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Peaceful Uses of the Earth's Atmosphere

An experiment for observing the world's weather—continuously, in three dimensions, all over the globe—has recently been proposed in a report of a National Academy of Sciences panel headed by Jule Charney of M.I.T.* The development of such a system, for experimental and operational purposes, is now being vigorously explored by the Environmental Science Services Administration and the World Meteorological Organization. The system is to be called the World Weather Watch. Charney and his associates are cautiously optimistic that, given adequate worldwide data and improved computers, weather forecasting can be upgraded in quality and extended in range. They envision 2-week forecasts of the accuracy now possible for 2- to 3-day predictions. The report gives substance to an old and shining dream of John von Neumann, who saw in applications to the atmosphere the full justification of the science of modern computers.

There are three critical elements needed to satisfy the dream: (i) repeated global weather observations at various atmospheric levels; (ii) a fast, worldwide, high-capacity communication system; and (iii) a computer of enormous capacity and great speed, containing an adequately realistic "numerical model" of the atmosphere. Some of the more modest components are already being tested.

There would be enormous rewards from even a few months of pilot operation of such a global weather system. It would almost surely bring progress toward more accurate, longer-range forecasting and toward understanding the interactions of atmospheric motions and processes on many scales. With such high stakes, an IGY-like international effort is clearly justified.

But there is a dimension to the World Weather Watch that is far more sweeping in potential. It is also far more speculative, and it is only vaguely hinted at in the report. With the World Weather Watch data, and with an adequate computer and a global mathematical model, a vast array of experiments on weather and climate modification can be "performed" by numerical computation rather than in nature. The beneficial consequences can be evaluated and compared to the expected costs. The full effect and the potential hazards can be determined without risk to life and property. For example, a dam can be "built" across the Bering Strait for an infinitesimal fraction of its real-life cost, and we can evaluate its effect on the Kamchatka or Canada wheat-growing season without actually taking the risk of unforeseen adverse effect, or of no effect at all. We can model a megalopolis and its atmospheric cesspool, examine the extent to which it acts as an inadvertent weather modifier, then "clean up" the atmosphere and see the difference. We can do this without taxes, political strife, vast engineering expense—in a computer.

Weather and climate modification, if achieved, will surely have effects that transcend international boundaries. For this reason, research on them should be conducted under international auspices. When we come to understand the extent of public benefit or hazard involved, the nations of the world will then be in a far better position to exploit or control both. Global weather modification is, in potential for benefit or destruction, the analog of atomic energy; if we can develop it under cooperative international sponsorship and with participation of scientists of many nations, then perhaps we can guarantee that it will be used solely under international sanction and exclusively for beneficial, peaceful uses. No lesser goal should guide our nation's participation in the World Weather Watch.—WALTER ORR ROBERTS, *Director, National Center for Atmospheric Research, Boulder, Colorado*

* "The Feasibility of a Global Observation and Analysis Experiment," *Nat. Acad. Sci.–Nat. Res. Council Publ. 1290* (1966). $4.