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Jim Hansen Letters

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National Aeronautics and
Space Administration

Goddard Space Flight Center

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March 9, 1993

Ms. Katie McGinty
Office of the Vice President
Old Executive Office Building
Washington, DC 20501

Dear Katie,

Although I don't think Lindzen's proposal warrants the attention, for the sake of scientific precision you should tack the following comments onto my earlier letter.

(1) I see how Lindzen calculates 500 planes rather than 1000, because he spaces them 550 km apart in the North-South direction, rather than 300 km. But that means his effective resolution is about 500 km, rather than the 300 km he advertises. Of course, whether he uses 500 or 1000 planes does not alter any of the conclusions of my earlier letter. And I did not even mention the many logistical difficulties, such as the fact that air traffic control would not allow such an operation.

(2) I did not explicitly respond to Lindzen's contention that satellites can not obtain the needed vertical resolution. Here Lindzen confuses two different problems: (A) the resolution needed for data assimilation into Numerical Weather Prediction (NWP) models, and (B) the resolution needed to detect and measure change of a global climate forcing or feedback, such as water vapor. For (A), NWP, the Lindzen/Fox-Rabinovitz analysis applies; this should be of some concern to EOS, which intends to make use of data assimilation. For (B), global climate change, resolution requirements are different; we need to know whether water vapor is changing in the lower, middle and upper troposphere, at say 300, 200, 100 mb, as well as higher in the stratosphere. All one needs is a long enough high-precision time series at each location to carry out the statistical analysis. In this case the crucial issue is the time sampling, which we address in section 12 of the workshop report mentioned in my previous letter.

I hope things are going well in your new position. It must be very exciting (and hard work!).

Best regards,

Jim Hansen
Jim Hansen

*They keep on
please keep on
file*

*b/c of address
there was delay in
receipt. We are informing
people of change in
address. mail, people
to speed
up process*

*where
is this?*

*also --
I will
want to
write
note of
thanks.*



National Aeronautics and
Space Administration

Goddard Space Flight Center
March 8, 1993

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Ms. Katie McGinty
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Dear Katie,

I received your note dated 2-1-93 on 3-4-93; perhaps it was actually sent on 3-1-93.

Below I comment on the points raised in Lindzen's letter.

Unmanned aircraft have tremendous potential to contribute to atmospheric measurements, but Lindzen's specific suggestion is crackpot. The cost he estimates, \$2B per year or \$20B per decade, at face value is unrealistic, but it is an understatement. He has not included personnel and analysis costs. Worse, he erred in his calculations. In the section he titles "Simple-minded Flight Strategy" he describes a plan for dropsondes at 300 km spacing. Since the area of the Earth is $5.1 \times 10^8 \text{ km}^2$, that requires about 1000 planes (not the 500 he mentions), and that estimate depends upon keeping all of them in the air all of the time. Not only is the cost unreasonable, at least \$5B/year, but it would pollute the environment (land and ocean) with about 8,600,000 dropsondes per year!

Contrary to Lindzen's implications, satellites are an essential component for monitoring water vapor, and are the appropriate way to get global coverage. It is easy to design a system with a small number of satellites which yields better coverage, does not pollute the environment at all, and costs far far less than 1000 aircraft. The requirements and sampling issues are discussed in the workshop report "Long-Term Monitoring of Global Climate Forcings and Feedbacks", which will be available soon.

RPVs (Remotely Piloted Vehicles), which Jim Anderson has been advocating for several years, have great potential for climate and environmental applications. For the past few years middle to upper level NASA management has failed to support RPVs in my opinion, I believe because they saw them as a threat to EOS (the same reason they oppose Climsat). But that situation is changing rapidly. I don't mean to underestimate the difficulty of reinvigorating a hide-bound bureaucracy, but we now have an Administrator who understands the problem. Recently Administrator Goldin asked all NASA Center Directors to examine potential roles for RPVs. I am sure he is intent on developing these high-tech vehicles for cost-effective applications.

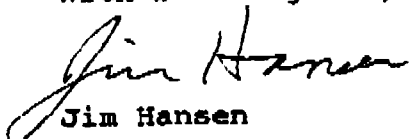
It is true, and recognized by all concerned, that radiosonde (weather balloon) measurements of water vapor in the upper troposphere are of low accuracy and reliability. It is important that NOAA improve calibration and standardization of radiosonde instruments, and work with the international community to achieve improved accuracy on a global scale. We discussed this a week ago at an OTA workshop (on EOS and USGCRP) chaired by Jerry Mahlman of NOAA/GFDL. It is expected that under Jim Baker the NOAA Global Change Program will give emphasis and support to upgrading radiosonde data; I intend to ask Baker about this at the Environmental Task Force meeting next week. In the workshop report referenced above we underline the need for improved radiosonde water vapor measurements as an important complement to global satellite monitoring.

Lindzen's inference that climate sensitivity is 0.25C for doubled CO₂, based on Oort's water vapor data, is nonsense. Any empirical inference must take account of all changes of climate forcings, including, for example, ozone depletion, which appears to cool the atmosphere above about the 300 mb level. Also, the water vapor changes he uses for the upper troposphere are widely believed to be dominated by instrumental artifacts. A more direct measure of climate sensitivity is provided by the temperature change, also measured by radiosondes, but with a much greater accuracy; the temperature changes are consistent with a climate sensitivity of 1.5-4.5C, as shown in the paper "Global Climate Change", which I sent to you earlier. However, adequate determination of climate sensitivity requires measurement of all the major global climate forcings and radiative feedbacks, as we stress in the above-mentioned workshop report.

In conclusion, I believe that the Vice President should make, at most, a perfunctory response to Lindzen. Although radiosonde calibration and RRV development warrant strong support, these are under the purview of other people, and have nothing to do with Lindzen. Satellite measurements must be made more effective for environmental purposes. With Jim Baker at NOAA and NASA Administrator Goldin intent on revitalizing NASA capabilities, I believe you can expect rapid progress in these areas, but of course this is something that you will want to keep an eye on.

I believe it would be a mistake for the Vice President, or his office, to get involved in a dialogue with Lindzen, which Lindzen could exploit in public. I believe that is what he has in mind. No matter what the data show, Lindzen will weasel out of the conclusions, and leave the impression that there is scientific disagreement. But it would not be inappropriate to respond that the Vice President is aware of the scientific potential of RRVs and the need for improved radiosondes, and that these matters will be given careful consideration in broad review of the adequacy of global change and environmental observations.

With best regards,


Jim Hansen