ASSET

Assimilation of Envisat Data

ASSET is a major European initiative to exploit and develop earth observation data from Envisat using data assimilation. The project will help research in areas such as ozone depletion in the stratosphere and air pollution in the troposphere. Its aims are:

- to develop a European capability for chemical and UV forecasting;
- to provide analyses for coupled climate/chemistry studies.

Assimilation into Numerical Weather Prediction (NWP) models

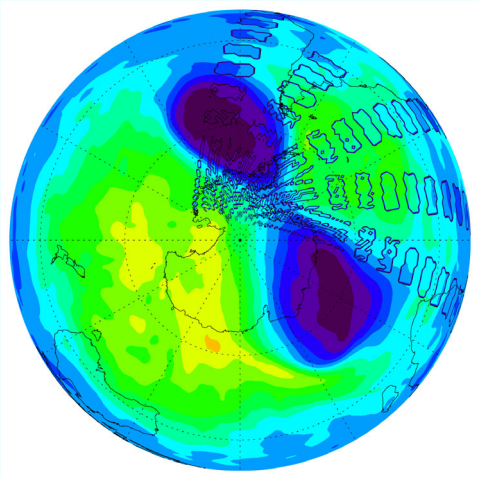
Meteorological agencies use numerical models to make their forecasts, but without the assimilation of observations, weather forecasts would soon diverge from reality. This means that data assimilation must be at the heart of the forecasting process, combining the simulated atmosphere with global weather observations from satellites, radiosondes, ships, aircraft and the surface.

Research satellites such as Envisat produce data that can be used to improve forecasts and understanding in the stratosphere and upper-troposphere, but these data have rarely been used in operational NWP models. ASSET will meet many new technical challenges, such as the assimilation of Envisat limb sounding data both in retrieved and radiance form. ASSET will test a variety of assimilation strategies using the NWP models of the Met Office (UK), European Centre for Medium-Range Weather Forecasts and Météo-France.

Assimilation into Chemical Transport Models

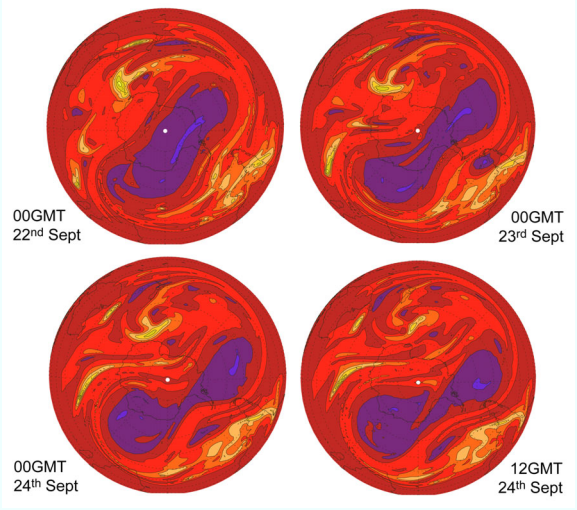
The complex photochemical processes that occur in the stratosphere and troposphere play a key role, yet are difficult to include in full NWP models. Chemical Transport Models (CTMs), using wind fields supplied

ASSET runs from January 1st 2003 until the end of 2005. It is a shared-cost project (contract EVK2-CT-2002-00137) co-funded by the Research DG of the European Commission within the RTD activities of the Environment and Sustainable Development sub-programme (5th Framework Programme).



During September 2002, in a previously unobserved development, the Antarctic polar vortex and the ozone hole split in two. The figure shows SCIAMACHY total column ozone data superimposed on the KNMI/ESA total column ozone analyses for 25th September 2002. Low ozone amounts are shown in blue and purple; higher amounts in green and yellow. *Picture: UREADMY; Data: KNMI and ESA © 2002.*

Envisat was launched in March 2002 to monitor global change in the Earth system. It is the largest earth observation satellite ever built. Envisat provides ASSET with data, from the troposphere to the thermosphere, on temperature, ozone, water vapour, NO_2, CH_4, CH_2O, CO and aerosol. ASSET uses these instruments: the limb-sounder MIPAS and stellar occultation sounder GOMOS, both providing high vertical resolution; SCIAMACHY for both limb- and nadir-sounding of chemical species; and AATSR and MERIS for aerosol measurements. *Picture: ESA*

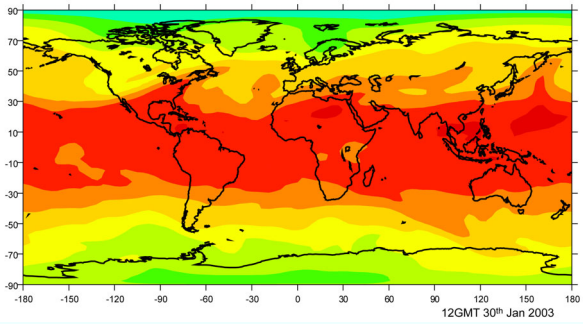


This sequence shows the behaviour of the Antarctic polar vortex and the ozone hole during September 2002. The plots show ozone on a 550K isentropic surface in the stratosphere, derived from an assimilation of GOMOS ozone data into the Université Pierre-et-Marie Curie Chemical Transport Model. Low ozone is shown in purple; higher amounts in yellow. *Picture: UPMC.*

from other models, can provide a more sophisticated understanding of these complex photochemical processes. ASSET will assimilate Envisat data into four leading CTMs (those of KNMI, UPMC, BIRA-IASB and FRIUUK).

Data management

A major goal of ASSET is to produce quality-controlled four-dimensional analyses of ozone, water vapour, aerosol and NO_y in the stratosphere, as well as some tropospheric chemical species. These will be made available to the science community via the well-established online facility at NILU, Norway.



MIPAS ozone profiles and routine operational data have been assimilated into the Met Office Unified Model to produce analyses of stratospheric ozone. The plot shows ozone at 10hPa, with high ozone amounts shown in red and low amounts in green. *Picture: UREADMY.*

Glossary

The **polar vortex** is an area of low pressure in the stratosphere, usually over the pole. In winter, air trapped in the vortex becomes very cold, producing conditions that in springtime can allow ozone depletion to happen. Hence, the ozone hole is associated with the polar vortex, especially over Antarctica.

Nadir sounding is when atmospheric measurements are taken directly below a satellite; in **limb sounding**, the satellite instead views nearly horizontally through the atmosphere. Limb sounding is typically used to measure constituents in the stratosphere, giving good vertical resolution.

Stellar occultation is a form of limb sounding, measuring the effect of the atmosphere on starlight (and hence deriving constituent amounts, such as ozone). The moon and the sun can also be used for occultation measurements.

An **isentropic surface** is a surface of constant potential temperature. On such a surface, and under certain conditions, ozone amounts are conserved over time.

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