

Cloud Hole Over the United States?

Stephen G. Warren⁺, Julius London^{*},
and Carole J. Hahn^{**}

The National Weather Service (NWS) is planning to make revisions in its surface weather observing network and to set up an Automated Surface Observing System (ASOS) to be installed at about 1300 stations. Such extension of weather observations and the use of improved observational techniques are welcomed. However, the ASOS is intended not to augment, but rather to replace the current operational system. As part of the ASOS plan, NWS is planning to terminate the visual cloud observations at weather stations in the U.S., replacing the observers by laser ceilometers. The potential damage to the continuity of long-term climatic data sets has been addressed by the ASOS Climate Working Group (chaired by David Rodenhuis). Its report of September 1989 requested that conventional weather observations be continued after ASOS is installed. We support that request because, if the NWS plan is put into effect, some of our future analyses of the climatic role of clouds will be limited to regions outside the U.S.

For the past ten years, we have been analyzing conventional cloud observations worldwide. We have published a series of climatic atlases of the global distribution of total cloud cover and cloud type amounts. The results of our studies are being used for the following purposes:

- a) as baseline data (since 1952) from which to monitor future climatic changes in clouds,
- b) as ground-truth data to aid in developing algorithms for quantitative determination of cloud statistics from satellites,
- c) to initialize climate models that do not predict clouds, and
- d) to validate the predictions of climate models that do predict clouds.

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The data we have been using are the visual observations coded into the standard form of the WMO synoptic code, which allow us global coverage over all continents and oceans using a uniform observing procedure. The synoptic code (as regards the cloud-type information) was defined in 1929, so a long time-series is available with unchanged reporting procedures.

The cloud information that we use from the synoptic reports consists of 1) total cloud cover, 2) low-cloud amount, 3) low-cloud base-height, 4) low-cloud type, 5) middle-cloud type, 6) high-cloud type, and 7) present weather.

In the U.S. at present, there are on average about six stations per 5° x 5° latitude-longitude box giving synoptic weather reports. This is more than in Australia and Africa, about the same as in South America, and less than in Europe and Asia. However, at most stations in the U.S., reports are made in the WMO synoptic code only every 6 h, as compared to every 3 h elsewhere on earth.

We think it important that these routine synoptic weather observations be continued by at least 100 stations in the U.S. (which would allow 3 stations per 5° x 5° box [5° x 10° boxes in Alaska], if carefully selected as to location), and that the reporting frequency be increased from four times per day to eight times per day. Our reasons are as follows:

- 1) Clouds have large effects on the Earth's radiation budget, both on solar and infrared radiation. These effects differ depending on the type of cloud, and they also depend on the time of day or night.
- 2) Cloud properties are difficult to predict in climate models. They are now the source of greatest uncertainty in climate modeling and climate prediction. Visual observations of cloud types are used as input data and verification data for climate models.
- 3) Visual cloud observations are useful in studies of climatic change, because for such studies long time-series without changes in instruments, procedures, or code definitions are needed. In the U.S. Global Change Research Program, the leading topic is the "role of clouds."
- 4) The planned installation of laser ceilometers will

AVERAGE TOTAL CLOUD COVER (%)
DECEMBER, JANUARY, FEBRUARY

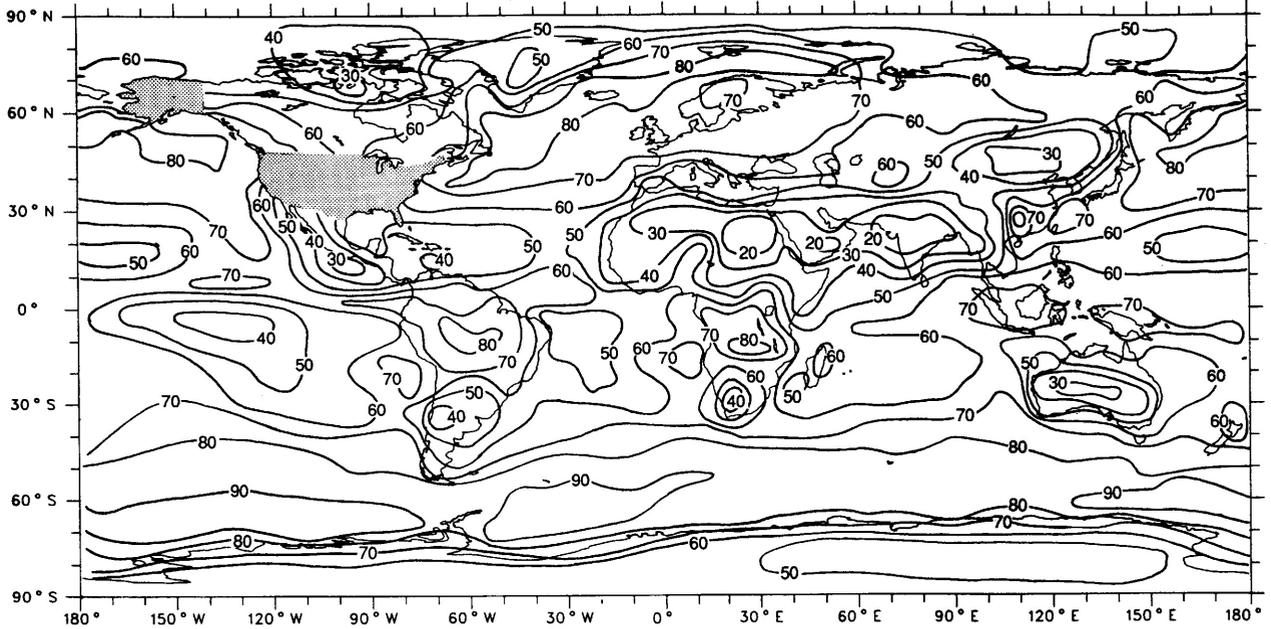


FIG. 1. If the National Weather Service follows through with its plan to terminate visual cloud observations, this could be the future format of our cloud maps.

provide valuable new information on the base heights of low and middle clouds, eliminating the need for one of the seven items in the visual cloud report at stations with ceilometers. But the other six items in the visual cloud report cannot be fully automated, especially the identification of the different cloud types. The ceilometer also cannot be used to obtain total cloud cover, because it does not detect clouds higher than 12 000 feet.

5) Obtaining a climatology of cloud types, thicknesses, and heights from satellites is still a research topic; it is not a solved problem. Cloud observations from the surface are thus needed for comparison with the cloud information obtained by the International Satellite Cloud Climatology Project (ISCCP).

For global climatic studies, the essential requirement is that the same reporting procedures be used worldwide; and the WMO has achieved great international cooperation in support of this objective. The U.S. represents nearly 2% of the earth's surface, so the loss of conventional cloud data from the U.S. under the NWS proposals would mean a significant gap in global coverage for our future climatic analyses of clouds (Fig. 1).

We, therefore, request that the NWS continue visual cloud observations indefinitely at a minimum of 100 stations.

Concurrence: One hundred and one individuals from meteorological organizations and academic institutions worldwide, whose current research concerns clouds, radiation, and climate, have concurred with the authors of this letter.

Concurrence: [These individuals, whose research concerns clouds, radiation, and climate, are indicating their own opinions, not necessarily the positions of their organizations. Some other scientists who also support our request are not listed here because they are involved in formal negotiations on this issue.]

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Louvain-la-Neuve, 10 September 1990.

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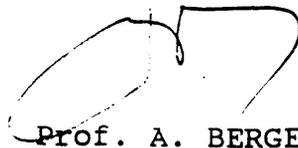
Dear Colleague,

Ref.: Your letter 27 August 1990 - visual cloud observations.

I support your initiative as I find

- important that any country follows the international policy for observations within WMO;
- ground truth will remain fundamental to validate remote sensing, satellite measurements in particular.

Sincerely,



Prof. A. BERGER, head of Institute
President of International
Commission on Climate

RADIATION COMMISSION

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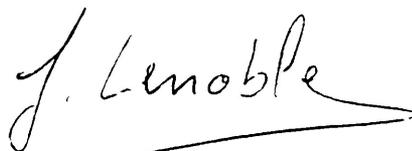
September 25, 1990

Dear Dr. Warren,

Thank you for sending me your manuscript concerning the planned termination of visual cloud observations in the US. Due to the predominant role of clouds in atmospheric radiation, the IRC is fully concerned by this problem.

Personally I feel that, in general, when a new instrument or a new technique is installed, the previous one must be kept active for a long period of overlapping, in order to make the observations comparable and to assure the continuity which is essential in atmospheric physics. On the other hand, although instruments are generally much more precise than visual observations, they lack the flexibility and intelligence of the human observer; in this particular case of concern, I understand from your description that the ASOS is not able to perform all the observations made by the human observers. I therefore support your request that the NWS continue visual cloud observations.

Sincerely yours,



J. LENOBLE

METEOROLOGISCHER DIENST DER DEUTSCHEN DEMOKRATISCHEN REPUBLIK

Prof. Stephen Warren
Atmospheric Sciences AK40
University of Washington
Seattle, WA 98195
USA

Dear Dr. Warren,

with grave concern I learned about the planned termination of visual cloud observations in the U.S.. At a time when everybody is aware of the increasing greenhouse effect with all consequences of climate change the monitoring of the climate state is of significant relevance for studies of climate and Global Change. To trace changes in the climatic conditions homogeneous long-term observations are of outstanding importance. As clouds play a significant role in the energy budget of the atmosphere and the water cycle -both aspects are addressed in international programmes - it is simply not understandable that these observations should be cut off. I would like to add that the analysis of the U.S. cloud observations was done with great care being a reference for similar studies in other regions of the world. As we need continuous monitoring the argument does not hold that satellite observations can replace visual observations from ground because (i) the analysis of satellite observations for operational cloud analysis is far from being solved satisfactorily (ii) important parameter as the lower boundary of clouds are not retrievable from satellite pictures. Therefore, I would like to be added to the 'concurrence list'.

Yours sincerely,

Dietrich Spänkuch

Dr. sc. nat. Dietrich Spänkuch
Main Meteorological Observatory
Potsdam



September 7, 1990

Bulletin American Meteorological Society
American Meteorological Society
45 Beacon St.
Boston, MA. 02108

Dear Sir;

Stephen Warren has cogently stated his arguments against the planned termination of visual cloud observations in the U. S. I would also like to add on more protest against removal of these observations. Eliminating cloud symbols on weather charts will harm the science of meteorology. The sky is the signpost of the weather and meteorologists who can not read it or appreciate it are illiterate.

The type and amount of cloud at different levels are extremely important indicators of the evolving weather system. In this age of computers, guidance, prediction models and objective analysis, meteorologists are becoming increasingly insensitive to actual atmospheric phenomena and the changing panorama in the sky. Weather is becoming an abstraction, rather than a source of inspiration for attracting students to the profession. In my opinion, there are too few cloud observations on synoptic charts.

Yours truly,

A handwritten signature in black ink that reads "Toby Carlson". The signature is written in a cursive style.

Toby Carlson
Professor of Meteorology



NATIONAL SCIENCE FOUNDATION
Washington, DC 20550
DIVISION OF ATMOSPHERIC SCIENCES

September 5, 1990

Professor Stephen G. Warren
Department of Atmospheric Sciences
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Seattle, WA 98195

Dear Steve:

I just received your letter of 27 August 1990 addressed to "Dear Colleague" and requesting my concurrence on your proposed letter "protesting the planned termination of visual cloud observations in the U.S." Of course, I agree with your letter and fully concur; please add my name to your list.

It will not escape the notice of those with some capacity for irony or sardonic humour, that the same government who proposes to terminate the visual cloud observations is also urging the Congress to support the U.S. Global Change Research Program (\$1034.1 million in FY 91) wherein the leading topic is "role of clouds"!

Finally, I enclose the response of Sancho Panza to a similiar event some while ago!

Best Regards,

A handwritten signature in cursive script that reads "Ron Taylor".

Ronald C. Taylor
Program Director
Physical Meteorology

DON QUIXOTE: *I propose to do such exploits that you shall deem yourself fortunate to have been found worthy to come with me and behold marvels that will be almost beyond belief.*

SANCHO PANZA: *I believe everything that your Grace says; but for now tighten up your saddle a little, because you seem to be slipping off your horse.*