values. • Modify the graphical display by setting the color map, the projection or additional features like graticule or the overlay of continental coastlines. • Generate derived product presentations like the mean of products, the difference of two products or an animation of a set of consecutive products. • Export of displayed data as image or as tabulated values. The storage format of the products is HDF4. • Additionally the display state of the ENVISAT Toolbox can be saved, thus allowing to recreate a desirable graphical configuration for a selected product. The ENVISAT Toolbox does not modify the original product data files directly. Instead the ENVISAT Toolbox generates a tiny product information file (.etb-file) that contains a reference to the data file together with a reference to a color map and a set of display parameters. The product information file can be saved and retrieved explicitly by the user. As a default it is generated automatically when the user closes a product. Reopening the same product again causes the product information file to be read and the previous display state to be restored. To facilitate the comparison of different product instances the ENVISAT Toolbox comes with an integrated color map editor that allows to modify, store and retrieve color maps. Each of the product types has a default color map. The user can choose to save a named version and modify this version. This named color map can then be applied to any number of other product instances to create comparable views on the data.
INPUT DATA	All ENVISAT Value Added Products of DFD (HDF 4.1)
OUTPUT DATA (COMPONENTS)	User derived data subsets in ASCII (e.g. for import in MicroSoft Excel), plots, animations, quicklooks, means, etc.
COVERAGE	-
PROCESSING TYPE	-
AVAILABILITY	Online via WWW download or on CD-ROM (http://auc.dfd.dlr.de)
Product available as of	November 2002



Example: Graphical display of the ENVISAT Atmos Toolbox showing an easily generated animation by the Toolbox menu for GOME total column ozone data. On the rigth hand side the legend is visible. The Toolbox pane is designed for easy, intuitive and comfortable data visualisation and exploration.



Example: The meta information display pane shows all available attributes of the selected product. There are several sources for meta information. The ENVISAT Toolbox contains some product related configuration information that is shown in this pane. Most information stems from the data attributes of the individual product files.