2. Indicators: Themes and sectors

2.1 AIR

In January 2011, Royal Decree 102/2011 related to the improvement of air quality was approved, It transposes Directive 2008/50/EC into Spanish law, implements Law 34/2007 in matters related to air quality and simplifies national regulations on air quality.

Amongst other issues, this decree establishes the methods and common criteria for the evaluation of air quality, as well as management criteria to ensure appropriate air quality. It also regulates the contents of the plans for improvement of air quality. It sets air quality objectives for each pollutant (except ammonia), specifying the information to be provided to citizens and made available between administrations.

In November 2011, the National Plan for Improvement of Air Quality was approved following a process of consensus and public participation. Its ultimate goal is to achieve healthy urban areas by promoting pedestrianisation, alternatives for mobility and the rational use of private vehicles.

The Plan includes 90 measures structured in areas of action to ensure compliance with the maximum values for particulate matter and NO_2, including the reduction of ozone precursors. It includes measures designed to achieve a model of sustainable development and well-being aimed at both public Administrations and citizens,

who are the targets of measures to raise awareness and disseminate information in order to promote changes in behaviour regarding mobility. Among other aspects, it includes the development of mechanisms for the exchange of information in risk situations, speed limitation and urban traffic in specific areas for certain types of vehicles as well as renewal of the fleet of vehicles through replacement with electric cars and hybrids.

KEY MESSAGES

In 2010 GHG emissions continued to fall. That year the Spanish contribution to the GHG emissions of the EU was 7.54%. Emissions per capita and per unit of GDP are lower than the EU average.

Overall emissions of acidifying and eutrophying substances show a decreasing trend of almost 50% between 1990 and 2010 (48.6%). By type of gas, SO_2 decreased by 77.5% and NO_X by 22.8%. By contrast NH_3 emissions rose by 17.6%.

Tropospheric ozone precursors also fell. As a whole, in the period 1990-2010, they fell by 24.7%. By type of gas, only methane emissions increased (32.4%).

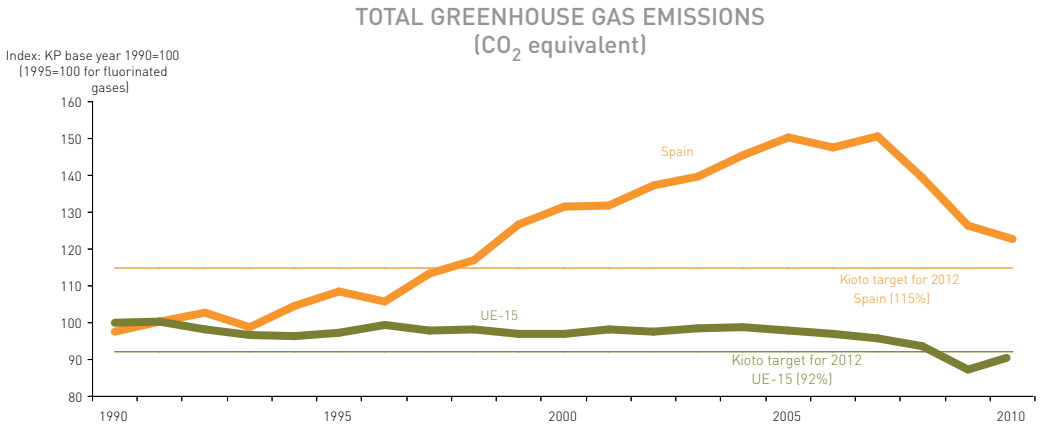
Total PM10 emissions have dropped by 22.6% in Spain since 2000, and stood at 112,695 tonnes in 2010. In 2008 and 2009 there were sharp drops (18.1% between the two), but in 2010, the decrease was 1%. PM2.5 behaved similarly with a reduction of 20.9% between 2000 and 2010. Non-industrial combustion plants and road transport are the sectors that emit the most particulates in Spain.

INDICATORS

- **Emissions of greenhouse gases**
- **Emissions of acidifying and eutrophying gases and tropospheric ozone precursors**
- **Emissions of particulate matter**
- **Regional background air quality for the protection of health and vegetation**

Emissions of greenhouse gases

For the third year running GHG emissions decreased, although to a lesser extent this past year



Source: AEMA and MAGRAMA

The total emissions of GHGs estimated for the year 2010 amounted to 355,898 kilotonnes of CO_2-eq, representing an increase of 22.8% above those of the base year (289,773 kt CO_2-eq). With regard to 2009, there was a decrease of 2.8% compared to the 9.3% experienced between 2008 and 2009. In 2010, the decrease in emissions started in 2008 was consolidated, determined by the progress in energy efficiency, energy mix and the economic and financial situation.

The “energy processing” sector is the one with most emissions, with a share that grew from 1990 to 2005 (the year from which its emissions begin to drop), making a contribution of 75.8% of total emissions in 2010. Meanwhile, in the same year “industrial processes” and “agriculture” contributed 7.9% and 11.2%, respectively. “Waste treatment and disposal” had a 4.2% share in 2010, a higher percentage than in 1990.

Between 2009 and 2010, the most important variations in CO_2-eq emissions were recorded in the "Energy processing” sector, with highly significant drops detected in the “Energy-sector industries.” Specifically, these occurred in thermal power stations and solid fuel transformation plants, with emissions related to "Public heat and electricity production" having fallen. Their origin lies in the variation of the mix of fuels used in electricity generation in thermal power stations, with a very marked drop in fossil fuels, coal and natural gas and an increase in renewable energies and nuclear energy. Moreover, the "Transport" sector was responsible for the decline of these emissions, especially road transport.

By type of gas, CO_2 was the largest emission in 2010 (79.9% of total emissions), produced predominantly by "energy processing" and "industrial processes." However, the proportion of CO_2 decreased by 4.3% in comparison to 2009. It is followed in size by CH_4 (9.8%) and N_2O (7.8%) and fluorinated gases (which are less than 2.5% as a whole).

In the context of the EU, Spain was responsible for 7.54% of the total emissions in 2010, a lower share than in 2009, which was 7.95%. In 2010 Spain issued 7.7 tonnes of CO_2-eq per capita, a lower figure than the average for the EU-27, which was 9.4 tonnes of CO_2-eq per capita. With regard to GDP, Spain was also one of the countries with the lowest intensity of emissions and to generate a unit of GDP 0.34 kg of CO_2-eq were emitted in 2010. In the EU-27 the average emissions made to generate a unit of GDP were 0.39 kg. of CO_2-eq.

NOTES

- This indicator presents total emissions of the six main greenhouse gases that contribute to the greenhouse effect (CO_2, CH_4, N_2O, HFCs, PFCs and SF6), expressed jointly as CO_2 equivalent (index 1990=100 and 1995=100 for fluorinated gases).
- Within the Kyoto Protocol of the United Nations Framework Convention on Climate Change the EU has undertaken to reduce its greenhouse gas emissions by 8% in relation to 1990 levels within the period 2008-2012. Each EU member state has different obligations and Spain has to stabilise GHG emissions at 15% above 1990 levels.
- The figures are for gross emissions and exclude net sink (capture minus emissions) in the Category "Land use, changes in land use and forestry."
- The figure taken as a reference value (base year figure) when examining the changes over time in aggregate emissions (without including emissions and absorption attributable to "Land use, changes in land use and forestry") is the officially approved value used to calculate the quantity allocated to Spain when evaluating its Kyoto Protocol commitments.

SOURCES

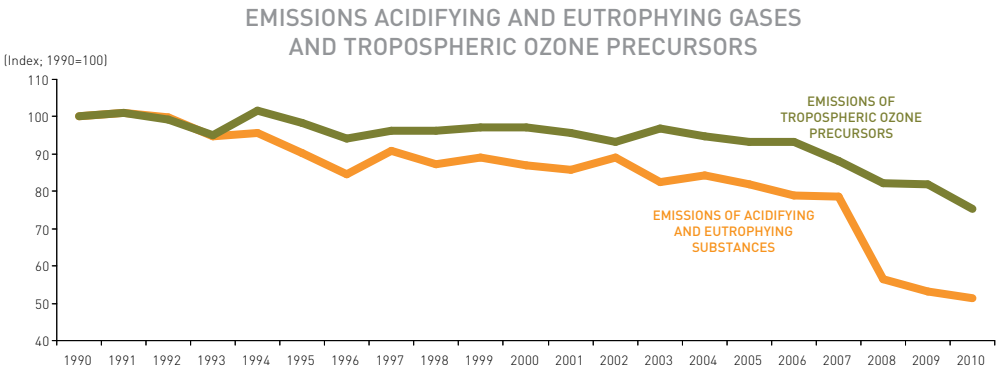
- Ministry of Agriculture, Food and the Environment, 2012. *Inventario de Emisiones Gases de Efecto Invernadero de España. Años 1990-2010. Communication to the Secretariat of the Framework Convention on Climate Change and the Kyoto Protocol*. Directorate-General for Environmental Quality and Assessment and Natural Environment.
- European Environment Agency, 2012. EEA greenhouse gas data viewer (on website). 2012. EEA greenhouse gas data viewer (on website).

FURTHER INFORMATION

- **http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/topics/sistema-espanol-de-inventario-sei-/**
- **http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer**

Emissions of acidifying and eutrophying gases and tropospheric ozone precursors

In 2010 emissions of acidifying and eutrophying gases and tropospheric ozone precursors continued to decrease



Source: MAGRAMA

Generally speaking, acidifying and eutrophying substances continued to fall as a whole. They underwent a similar reduction to that of the previous year, but less than the maximum for the period, which was recorded in 2008. Since 1990, and without taking into consideration slight isolated rises which occurred in intervening years, the drop in emissions is clear, reaching 48.6% in 2010.

By type of gas, SO_2 showed a significant decrease in emissions of nearly 77.5%, caused above all by the reduction in road transport (99.2%), combustion in energy and transformation industries (92.4%) and waste treatment and disposal (84.4%). The decrease of 32% in emissions from industrial combustion plants was also relevant, because of this sector's share of total SO_2 emissions (46.6%). All sectors reduced their emissions, except for other modes of transport and mobile machinery, where they increased by 37.1%. The reduction in SO_2 as compared to 2009 was 6%.

NO x emissions were reduced by to 22.8% over the period and 7.1% compared to the previous year, due mainly to the decrease of 46.4% of the emissions from combustion in energy and transformation industries, industrial processes without combustion and road transport (the latter two with reductions close to 40%).

NH_3 is the only one of the substances that increased emissions by 17.6% between 1990 and 2010 and 3.8% between 2009 and 2010. The agricultural sector has the

biggest impact on this increase, as the largest contributor to these emissions, and where they have increased by 16% in the period in question.

Emissions of tropospheric ozone precursors also continued to fall, more sharply in 2010 (-8.2%) than in 2009 (-0.1%). The total reduction in the period 1990-2010 was 24.7%. All ozone precursor gases dropped except methane, which increased by 32.4%.

NMVOC emissions fell by 22.1% since 1990, with those from other sources and sinks (nature) having a considerable impact as a result of their weight in the total and the decrease experienced. CO was reduced by 49%, with the reduction in emissions from road transport (87%) and the weight of this sector in total emissions (13.8%) exerting a considerable influence.

The main sources of methane (CH_4) are waste treatment and disposal and agriculture (which contributed 50.3% and 37.7% respectively in 2010), although they are not the sectors that have increased their emissions the most.

NOTES

- The graph for the indicator shows the changes in aggregate total annual emissions of acidifying and eutrophying substances (SO_2, NO_x and NH_3) and tropospheric ozone precursors (NO_x, NMVOCs, CO and CH_4), in relation to the base year 1990 (1990=100).
- SNAP 11 group emissions (other sources and sinks) are not included for NMVOCs, nor are emissions pertaining to subgroups 10.01 and 10.02 (fertilised and unfertilised crops) corresponding to leaf biomass.
- Emissions of acidifying and eutrophying gases are presented as acid equivalent (hydrogen ion-generating potential), and are aggregated using the following weighting factors: 31.25 acid equivalent/kg for SO_2 (2/64 acid equivalent/g), 21.74 acid equivalent/kg for NO_X, expressed as a NO_2, (1/46 acid equivalent/g) and 58.82 acid equivalent/kg for NH_3 (1/17 acid equivalent/g). Emissions of tropospheric ozone precursors were estimated by using the tropospheric ozone depleting potential (expressed as NMVOC equivalent). The following weighting factors were employed: 1.22 for NO_X, 1.00 for NMVOCs, 0.11 for CO and 0.014 for CH_4.
- The objective of Directive 2001/81/EC, of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants, is to limit emissions of acidifying and eutrophying pollutants and ozone precursors in order to protect human health and the environment.

SOURCES

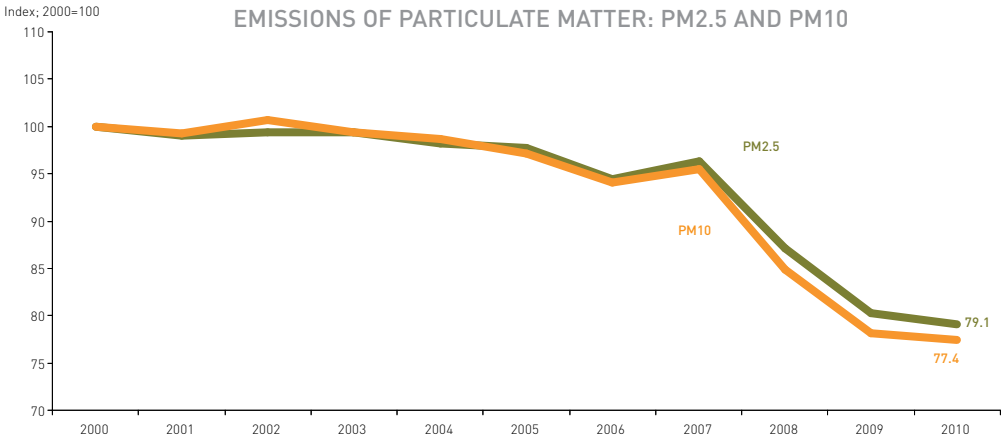
- Ministry of Agriculture, Food and Environment, 2012. *Inventario de Gases de Efecto Invernadero de España. Años 1990-2010. Communication to the Secretariat of the Framework Convention on Climate Change and the Kyoto Protocol*. Directorate-General for Environmental Quality and Assessment and Natural Environment.

FURTHER INFORMATION

- **http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/topics/sistema-espanol-de-inventario-sei-/**
- **http://www.eea.europa.eu**

Emissions of particulate matter

The emission of particulate matter keeps drooping in Spain in 2010, although the reduction was lower than in recent years



Source: MAGRAMA

The total emissions of particulates smaller than 10 µm have dropped by 22.6% in Spain, from 145,636 t in the year 2000 to 112,695 t in 2010. Emissions in 2008 and 2009 fell by 18.1%, while in 2010, they decreased by 1%.

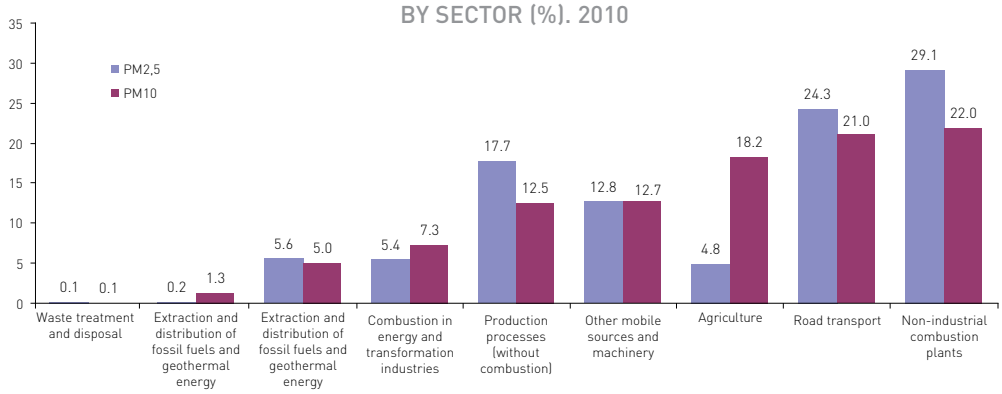
The largest drop occurred in combustion processes in energy and transformation industries, where these emissions decreased by 81% (23,505 t). The decrease in emissions from road transport was also significant, dropping by 25.5% (8,121 t). Particulates from waste treatment and disposal underwent a significant reduction (36.5%), although quantitatively, their influence on total emissions is minor, so their contribution to the reduction is not so significant (only 65 t contributed towards the total reduction of 112,695 t).

Particles smaller than 2.5 µm behaved similarly, dropping by 20.9% (21,042 t) since 2000. Between 2007 and 2009, the reduction in these particles was 16.6%, whereas in 2010 it was 1.5%. As above, combustion in energy and transformation industries was the sector with the largest reduction in amount of PM2.5 emitted, followed by road transport and industrial combustion plants.

Non-industrial combustion plants, and transport as a whole (road transport and the other modes), are the biggest emitters of particles in Spain. In the case of road

transport, the particles detached by the effect of the tread on roads are also significant, and contribute to this emission. Non-industrial combustion plants (including commercial, residential and agricultural activities) carry great weight. For particulates smaller than 10 µm, the agricultural sector also stands out as one of the main sources, mainly due to the management of manure with reference to organic compounds. The dynamics of these particles in the atmosphere in Spain is also determined by African dust particles which are incorporated into our atmosphere at certain times.

BREAKDOWN OF PARTICULATE MATTER EMISSIONS BY SECTOR (%). 2010



Source: MAGRAMA

The causes for these reductions lie mainly with the introduction of improvement measures implemented in the energy, road transport and industry sectors. And also use of fuels with a low sulphur content.

NOTES

- This indicator includes suspended primary particulate matter with an aerodynamic diameter less than or equal to 10 and 2.5 µm (PM10 and PM2.5).
- The EU has not established specific limits for emissions of primary particulate matter, but it did put limits in place in 2010 for their precursors (NOx, SOx and NH_3) under the National Emission Ceilings Directive on (Directive 2001/81/EC) and the Gothenburg Protocol to the Convention on Long-Range Transboundary Air Pollution (Council Decision 81/462/EEC of 11 June 1981).

SOURCES

- Ministry of Agriculture, Food and Environment, 2012. *Inventario de Gases de Efecto Invernadero de España. Años 1990-2010. Communication to the Secretariat of the Framework Convention on Climate Change and the Kyoto Protocol*. Directorate-General for Environmental Quality and Assessment and Natural Environment.

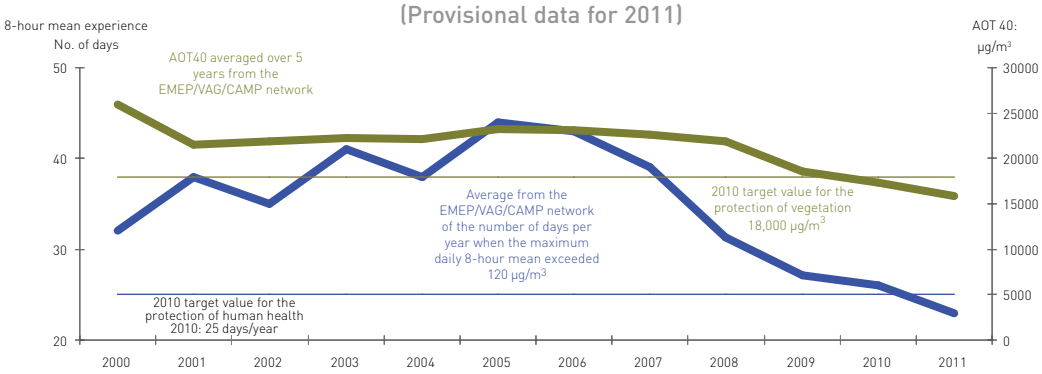
FURTHER INFORMATION

- **http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/topics/sistema-espanol-de-inventario-sei-/**
- **http://www.eea.europa.eu**

Regional background air quality for the protection of health and vegetation

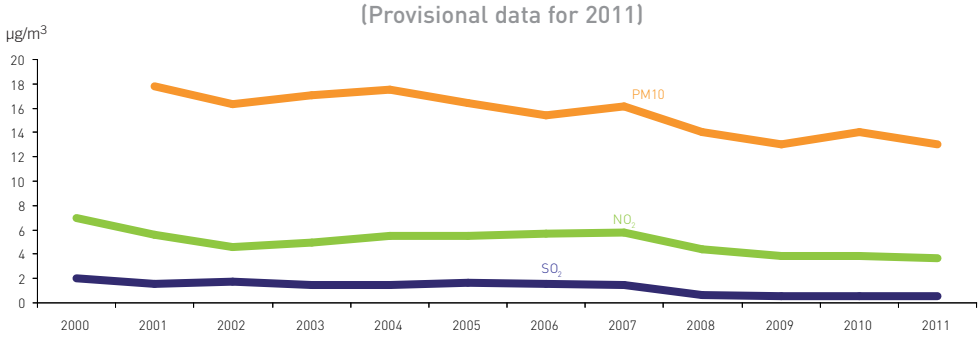
In 2011 background pollution in Spain complied with legislated values, with average values below the limit values set for each pollutant

BACKGROUND POLLUTION IN SPAIN: OZONE
(Provisional data for 2011)



Source: MAGRAMA

BACKGROUND POLLUTION IN SPAIN.
AVERAGE OF ANNUAL MEAN CONCENTRATIONS
(Provisional data for 2011)



- Critical level for the protection of vegetation since 11-6-2008: 20 µg/m³ of SO_2 (calendar year and winter)
- Critical level for the protection of vegetation since 11-6-2008: 300 µg/m³ de NO_x (calendar year)
- Annual limit value for the protection of health since 2005: 40 µg/m³ PM_{10}

Source: MAGRAMA

There are still high levels of the pollutant tropospheric ozone in suburban or rural areas, mainly due to the high level of solar radiation in Spain and the fact that the emission levels of their precursors (NO_X and volatile organic compounds) are maintained. However, the mean value of the EMEP/GAW/CAMP Network for annual exceedances of the maximum daily 8-hour average of 120 µg/m^3 was under 25 days

in 2011, this being the target value set in 2010 as a threshold for ensuring the protection of vegetation. Likewise, in the same network the mean 5-year running average for AOT40 was lower than the target value 18,000 µg/m3 established in 2010 for the protection of vegetation.

The situation when assessing sulphur dioxide, nitrogen dioxide and particles smaller than 10 microns has fulfilled legislated values since 2000. As regards SO_2 and NO_2, this critical level guarantees the protection of vegetation whereas that of PM10s guarantees the health of the population.

The graphs show a downward trend in the averages obtained, and that they may be seen as representative of the average quality of background pollution in Spain. This does not take into account any possible scenarios which may give rise to isolated episodes of exceedances of the values, in both space and time. Regarding ozone, in the year 2011 values below the target stipulated for 2010 were consolidated and with regard to the rest of pollutants, the limit values applicable since 2008 for sulphur and nitrogen oxides, and since 2005 for particulate material smaller than 10 micrometers were consolidated.

NOTES

- The indicator assesses general background pollution in Spain. This is presented for each pollutant and year as the mean of the mean concentrations recorded at all of the stations on the EMEP/GAW/CAMP network, providing approximate data on background air pollution in Spain. It does not provide information on isolated exceedances that may occur at certain times.
- AOT40 stands for Accumulation Over Threshold. This index is defined as the sum of the differences between the hourly concentrations above 80 µg/m³ (= 40 parts per billion or ppb) and 80 µg/m³ over a given period (which, in the case of the protection of vegetation, is that comprising the months of May, June and July), using only hourly values measured every day between 8:00 and 20:00 Central European Time (Royal Decree 1796/2003, which transposes Directive 2002/3/EC into Spanish law; both replaced both by Royal Decree 102/2011 and Directive 2008/50/EC). In order to obtain the AOT40 figure from the 1-hour ozone concentrations of ozone at each of the stations covered, figures are taken for those years in which 90% or more of the available data are valid, corrected to standardise all at 100% of possible data. Averages are calculated over five years (running averages) or, in the absence of a complete consecutive series of annual AOT40 figures, a minimum 3-year average is used (Annex I of Royal Decree 1796/2003, which transposes Directive 2002/3/EC into Spanish law; both replaced by Royal Decree 102/2011 and Directive 2008/50/EC).
- The EMEP (European Monitoring Evaluation Programme), established under the framework of the Geneva Convention, measures background air pollution. The Global Atmospheric Watch (GAW) is a project implemented by the World Meteorological Organization (WMO). The Comprehensive Atmospheric Monitoring Programme (CAMP) is fruit of the OSPAR Convention and is designed to identify the atmospheric inputs in the North-East Atlantic region and examine their impact on the marine environment. The EMEP/VAG/CAMP network, which seeks to meet the aims of the three aforementioned programmes, monitors tropospheric levels of background air pollution and sedimentation on the Earth's surface in order to protect the environment.

SOURCES

- Ministry of Agriculture, Food and the Environment, 2012. Air Quality Database. Directorate-General for Environmental Quality and Assessment and Natural Environment.

FURTHER INFORMATION

- **http://www.magrama.es**
- **http://www.aemet.es/**
- **http://www.eea.europa.eu/**