Seeing through the smoke

Robert Field and colleagues turned their attention to the newspapers and used the simplest of weather observations to better understand the climatological and human causes of Indonesia's fire problem.

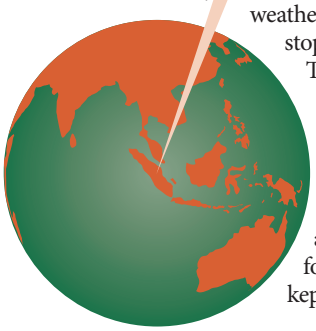
What was the objective of the work?
This study grew out of a project designed to prevent future haze disasters in Indonesia. Our main aim was to ascertain whether major fire episodes in Indonesia have occurred under drier conditions. Satellite data since the mid-1990s indicates that fires are more likely when rainfall is low, but we wanted to understand the long-term relationship. Have all major fire episodes occurred under drier conditions and, conversely, does drought necessarily lead to major fire?

What sorts of data were you after?
We needed a long-term record of fire occurrence, but none existed. However, one of the major impacts of large-scale fires is a reduction in visibility due to the smoke haze that is generated. The media regularly report visibility reductions at airports and over the Malacca Strait, one of the most important shipping lanes in the world, so we thought we could use these visibility records as a proxy for past fires.

MICHAEL BRADY

Fire and smoke from a burning peat forest on Pedang Island in Riau Province, Sumatra, Indonesia, during the El Niño-induced dry season in 1991.

Did you encounter any difficulties?
Initially we looked for visibility data in Indonesia, but discovered that much of it was lost in 1999, when the Indonesian meteorological service moved their headquarters. There were some hardcopy records at individual stations in Sumatra and Kalimantan, but these weren't continuous, and the cost of recovering them and entering the data was prohibitive. What ultimately saved us was the World Meteorological Organisation's Global Telecommunications System: since the 1950s, weather records at airports have been freely exchanged between countries through a set of regional data networks — a sort of early weather-only internet built with single-sideband radios and teletypes. What is truly remarkable is that, despite Indonesia's tumultuous history since independence, the weather data has never stopped flowing. The US Weather Bureau in Washington DC had been archiving the data, and luckily for us they kept every last bit, including the visibility records. What seems amazing is that over time these very simple visibility observations have ended up containing really useful information, the utility of which couldn't possibly have been anticipated at the time.



What were the low points of the project?
Overall the experience in Indonesia was incredibly positive. Still, some particularly low points came when we witnessed periods of political unrest. We were in Pontianak, West Kalimantan in 2001 after horrible ethnic violence had broken out in Central Kalimantan earlier in the year. A refugee camp had been set up at the soccer stadium in Pontianak for the Madurese escaping from Central Kalimantan. The conflict between the indigenous Dayak and the Madurese was ultimately a result of the transmigration programme. The impacts of transmigration had been abstract up until that point.

Did you learn anything new about doing your job?
We're physical scientists, and use environmental measurements and models to answer questions. However, we soon found that our data couldn't explain the absence of fire in Kalimantan before the 1980s, and we had to look elsewhere for answers. So we began to read more about demographics and socio-economic policy in Indonesia. This turned out to be a big factor in our analysis, because we realised that Sumatra's development had accelerated several decades earlier than Kalimantan. Not surprising in retrospect, but it was really important to branch out like that.

Did the study give you any ideas for future research projects?
Absolutely: there is still considerable uncertainty about the magnitude of emissions from these fires, especially going further back in time. It would be interesting to see if simple visibility observations could help to constrain bottom-up emissions estimates by means of chemical transport modelling and inversion techniques. There's also evidence that smoke during the 1997 fire event cooled sea surface temperatures enough to reinforce the positive Indian Ocean Dipole conditions; the visibility record might also be useful in longer-term studies of such phenomena.

This is the Backstory to the work by Robert Field and colleagues, published on page 185 of this issue.