AMERICAN METEOROLOGICAL SOCIETY
NEWS RELEASE
Headquarters
45 Beacon Street
Boston, MA 02108-3693

1120 G Street, N.W., Suite 800
Washington, DC 20005-6115

Contact(s): Stephanie Kenitzer, AMS
(425) 432-2192
Kenitzer@dc.ametsoc.org

Kate Eckhaus, AER, Inc.
(781)761-2288
keckhaus@aer.com

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Can We Influence Global Weather -- Some Scientists Say Theoretically Yes, Practically, Not Yet

Influencing the weather seems like something out of the movies or science fiction books, but some scientists contend that influencing the weather may be possible if we can sufficiently improve our current ability to observe, predict, and make changes to the atmosphere.

"In the past century we've learned a great deal about how the atmosphere works and how to represent that through complex numerical models," said Ross N. Hoffman, Principal Scientist with Atmospheric and Environmental Research, Inc. (AER) in Lexington, Mass. "What will the next century yield? Will greatly improved satellites and other observing systems, and much more powerful computers make it possible to one day control the evolution of the atmosphere? Just imagine: no droughts, no tornadoes, no snowstorms during rush hour."

The basic premise behind influencing the weather is this. The earth's atmosphere has been hypothesized to be chaotic. That means that no matter how good the observation systems and numerical models, the predictability of large-scale weather patterns is typically limited to two weeks. Chaos also implies that small differences can grow enormously and make a big difference in our weather--just give the atmosphere a week or two.

"Since small differences can grow in our chaotic atmosphere," says Hoffman, "then, limited resources used intelligently might be all that's necessary to alter the weather. Now that we're getting better at figuring out when and where small disturbances might make the biggest difference, we should start to think about how weather modification might work in the future."

The notion of influencing the weather is, at this point, only theoretical possibility but not practical. Tremendous improvements in today's technology are needed, including significant advances in data assimilation (i.e. collecting world-wide observations and processing the data); even higher resolution numerical models that accurately portray the physics of the atmosphere; more complete and accurate satellite observations; and computer power much beyond our current technology,

perhaps based on breakthroughs in nanotechnology or quantum devices. Then there must be coordination among all the systems.

"The goal is not to change the climate but to influence the precise timing and paths of weather systems for the protection of lives and property," said Hoffman, in an essay in the February issue of the *Bulletin of the American Meteorological Society*. "Can we use the theory to make the right changes to the atmosphere to protect ourselves from dangerous weather. Could we control the path of a hurricane to prevent it from striking the most populated coastal areas? If we could, should we?"

Hoffman is proposing a "Global Weather Control System," an initiative that includes real-time data gathering, prediction, and command capabilities. Among the possible ways of introducing small changes to the atmosphere some possibilities include contrails produced by aircraft, solar reflectors in low earth orbit, microwave energy from solar power satellites, and wind turbines that can also function as fans.

"There have been substantial technological advances in many of the supporting disciplines -- computers, models, remote sensing, and more," added Hoffman. "We believe there is good reason to pursue this research now at this early stage to set the stage for discussions about the social and political issues."

Hoffman's work in this research area has been funded by the NASA Institute for Advanced Concepts (NIAC). NIAC's provides an independent, open forum for the external analysis and definition of space and aeronautics advanced concepts, complementary and independently of NASA. To do this NIAC focuses on revolutionary concepts for systems and architectures, seeking to expand our vision of future possibilities. Visit http://niac.usra.edu/.

Founded in 1977, AER is an environmental research and consulting company with demonstrated expertise in remote sensing, satellite meteorology, atmospheric sounding, numerical weather prediction, climatology, circulation diagnostics, atmospheric chemistry, air quality and risk assessment, mathematical modeling, planetary sciences, and systems engineering. In addition to its Lexington, Mass. headquarters, AER has offices in Washington, D.C., San Francisco and Los Angeles, and Omaha, Neb. Visit http://www.aer.com/.

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