Clearing up Europe's air pollution hotspots

February 19 2015

Current air quality legislation in Europe will lead to significant improvements in particulate matter pollution, but without further emission control efforts, many areas of Europe will continue to see air pollution levels above the limits of the EU and the World Health Organization. Strict control of vehicle emissions alone will not be sufficient to achieve the limit values.

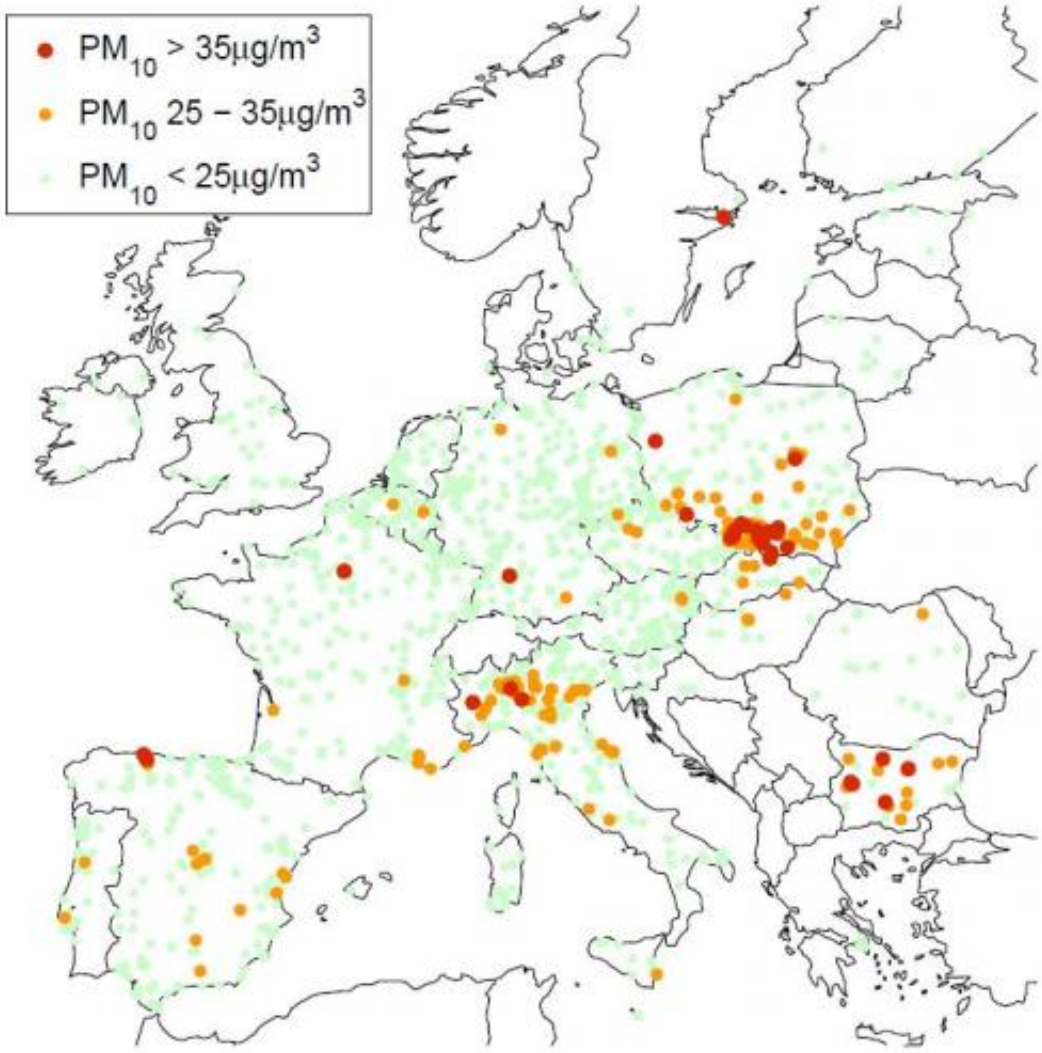
Under current legislation, air pollution hotspots will remain in Eastern Europe, Southern Poland and major European cities such as Warsaw, Paris, and Milan, according to a new study published in the journal *Atmospheric Chemistry and Physics* by researchers at the International Institute for Applied Systems Analysis (IIASA) and colleagues around Europe.

"This is the first time that we have analyzed particulate matter at individual monitoring stations across Europe, from regional background to urban streets, exactly where it's important to know if air quality limits will be met. We show the potential and the need for further emission controls to achieve safe levels of air quality - current legislation will not do the job," says IIASA researcher Gregor Kiesewetter, who led the study.

Air pollution has a major impact on human health, contributing to lung and heart disease. Exposure to particulate matter was linked to as many as 400,000 premature deaths in 2011 in Europe, according to the European Environment Agency.

EU legislation sets limit values on ambient concentrations for particulate matter of less than 10 microns in diameter (PM10). While new policies in Europe have contributed to significant decreases in air pollution over the past several decades, an estimated 80% of Europe's population is still exposed to PM levels above WHO air quality guidelines, and a significant proportion of the region still exceeds the air quality limit values set by EU law.

Such pollution comes from a number of sources, including power plants, agriculture, domestic heating, and city traffic. IIASA's GAINS model has been used for years to provide estimates of emissions and air pollution levels to support policymakers in Europe and around the world. In particular, the model has been employed in the ongoing revision of the EU air quality legislation.



Modeled annual mean PM10 concentrations around Europe for the year 2030 under the current legislation scenario. Credit: (Kiesewetter, et. al., 2015)

The new study also uses the GAINS model, and improves the estimation of ground-level PM levels by adding in air quality data collected on the ground at monitoring stations across Europe. "We are now able to explicitly identify the different sources contributing to ambient pollution levels. Some cities clearly have a local problem that may be tackled by local measures. In many others, like Vienna, the majority of measured concentrations comes from sources outside the city or even outside the

country", explains Kiesewetter. He adds, "Approaching the WHO guideline value will require emission reductions from various sources, two of which were often overlooked in the past. Especially in Eastern Europe, emissions from solid fuels used for home heating are dominating. In many European regions we also see an important contribution of secondary inorganic aerosols, which are steered by agricultural ammonia emissions."

Using the improved model, the researchers explored two scenarios for how air pollution levels could develop across Europe by 2030. Assuming that current legislation is successfully implemented, average air pollution levels would decrease substantially. However, the study shows that a substantial proportion of the European population would still be exposed to PM10 concentrations exceeding EU standards in 2030, in particular in southern Poland, the Czech Republic, Slovakia, northern Italy, and Bulgaria, as well as in a number of major cities.

In a second scenario, the researchers examined what would happen if the most efficient air pollution control technologies that are currently available were implemented across Europe. In this case, they found that by 2030, 99% of monitoring stations would see air pollution levels reduced below EU limits.

"A mix of EU-wide and local measures will be needed to bring PM concentrations below limit values. We show that coordinated EU-wide action could eliminate a large part of the problem," explains Kiesewetter.

Indeed, even in the second scenario the researchers say that challenges will remain in Eastern Europe. Switching to cleaner heating fuels and local traffic management are additional measures that could make a difference.

More information: Kiesewetter, G., Borken-Kleefeld, J., Schöpp, W.,

Heyes, C., Thunis, P., Bessagnet, B., Terrenoire, E., Fagerli, H., Nyiri, A., and Amann, M. 2015. Modelling street level PM10 concentrations across Europe: source apportionment and possible futures, *Atmos. Chem. Phys.*, 15, 1539-1553, DOI: 10.5194/acp-15-1539-2015