Air Pollution Knows No Boundaries

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Abstract

How do atmospheric scientists understand air pollution in a city, when the air is constantly moving from state to state, and country to country? Answering this question is crucial for developing public health and environmental policy. By directly measuring air pollutants and combining information about the winds with a computer model, atmospheric scientists can better understand transport of urban air pollution. Atmospheric scientists develop models to generate high-resolution and time-resolved information about the atmosphere that we can't easily measure everywhere and all the time. I will discuss how we use cutting-edge technology and models of winds and the atmosphere to understand the transport and sources of carbon dioxide emissions. In light of the recent Paris Climate Agreement, integrated modeling-data networks are important to improve monitoring, reporting, and verification of carbon dioxide emissions in cities around the world.

Tonight's Speaker

Yanina Barrera is a fourth year PhD candidate in Environmental Science and Engineering at Harvard University. She born in Argentina and grew up mostly in Southern California. Prior to entering my PhD program, she worked as an environmental consultant for four years. Her current research focuses on using Lidar technology to study the planetary boundary layer in the City of Boston, and studying urban air pollution within the Northeastern U.S., using instrumentation and atmospheric transport models. I enjoy staying active by dancing, hiking, standup paddleboarding, and hitting the gym. I am very passionate about keeping a healthy-life style and living life to its fullest potential. I am currently a resident tutor for Lowell House at Harvard University.

Glossary of Important Terms

Backscattering: the deflection of light particles, also known as “photons”, at an angle of 180 degrees.

Carbon cycle: the movement and exchange of carbon through living organisms, the ocean, the atmosphere, rocks and minerals, and other parts of the Earth. Carbon moves from one place to another through various chemical, physical, and biological processes.

Carbon dioxide (CO_2): A colorless, odorless greenhouse gas. It is produced natural when dead animals or plants decay, and it is used by plants through photosynthesis. Human activity has added carbon dioxide into atmosphere mostly through the burning of fossil fuels such as cola and natural gas. The extra carbon dioxide trapped in the atmosphere is warming up the climate.

Greenhouse Gas: A greenhouse gas is also known as a “heat-trapping gas” and it is both natural and man-made gases. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and fluorinated gases.

Lidar: Lidar stands for “light detection and ranging” and it’s a surveying technology that has been used to make high-resolution maps, and can be used to target aerosols and clouds. This technology is being used actively in atmospheric sciences and it measures distance by illuminated a target with a laser light.

Model: A model means both the computer program and the concept. It uses math, physics, and even chemistry to better understand a real system or process.

Parts per million (ppm): A unit of measurement that can be used to describe concentration of a particular substance within air and water, or some other medium. The concentration of the Earth’s atmosphere is a little over 400 parts per million, which means 1 million molecules of air would contain 400 molecules of carbon dioxide.

Photosynthesis: The process by which green plants use sunlight, water, and carbon dioxide to make food and other substance that they use to grow. In the process, plants release oxygen into the air.

Planetary Boundary Layer (PBL): The lowest layer of the troposphere extending from the ground to the bottom of where the cumulus clouds form, and its behavior is influenced by surface forcings such as friction from vegetation and topography and solar heating. The height of the PBL is not constant. It can warm-up significantly during the day and cool at night while the rest of the atmosphere stays at relatively constants temperature. This layer traps air pollution from the biosphere below and thus, can form haze or air pollution events that at times can cause adverse health affects.