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Smoking in Paris: how burning historic buildings like Notre-Dame disperse pollutants

Scientists propose new model to track where smoke and dust from fires travel; such models can be useful to assess any large-scale fire across Europe

MUNICH – Across Europe, numerous historic buildings have survived the ravages of war and the passage of time. The famed Notre-Dame de Paris, a medieval Catholic cathedral on the Seine River, is one such landmark. However, on April 15, 2019, a structural fire sparked in its attic, resulting in a fire that engulfed much of the wooden, lead-sheathed roof. The iconic spire collapsed as flames released toxic lead dust into the air, which was dispersed to parts of Paris. Like Notre-Dame, many of the city's older buildings were similarly constructed and pose a potential hazard to nearby densely populated neighborhoods, says **Emilie Launay, a doctoral student at École des Ponts and research engineer at Laboratoire Central de la Préfecture de Police**.

When such fires break out, rapidly alerting residents of areas likely to be most impacted by such airborne pollutants can be challenging, as can determining where the dust settles at longer timescales. To that end, Launay will present details of a method that assimilates air quality data into an atmospheric dispersion model, developed in collaboration between the Laboratoire Central de la Préfecture de Police and École des Ponts, next week during the European Geosciences Union (EGU) General Assembly EGU23.

The goal of this work is to characterize the source of a given fire by determining the plume height and the mass of pollutants released into the air, Launay said. These attributes strongly influence where dust is dispersed. To conduct this calculation, Launay used air quality measurements collected via sensors installed by local air quality monitoring agency Airparif, as well as data collected by fire response teams who have mobile devices that measure the concentration of particulate matter in the air. "But, the number of measurements carried out in the field are limited and only allow an estimation of the pollution impact at specific points," Launay said. Combining the sparse data with dispersion modeling can characterize the fire's source, which can then be used to more reliably model where the dust is going at a broader scale.

To test how well they can model plume height and pollutant mass, Launay and colleagues applied this method to a large warehouse fire — more than 4,000 square meters — that occurred in the Paris suburb of Aubervilliers. Using air quality data collected by both Laboratoire Central de la Préfecture de Police and Airparif, they successfully calculated the height of the smoke plume, which travelled upward between 200 and 300 meters — corroborated by other independent observations of the fire.

Better models of where smoke and dust from fires travel can be useful across Europe, not only for historic buildings, but any large-scale fire. Results from these models can also help guide post-fire environmental investigations, Launay said.

To learn more about how these models work, visit poster session BG1.2 at EGU23 on **Tuesday, 25 April between 14:00-15:45 CEST** in Hall A.

Note to the media:

When reporting on this story, please mention the EGU General Assembly 2023, which is taking place from 23-28 April 2023. This paper will be presented in session BG1.2 on Tuesday, 25 April, 14:00-15:45 CEST. If reporting online, please include a link to the abstract: https://meetingorganizer.copernicus.org/EGU23/EGU23-6777.html

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The European Geosciences Union (EGU) is Europe's premier geosciences union, dedicated to the pursuit of excellence in the Earth, planetary, and space sciences for the benefit of humanity, worldwide. It is a non-profit interdisciplinary learned association of scientists founded in 2002 with headquarters in Munich, Germany. The EGU publishes a number of diverse scientific journals, which use an innovative open access format, and organises a number of topical meetings, and education and outreach activities. Its annual General Assembly is the largest and most prominent European geosciences event, attracting over 14,000 scientists from all over the world. The meeting's sessions cover a wide range of topics, including volcanology, planetary exploration, the Earth's internal structure and atmosphere, climate, energy, and resources. The EGU General Assembly 2023 is taking place in Vienna, Austria and online from 23-28 April 2023. For information and press registration, please click here, or follow the EGU on Twitter and Facebook.

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Accompanying artwork:

Description: Photo of de Notre-Dame Cathedral in Paris on 15 April, 2019, as the fire engulfs the roof and smoke billows into the sky. Credit: Wandrille de Préville - Own work, CC BY-SA 4.0