

Going with the flow of the air pollution

Last spring, a zeppelin crossed Europe loaded with measurement equipment. Environmental scientists were using it to track chemical reactions in the polluted air. TEXT RENÉ DIDDE PHOTOGRAPHY ANP

Professor Maarten Krol normally suffers from vertigo but he had no problems at all on board the zeppelin being used for environmental science studies over the past few months. ‘It was very relaxed, you feel safe and you can even open a window if you want. Of course the views are fantastic’, says the professor of Air Quality and Atmospheric Chemistry at Wageningen University, part of Wageningen UR.

The helium-filled zeppelin spent the late spring and summer flying over Germany, the Netherlands and Italy to measure air samples for the PEGASOS measurement campaign. The name is more than just the original Greek form of Pegasus, the mythological winged horse: it is also a rather complicated acronym for the Pan-European Gas-AeroSOI-climate interaction Study, a collaborative venture involving 26 partners in 15 European countries.

‘The aim of this long-term European research programme is to get a better understanding of the complex interactions between air pollution and climate change’, explains Krol, who is taking part in the measurement campaign on behalf of Wageningen University. Also taking part in the study are researchers from the Royal Netherlands Meteorological Institute, the National Institute of Public Health and the Environment, ECN (the Dutch

institute for energy innovation), TNO (the Dutch organization for applied scientific research) and Utrecht University. Scientists wanting to unravel the relationship between the climate and air pollution need a better understanding of the chemical processes taking place in polluted air. What happens, for example, when the west wind blows it from the Rhine mouth region around Rotterdam across the rest of the Netherlands?

BLOWING UP METHANE

‘The problem is that polluting compounds are involved in a variety of reactions, some of which are damaging and some of which have a positive effect on the climate’, says Krol. For example, ozone in the air can lead to complex reactions in which very short-lived free radicals are created that blow up the very strong greenhouse gas methane.

Ammonia, which is released into the air from the manure of pigs and poultry, has a highly acidifying effect. ‘But it also creates fine particles if it reacts with nitrogen oxides in the atmosphere’, says Maarten Krol. ‘Then you get ammonium nitrate particles that reflect sunlight. That means they have a cooling effect and could counteract global warming.’

Usually studies of air pollution in the atmosphere involve measurements close to ground level or from the Dutch Meteorological

Institute’s two-hundred-metre mast in Cabauw. Satellite measurements from space are also becoming increasingly important. ‘This all gives us a good picture but it is rather static’, says Krol. ‘The great thing about the zeppelin is that it helps us fill the “gaps”’. The zeppelin flies at a nice slow pace at any height you like up to about 2,000 metres. You can also fit an awful lot of measuring equipment into it. ‘We can use the zeppelin to follow the air pollution on its travels, as it were, and track the various reactions’, explains Krol.

OVER LAND AND SEA

Those travels can be in both the vertical direction and the horizontal direction, as Krol recalls from the perfect Saturday in the Whitsun weekend. ‘We started in the zeppelin in the early morning, with hardly any wind, monitoring reactions at a height of fifty metres. Then we climbed to a height of five hundred metres within fifteen minutes to see how the particles behaved in this much colder stratum. After that measurement, we went back down to a height of fifty metres to look at the effect the air was having on the chemical reactions now that it had warmed up a bit.’ Earlier that week the scientists had followed a plume of pollution being blown from the Rhine mouth region out to sea by a calm easterly wind. ‘We

were able to follow the chemical reactions above land first and then above the much colder surface of the sea.' The researchers were also able to track the pollution caused by a large ship by flying directly above it and mapping the emissions in real time. Thanks to the zeppelin, the researchers expect to be able to fill many gaps in their knowledge about the complex interplay between air pollution and weather conditions.

They hope this new knowledge will let them improve climate and air pollution models so that policymakers and politicians will eventually have a more secure basis for choosing which measures to take.

Next year, the zeppelin will be put to work for another purpose. 'In 2013 we are going to be flying over the forests of Finland', says Krol, 'as we want to gain a better understanding of reactions in clean air.' ■

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The PEGASOS project zeppelin flying over Rotterdam.