

SATELLITE METEOROLOGY

How It All Started, 50 Years Ago

BY W. PAUL MENZEL AND JEAN M. PHILLIPS

The first successful meteorological experiment conducted from a satellite was launched on *Explorer VII* on 13 October 1959, 50 years ago this year. *Explorer VII* carried an early version of a radiometer designed to measure Earth's heat balance from a satellite. The thermal radiation experiment, devised by Verner E. Suomi, along with University of Wisconsin—Madison engineering professor Robert J. Parent, established Suomi as the “father of satellite meteorology.”

The instrument was designed to measure the most basic meteorological parameter: the balance between incoming solar radiation to the atmosphere and the radiation exiting the atmosphere as a result of reflection and emission processes. The spatial distribution of the radiation imbalances between incoming and outgoing radiation, the net radiation, is the primary driving force of atmospheric circulation. The solar input had already been measured from ground-based and balloon-borne platforms. Suomi's experiment was the first to measure the energy loss to space.

Suomi's radiometer (or, more correctly, “bolometer”—an extremely sensitive device that can be used to measure solar radiation) consisted of sensors varying in their sensitivities to solar (short wavelength) and terrestrial (long wavelength) radiation—one type equally sensitive to both, another more sensitive to terrestrial radiation, and a third type more sensitive to solar radiation. Suomi was then able to differentiate between the energy leaving the Earth's atmosphere due to reflected sunlight and that thermally emitted by the Earth and its atmosphere. He correlated these findings to cloud and weather patterns and began to estimate the Earth's albedo.



Verner E. Suomi (left) and Herman LeGow inspect Explorer VII. (PHOTO: NASA/nasaimages.org.)

Clouds are important in the radiation balance because they modulate the longwave thermal radiation to space as well as block the shortwave visible radiation to Earth. Longwave thermal radiation emitted to space decreases as cloud cover and cloud height increase. Also, since clouds are better reflectors than Earth's surface, shortwave visible radiation reflected to space increases with increasing cloud cover, reducing the amount of shortwave radiation that reaches Earth's surface. Suomi's experiment on *Explorer VII* helped to quantify these processes.

United States participation in the International Geophysical Year (IGY) was enhanced with the announcement by the National Science Foundation and National Academy of Sciences in 1955 of plans for “construction of a small, unmanned,

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earth-circling satellite to be used for basic scientific observations.” Conveners of the IGY, which was planned for July 1957–December 1958, envisioned a coordinated effort that would encourage scientists around the world to conduct significant research and share their results. When the IGY opened in July 1957, the United States was one of 60 participating nations and meteorology was one of many topics that would serve as a focus.

Those early measurements of the net radiation by Suomi and Parent have fostered 50 years of investigations into Earth’s energy balance and the important role of clouds. Modified versions of the early radiometer continued to fly on subsequent satellites well into the 1970s.

The 50th anniversary of satellite investigations of the Earth will be celebrated in Madison, Wisconsin on 2 November 2009. For more information, see www.ssec.wisc.edu/50thMetSat.

FOR FURTHER READING

- Eisenhower, President Dwight D., 1957: Remarks by the president in connection with the opening of the International Geophysical Year. Press release. [Available online at www.eisenhower.archives.gov/Research/Digital_Documents/IGY/6-30-57_Press_release.pdf.]
- National Science Foundation and National Academy of Sciences, 1955: Plans for construction of earth satellite vehicle announced. Press release. [Available online at www.eisenhower.archives.gov/Research/Digital_Documents/IGY/7-29-55_NSF_Release.pdf.]
- Suomi, V. E., 1961: The thermal radiation balance experiment on board *Explorer VII*. *Juno II* summary project report, Vol. I, *Explorer VII* satellite. NASA Tech. Note D-608, 273–305. [Available online at http://library.ssec.wisc.edu/SuomiWebsite/Suomi-Images/scanned%20documents/Suomi_ExplorerVII_Radiometer_018.pdf.]