The Earth – Man and Atmosphere, NO_2-Distribution

Ever since the emergence of human culture mankind has influenced the composition of the atmosphere, with respect both to the proportions of elements and to the distribution of aerosols. Some of the consequences of this influence are still subject to discussion, although the greenhouse effect and global warming do seem to be significant.
Atmospheric emissions are closely related to economic activity. This is the case not only for industrial activities or the emissions caused by traffic, but to a high degree also for agricultural practice, e.g. smoke from bush fires or methane emissions from cows or rice production. The distribution of the NO_2 pollution presented on the page show a very pronounced relationship with the distribution of the population. Nitrogen oxides, which originate from combustion processes, are prominent air pollutants and play a major role in the formation of ground-level ozone. Moreover, the environmental effects of high concentrations of the gas can affect the lungs and cause respiratory problems.
In addition to the global distribution of NO_2 satellite images of selected areas provide examples of air pollution and environmental problems. They also show the role the surface relief plays in the transport of pollutants, e.g. trapping in valleys or basins, or transport to the open sea. Thus the page shall help to

- identify regions in the world facing problems of air quality;
- understand the relationship between different economic patterns and air quality;
- form an impression of the role of the geography of a region in the distribution of air pollutants.

Map Descriptions

Map 1: Global NO_2-distribution
Satellite/Sensor: Envisat SCHIAMACHY
Acquisition Date: Jan. 2003 – Jun. 2004
Band Combination: -
Map Information: nitrogen dioxide distribution, main cities, main rivers

Description: The map shows the global mean annual distribution of the NO_2 concentration for 2003 as measured by the spectrometer SCIAMACHY on board the ESA satellite Envisat. Nitrogen dioxide is primarily released by combustion processes in heavy industry, power stations and road transport. Lightning in tropical regions is another important source.
High NO_2 concentrations are found across the industrialised belt in North America and Europe as well as in East Asia and India. In the southern hemisphere the gas is distributed in the form of hotSPOTs around major cities. The (lower) pollution in West and Central Africa is a result of the combustion of biomass, from bush fires and fires for cooking and heating.

Map 2: Aerosol, Po Basin, Italy
Satellite/Sensor: Terra MODIS
Acquisition Date: 22.06.2002
Band Combination: near natural colours
Map Information: -

Description: The satellite image shows the Po River valley under a thick layer of aerosols. The polluted air is effectively trapped by the high walls of the Alps in the north and the Apennines in the south. Like a plume it seams to flow eastwards into the Adriatic Sea. One of the most industrialized regions of Europe lies in the Po Valley, centred around the cities of Turin and Milan. This industrial region generates large quantities of smog haze. Surrounding mountains protect the valley from winds that would otherwise disperse such plumes.

Map 3: Bushfires, Democratic Republic of Congo
Satellite/Sensor: Aqua MODIS
Acquisition Date: 06.05.2004
Band Combination: near natural colours
Map Information: -

Description: The satellite image presents smoke plumes which result from biomass burning in the savannah in the south-western part of the Democratic Republic of Congo. These fires, the result of agricultural activities, are a significant contribution to the emissions into the atmosphere. The darker green areas in the image are wooded hillsides; most of the fires occur in the savannah, which appears in a red-brown colour.

Map 4: Smog, Sichuan Basin and eastern Middle China
Satellite/Sensor: Terra MODIS
Acquisition Date: 02.10.2003
Band Combination: near natural colours
Map Information: -

Description: The Sichuan Basin and east-central China are shown under a thick layer of smog, which extends further east into the East China Sea. The region is known as one of the most densely populated and industrialised areas in China, and is therefore facing serious environmental pollution. Air pollution is mainly caused by smoke, the major pollutants being sulphur dioxide, carbon dioxide and aerosols. The emissions are caused by industrial sites, coal and oil burning, and transport. When sulphur dioxide mixes with moisture in the atmosphere it forms acid rain, which eventually falls to earth, damaging crops and forests, and polluting rivers and lakes. The satellite image map also illustrates the considerable influence of the topography on the distribution of pollutants.

Map 5: Industrial emission, Shanghai
Satellite/Sensor: Landsat TM
Acquisition Date: 04.12.1990
Band Combination: near natural colours
Map Information: -

Description: Shanghai is situated on the banks of the Yangtze River Delta. Due to its favourable geographical location it is one of the most important industrial and commercial centres in China, and is in the process of rapid development. Smoke emitted from industrial sites can be detected along the course of the Huanpu River through Shanghai.

Map 6a: Smog, Sichuan Basin
Satellite/Sensor: Ground photograph
Acquisition Date: -
Band Combination: -
Map Information: -

Map 6b: Smog in Shanghai
Satellite/Sensor: Ground photograph
Acquisition Date: -
Band Combination: -
Map Information: -

Description: The ground photographs illustrate situations of severe air pollution in China. Due to the dense smog the visibility is massively reduced. Furthermore, smog represents a severe threat to human health as it can cause respiratory problems.