Monitoring ground-level ozone from space

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Satellite views of the Midwestern United States show that ozone levels above 50 parts per billion (ppb) along the ground could reduce soybean yields by at least 10 percent, costing more than $1 billion in lost crop production, according to U.S. Department of Agriculture (USDA) scientists.

In a 5-year study led by the National Aeronautics and Space Administration, Agricultural Research Service (ARS) molecular biologist Lisa Ainsworth, ARS plant physiologist Fitz Booker, and university scientists surveyed widespread ozone damage to soybeans in Iowa, Illinois and Indiana, using both ozone surface monitors and satellite instruments.

Ainsworth works at the ARS Global Change and Photosynthesis Research Unit in Urbana, Ill., and Booker works at the ARS Plant Science Research Unit in Raleigh, N.C. ARS is USDA's principal intramural scientific research agency.

Satellite information is useful for investigating ozone impacts on crop yields because satellite information is available for rural regions, where ground monitoring networks do not exist. Satellite observations, which are also available for farmland in countries without ground networks, could provide important insight into the global extent of ozone reduction of crop yields.

Ozone levels in most urban areas of the United States have declined with improvements in emission controls, but they are still high enough to

damage soybean, peanut, cotton, rice, tomato and other crops. Ozone levels are expected to rise in countries like India and China as growing populations are able to afford more cars and build more power plants. Another concern is that ozone levels will rise in developing countries, whose people can least withstand losses of staples such as rice and wheat.

Ainsworth's and Booker's findings are consistent with those from their SoyFACE (Soybean Free Air Concentration Enrichment) experiments and studies in outdoor open-top chambers. SoyFACE involves testing plants in open-air field conditions under atmospheric conditions predicted for the year 2050. The consistency of the satellite data with SoyFACE findings and the agreement with data from ozone surface monitors suggests that satellites provide an effective way to monitor crop damage from ozone.

This research, in support of the USDA priority of responding to climate change, was published in the journal *Atmospheric Environment*.

Provided by United States Department of Agriculture

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