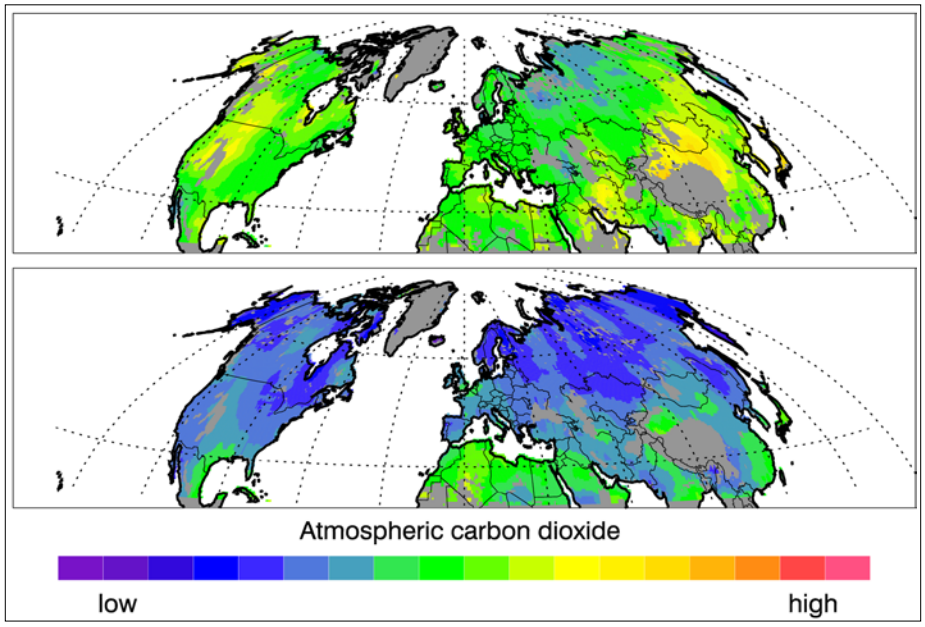
Greenhouse Gas and Aerosol Services

Within PROMOTE one issue ist the monitoring of greenhouse gas concentrations and atmospheric aerosol distribution. Levels of several greenhouse gases have increased by about 25 percent since the beginning of the industrialization 150 years ago - and levels are still rising. Ground based measurements of greenhouse gas concentrations are scarse and practically non existent over the oceans. Within PROMOTE satellite observations will be used to provide information on Carbondioxide and Methane levels on a global scale - an excellent data source for further analysis and climatic change modelling.
Aerosol distribution and aerosol type also play an important role in climate research but are difficult to measure especially over land. Within the project a historic record of aerosol concentration and type will be derived from satellite measurements.



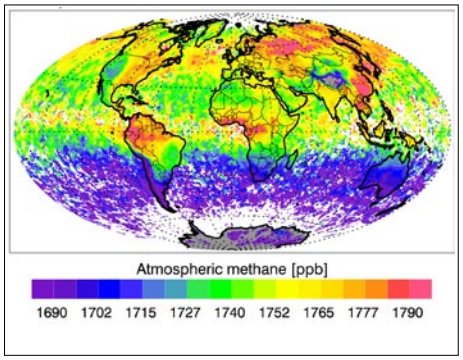
Difference of Winter (top) and Summer (bottom) CO_2 concentration on the northern hemisphere. The differences are due to high CO_2 absorbtion by photosyntecially active vegetation during the summer months (July - October)
Source: IUP/University of Bremen, DLR, ESA

Carbon Dioxide (CO_2)

Concentrations of carbon dioxide in the atmosphere are seasonally dependening on various, naturally regulated processes also known as the “carbon cycle”. The distribution of carbon between the atmosphere and the land and oceans is mainly influenced by plant photosynthesis. These natural processes can - to a certain extent - absorb some of the anthropogenic carbon dioxide emissions, but the Earth’s imbalance between emission and absorption still leads to a continuing growth in greenhouse gas levels. The monitoring of the seasonal change and the gradual increase in CO_2 concentration is one of the major objectives of the greenhouse gas service of PROMOTE.
Figure 1depicts the difference in CO_2 concentration on the northern hemisphere between winter (March - June) and summer (July - October) based on measurements of the SCIAMACHY sensor on board of the ENVISAT satellite.

Methane (CH_4)

Methane - an even more potent greenhouse gas - is relased from coal mines, thawing permafrost, oil and gas plants, and agriculture. A new data product generated within PROMOTE is global distribution of total column CH_4 concentrations derived from satellite observations provided by the SCIAMACHY instrument on board of the ENVISAT satellite.
Figure 2 shows the average Methane concentration for September 2003 provided by a pre-operational processing system based on a modified DOAS algorithm (WFM-DOAS).

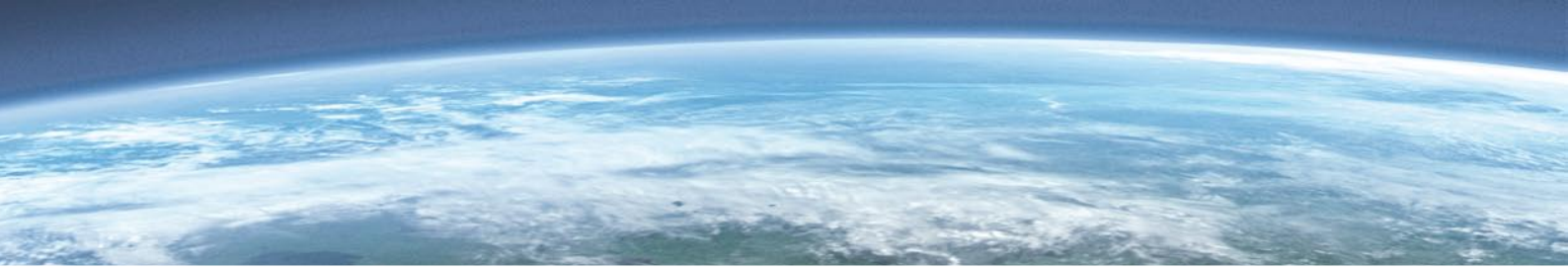


Average Methane concentration for the year 2003 derived from measurements of the SCIAMACHY sensor on board of the ENVISAT satellite

Source: IUP/University of Bremen, DLR, ESA

Aerosols Records

Long term Aerosol measurements are important for cimate research and



prediction modells alike. Currently the only possibility of observing aerosol concentrations is from scarsely distributed gorund-level stations which are part of the Global Atmospheric Watch (GAW) program. Retrieving aerosol concentration and type from satellite measurements can be achieved by using a combination of different satellite sensors, which complement their capabilites of spectral and spatial resolution. Within PROMOTE the SYNAER method, which uses simulatneous measurements of the AATSR and the SCIAMACHY instruments on board of ENVISAT is being used.

The SYNAER method offers the possibility to generate a 25-year-long aerosol record by constantly applying the same method since devices equivalent to AATSR and SCIAMACHY on ENVISAT have already been in orbit since 1995 on board of the ERS-1/-2 satellites with ATSR and GOME and will be in availbale on the METOP-satellite-series until 2020.

Daily European maps of aerosol optical thickness and type are available on a near-real-time basis - a global mapping will be produced offline.

The service also includes particulate matter concentrations near the surface for different particle sizes (PM10, PM2.5, PM0.5).