Huge pollution cloud discovered over Indian Ocean

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30 June 1999

A recent scientific investigation has identified a huge cloud of atmospheric pollution covering some 10 million square kilometres of the Indian Ocean—an area approximately the size of the United States. The unusual haze was discovered as part of the Indian Ocean Experiment (INDOEX), which is investigating how pollutants are carried through the atmosphere over the Indian Ocean.

The findings, released by the US National Science Foundation on June 8, will provide scientists an opportunity to investigate the impact of industrial pollution on the world's climate. It will also give a further insight into the quantity and types of emissions being pumped-out of factories on the Indian subcontinent, in China and South East Asia.

Scientists stumbled upon the pollution cloud during an intensive six-week field experiment from February to March this year. The region under investigation covers most of the northern Indian Ocean, including the Arabian Sea, much of the Bay of Bengal and equatorial Indian Ocean. The field experiment involved scientists from the United States, Europe, India and the Maldives, incorporating the use of four research aircraft, two oceanographic ships, several surface stations, balloons and a wide range of satellites.

The team discovered that the dense, brown haze of pollution extended from the ocean surface to altitudes of one to three kilometres. The co-chief scientist of the investigation, Veerabhadran Ramanathan said the scientists were shocked by the extent of pollution they encountered. He said: “It appeared as if the whole Indian Ocean was surrounded by a mountain of pollution.” In fact, the cloud rose to about 10,000 feet from the earth's surface, whereas similar clouds found previously only rose 2,000 feet.

The haze is caused by high concentrations of very small chemical particles, no bigger than a few micrometres in diameter, also known as “aerosols”. These “aerosols” are made up of soot, sulfates, nitrates, organic particles, fly ash, mineral dust and gases, including carbon monoxide and sulfur dioxide. It has long been acknowledged that similar pollution hazes are produced in the world's main industrial centres, the United States and Europe. Aerosol-type pollution hazes are characterised by being highly dense, often creating an open ocean visibility of less than 10 kilometres.

The INDOEX team said the characteristic darkness of the Indian Ocean cloud made it a unique finding. The marked darkness is thought to be due to the presence of huge amounts of soot and other materials from incompletely burned fossil fuels and wastes. In other words, these wastes have most likely come from areas surrounding the Indian subcontinent with growing industrial outputs, and little in the way of pollution controls on factory emissions.

Scientists believe that the haze floats over the Indian Ocean during wintertime because it is swept down via prevailing winds from the Himalayas and out to sea during the winter monsoon. During the summer monsoon, scientists suspect that the reverse takes place. That is, wind currents, opposite to those in winter, drive the cloud back onto the land where it is eventually converted into acid rain.

Further investigations are taking place into the effect of the pollution haze on cloud properties as a whole and thus on weather. Scientists will estimate the impact on the concentration of cloud droplets, the development of rainfall and cloud brightness.

It has long been understood that greenhouse gases like carbon dioxide trap the sun's heat, resulting in an increase in the earth's temperature. The effect of the chemicals that make up aerosols is the opposite. The

aerosol particles act like tiny mirrors scattering sunlight back to space and causing a regional cooling effect. Aerosols can also have an indirect cooling effect by acting as seeds for cloud condensation and thus increasing their reflectivity. In other words, the aerosol particles cause clouds to absorb less of the sun's radiation, forcing it to be reflected back into space. In the Indian Ocean study, the haze particles reduced solar radiation absorbed by the ocean surface by as much as 10 percent.

Scientists are still unsure of the overall effect of both “heating” and “cooling” particles and gases on the environment. Greenhouse gases can persist in the atmosphere for decades, while aerosols can be quite easily removed by rain in a matter of days. But the process whereby aerosols affect clouds and solar radiation is highly complex, and not yet well understood. Jay Fein, program director of the US National Sciences Foundation, a part sponsor of the INDOEX project, explained that “the effect of aerosols in our atmosphere radiation balance is one of the largest sources of uncertainty in predicting future climate. INDOEX was designed to reduce this uncertainty.”

The Indian Ocean haze is likely to harm the tropical marine life in its immediate vicinity, due to its transformation into acid rain. Furthermore, a reduction in the amount of sunlight reaching the ocean surface will also affect ocean plant life that depends on photosynthesis to make food. Microscopic sea plants, or plankton, are a key link and a major source of nutrients in the food chain of marine animals.

The discovery of the Indian Ocean cloud points to the often subtle environmental dangers produced by rising levels of uncontrolled emissions from industrial activity in Asia and elsewhere.