

# Olympic atmosphere

Veerabhadran Ramanathan, James Schauer, Hung Nguyen and colleagues found the Beijing Olympics to be conducive to international collaboration in science, as well as sport, as they attempted to assess the effect of emission restrictions on climate forcing.

## ■ What was the objective of the work?

During the 2008 Beijing Summer Olympics, the Chinese government achieved a massive reduction in the emission of atmospheric pollutants. This provided a unique opportunity to assess the uncertainties associated with the role of aerosols in climate change forcing. We wanted to directly assess the heating of black carbon in the atmosphere and to estimate the changes in this heating resulting from the air pollution controls put in place for the Olympics.

## ■ Why did you choose this particular location?

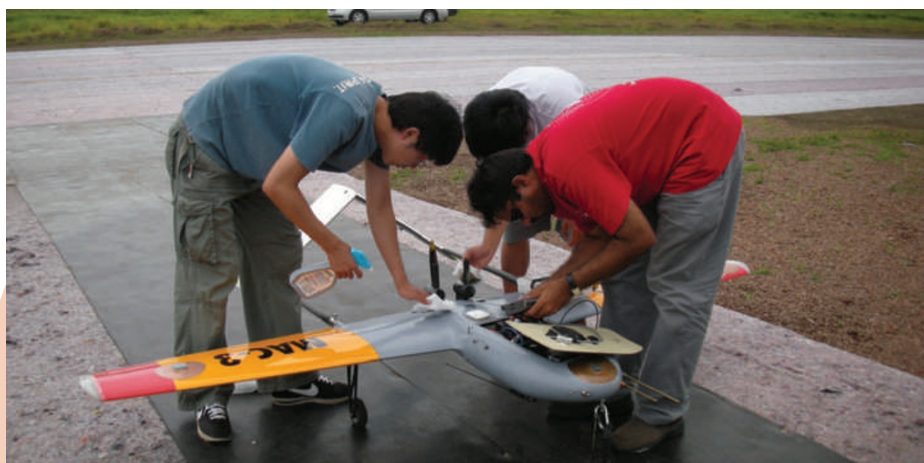
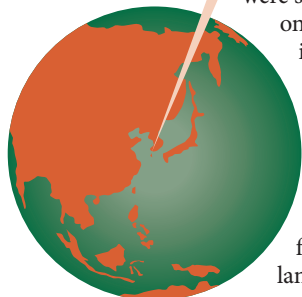
The Gosan sampling site, on the Korean island of Jeju, is a climate observatory for the United Nations Environment Programme (UNEP) atmospheric brown cloud (ABC) study. The sampling site is downwind of large Chinese cities, such as Beijing and Shanghai, so provided an ideal location to examine the regional and climate impacts of air pollution controls that were put in place for the 2008 Beijing Olympic Games.

## ■ What sort of data or samples were you looking for?

We collected measurements of the chemical composition, optical properties and absorption of solar radiation of the atmosphere in real time. We made surface measurements, using the ABC surface observatory on Jeju Island, and atmospheric measurements, using unmanned aerial vehicles (UAVs). Samples of atmospheric particulate matter were collected on filters and brought back to the US for advanced chemical analyses.

## ■ Did you encounter any difficulties?

The UAV aircraft is unmanned so there were severe restrictions on when and where it could fly, because of commercial and military flights. We had to fly within a narrow corridor of five to ten kilometres from our makeshift landing strip and



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The team prepares an unmanned aerial vehicle for take-off on a makeshift landing strip on Jeju Island, South Korea.

within a few hours each day. We couldn't sample all of the pollution events we wanted to, such as open-ocean cloudiness and its interaction with black carbon; instead we had to wait for both pollution and clouds to appear closer to the airstrip. Fortunately, there were several such occurrences and we had sufficient samples to fulfil the objectives of our study.

## ■ Any near misses?

Landing the UAVs is extremely tricky. Small crosswinds during landing can tip them forwards or sideways and damage the aerosol inlet tube on the nose or the wings. About three weeks into the campaign, we had exhausted all of the spare wings and inlet tubes. We had to piece together some of the parts from local hardware stores, while we waited anxiously for the spare parts to arrive, hoping we wouldn't miss the next pollution event.

## ■ What was the highlight of the expedition?

The culmination of the field campaign was marked by a grand Korean barbecue, hosted by the Korean Principal Investigator, Soon-Chang Yoon. While cooking, the server frequently removed the charred coating from the food. When we asked why, we were told that the black carbon from the soot is a health

hazard. This was impressive, considering that we were trying to recommend removal of black carbon from the atmosphere.

## ■ Did you learn anything new about yourself or your team members?

We were impressed with the dedication of the young scientists and students, from both the US and Korea. The international collaboration was superb. It was because of our close collaboration with Seoul National University and the Korean airlines, which control the airspace, that we had the privilege of flying the UAVs for as long as we did.

## ■ Did the trip give you any ideas for future research projects?

The study helped us to understand why black carbon in fossil fuel is so effective in global warming. We hope to study the impact of emission-control interventions further by continuing our UAV observations in China, and also by carrying out similar studies in India and the Arctic. There is huge potential for mitigating the effects of global warming through controlling emissions of black carbon, but we need more data to reduce the uncertainties.

*This is the Backstory to the work by M. V. Ramana et al., published on page 542 of this issue.*