IAU has accepted my recommendation of the following names:

Al-Khwarizmi: name for the new-found basin that is centered at 1°N, 112°E (*5*). The name is that of the Arab scholar (approximately A.D. 780–850) who compiled the oldest astronomical tables and composed the oldest work on arithmetic. He coined the term algebra and his own name, twisted by Western tongues as algorism, denotes the system of numerals in wide use today.

Necho: name for the new-found, 200-km crater that is centered at 3°S, 125°E. The name is that of the ancient Egyptian pharaoh and pioneer geographer (ruled from 609 to 593 B.C.) who commissioned a successful 3-year naval expedition to prove that Africa was surrounded by water on all sides.

Discovery of these features adds another dimension to our understanding of the lunar farside highlands and crater formation in the first half billion years of the moon's history. The process of basin-filling and subsequent cratering during a time when meteoroid flux rates must have been very high is well exhibited. This study is also an example of the successful correlation between Apollo orbital photography and laser altimetry. It encourges further correlations and integration of other remotely sensed data.

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References and Notes

1. Before the crater King (5.5°N, 120.5°E) was named by the International Astronomical Union (IAU), it was given the number 211: see F. El-Baz, *Science* **167**, 49 (1970).
2. The name "Soviet Mountains" was coined by Russian investigators following interpretations of the Luna 3 photographs [N. P. Barabashov, A. A. Mikhailov, Y. N. Lipsky, *Atlas Obratnoy Storony Luny* (Nauka, Moscow, 1960)]. It was later argued that what was interpreted as a mountain range are in reality bright ejecta and rays [E. A. Whitaker, *NASA SP-201* (1969), pp. 9–12]. The name was finally rejected by the IAU in 1970.
3. Additional photographs of the crater were obtained on Apollo mission 14, for example, frames 10298 through 10301 (also by the metric camera on Apollo mission 17, for example, frames 3183 through 3207). The relative age of the crater as well as the stratigraphic position of the basin are dealt with in D. E. Wilhelms and F. El-Baz, "Geological Map of the Eastern Limb Region of the Moon" (U.S. Geological Survey, Washington, D.C., in press).
4. W. R. Wollenhaupt and W. L. Sjogren, *Moon* **4**, 337 (1972); W. L. Sjogren and W. R. Wollenhaupt, *Science* **179**, 275 (1973).
5. The name "Arabia" was used to designate the basin during the Apollo 17 mission and also in the "Apollo 16 Preliminary Science Report" (National Aeronautics and Space Administration, Washington, D.C., 1973). Since the IAU does not encourage geographical names, the name "Arabia" was dropped in favor of "Al-Khwarizmi."

5 October 1972; revised 7 February 1973

Remote Radar Sensing: Atmospheric Structure and Insects

Abstract. *A high-resolution radar sounder has been used in the simultaneous detection of atmospheric structure and insects. The vertical distribution of insects was often correlated with atmospheric structure. Continuous recordings revealed diurnal fluctuations and layering of insects at various altitudes.*

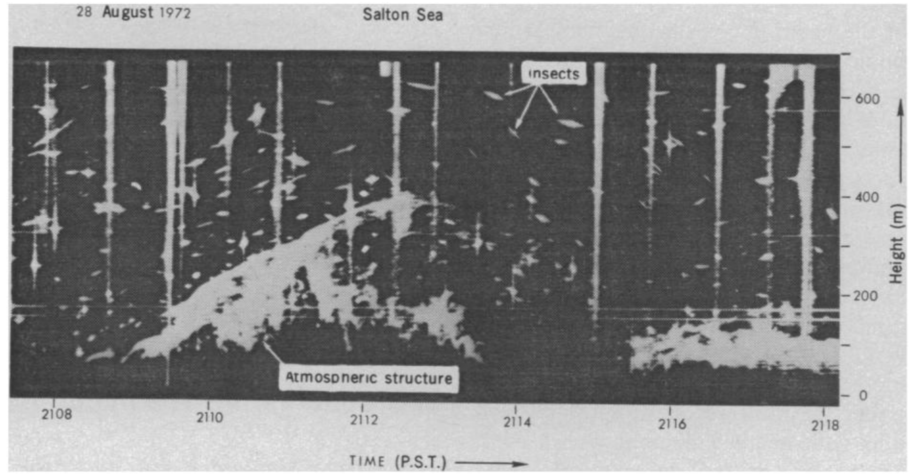
Research efforts in fields as diversified as air pollution, anomalous radio propagation, microphysical cloud structure, and clear air turbulence have produced a variety of active remote sensing techniques based on radar principles with the use of radio, optical, and acoustic waves (*1*). One of these remote sensors is a frequency-modulated, continuous-wave (FM-CW) radar, of which the most outstanding feature is the ability to observe extremely weak targets with ultrahigh range resolution at close ranges. Its sensitivity is sufficient to detect weak clear air atmospheric scattering layers and to observe structural details with a range resolution of only 1 m. A by-product of such a sensitivity is the ability to observe individual insects at large distances. The radar's sensitivity may be expressed in terms of insect detection capability. A typical insect such as a housefly (backscatter cross section = 10^{-3} cm^2 for a radio wavelength of 10 cm) at a distance of 1 km would be expected to produce echoes 24 db above noise level. We made actual measurements of the radar echoes of two insect species (*2*). An individual cabbage looper, *Trichoplusia ni* (Hübner), and a field cricket, *Gryllus* (*Acheta*) sp., were suspended from a tethered balloon. One steel ball of known diameter was placed 10 m below the insect, and another steel ball was placed 10 m above the insect. The return radar signal from the balls was then compared to that from the suspended insect to give an approximate calibration of the signals returning from insects in flight. The radar echo from the cabbage looper appeared similar to typical insect returns from our atmospheric soundings.

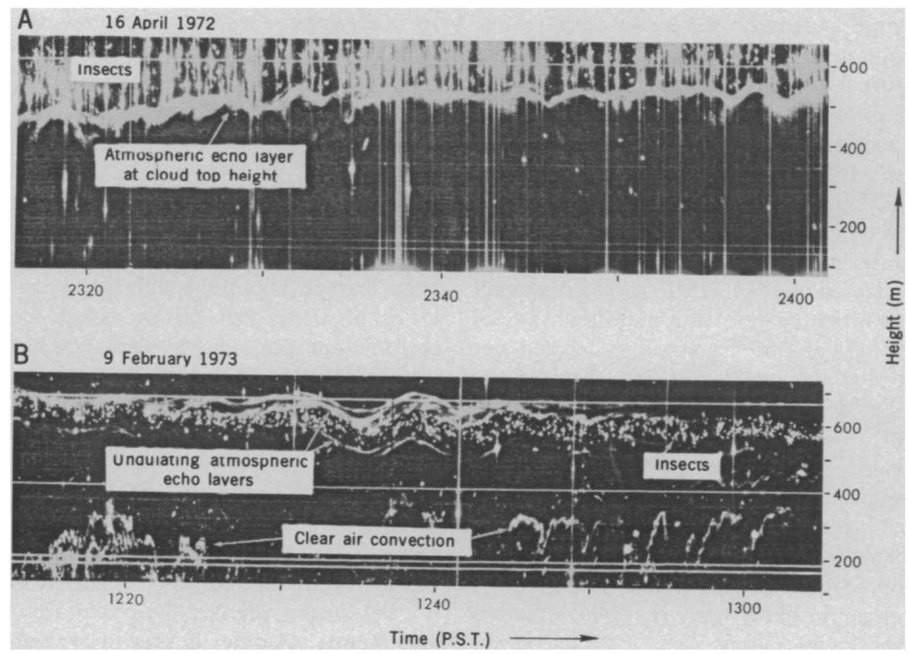
We utilized this remote sensor's ability to observe simultaneously microstructural details in the atmosphere and insect activity at San Diego and near the southwestern shore of the Salton Sea in southern California. San Diego has a mild coastal climate, and the Salton Sea is an arid desert valley. Large areas to the north and south of the Salton Sea are irrigated farmland and serve as a breeding area for numerous insect species; most of the surrounding land area is sandy desert. A mobile FM-CW radar sounder developed at the Naval Electronics Laboratory Center in San Diego (*3*) was operated continuously from 28 to 31 August 1972 at the U.S. Navy Salton Sea Base south of Salton City. Of particular interest to us were the ways in which the populations of cabbage loopers and field crickets interact with atmospheric structure and with winds.

During the measurement period, the antennas were fixed vertically and continuous time-height recordings of radar echoes were obtained. Figure 1 is a 10-minute record showing an excellent example of atmospheric motion influencing insect flight patterns. A clear air atmospheric scattering layer was carried over the radar starting at 2109 P.S.T. The echo changed height from 50 m to 400 m above ground in a 3-minute period. The vertical motion associated with this echo structure influenced the paths of the insects in the vicinity. A point target, like an insect, crossing the radar beam will appear on the radar record with a sloping trace on the recording if it changes height while in the beam. Through the entire height window of the recording the slope of the insect echoes paralleled the slope of the atmospheric echo. Thus, in the absence of atmospheric echoes, insect flight patterns are possible tracers of atmospheric motion (*4*). The interaction of atmospheric motion and insect flight is an important unknown factor in studies of insect dispersal and migration. Insect-control programs based on such concepts as the sterile male technique and pheromone mating interruption require a reasonable estimate of potential and actual insect ranges. The ranges may depend on how insects utilize existing winds to conserve their energy or how atmospheric motion prevents insects from reaching certain locations.

Figure 1 indicates the interaction of insects and atmospheric motion, although there is no evidence that the insects actively sought this kind of interaction. In contrast, Fig. 2 shows striking examples of insects occurring at specific altitudes (radar records taken at San Diego, California). The radar record of 16 April 1972 (Fig. 2A) shows a high density of insects above an undulating atmospheric echo layer associated with cloud tops. This example illustrates the capability of the radar to "see" insects through clouds. The high density of insects remained above the cloud top while the top changed in height from about 500 m at 2318 P.S.T. to 550 m at midnight. Very few insects are visible below the cloud top. Strong echoes from larger insects or birds often saturate the radar system, creating vertical streaks on the record. The cloud tops coincided with the base of a 5°C temperature inversion (a 5°C increase in temperature). The insects may have moved into the region above the clouds for better visibility and navigation, for more favorable winds, or for warmer air temperatures. The radar record on 9 February 1973 (Fig. 2B) shows a band of insects around 600 m. From 1225 to 1240 P.S.T. the insects were confined between two undulating atmospheric echo layers. The peak-to-peak amplitude of the undulation was 100 m, and the insects were apparently moved vertically by this amount. The internal wave structure responsible for the undulation indicates thermal stability in this height region. The echoes below 400 m resemble convective activity in a thermally unstable structure. A radiosonde taken 3 hours later and 17.6 km away verified this implied thermal structure. There is a distinct difference in the variability of the dot echo intensity between Fig. 2A and Fig. 2B. It appears that the dot echoes on 16 April 1972 are produced by a large variety of insect species and perhaps even by birds or bats, whereas the band of insects observed on 9 February 1973 with its small variation of echo intensity might be an indication of a small number of insect species.

The quantitative evaluation of insect echoes of the kind shown in Figs. 1 and 2 is quite involved. It is not possible to identify an individual insect by using its radar backscatter cross section because of uncertainty about the position of the insect relative to the center





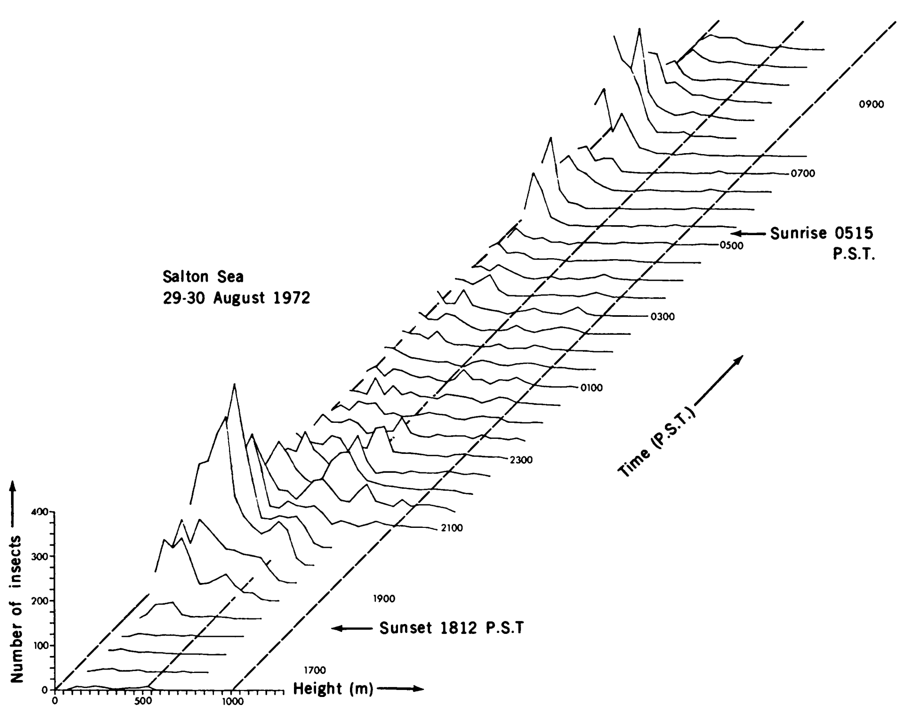


Fig. 1 (top). Clear air radar echo and dot echoes from insects in the vicinity of the Salton Sea. The slope of the insect echoes parallels the atmospheric structure. Fig. 2 (middle). (A) Concentration of insects above an atmospheric layer which coincides with a temperature inversion and cloud tops at San Diego. (B) Concentration of insects in an inversion region containing undulations at San Diego. Fig. 3 (bottom). Insect count as a function of height and time showing a double-layer structure after sunset and a large increase after sunset and sunrise at the Salton Sea.

of the beam. However, one can assume homogeneous spatial distributions to obtain estimates of the average cross sections of large numbers of observed insects. Estimates of the number of insects as a function of height can also be made. Figure 3 is an example of such an estimate for an 18-hour observation period at the Salton Sea under clear sky conditions. Because of the inherent minimum range of the radar, no insect could be detected below 50 m. Furthermore, no correction has been made for either the increase of the sampling volume with height (inherent with a conical beam) or the decrease of signal intensity with height. Two pronounced features are evident in Fig. 3: (i) the large increase in the insect density after sunset and after sunrise, indicating nocturnal and daytime insects, respectively; and (ii) the two-layer structure for the nocturnal insects. One layer of insects is centered around 150 m, the other at 400 m. This nocturnal layering appeared to be associated with atmospheric structure. A meteorological sounding balloon released at 1943 P.S.T. revealed a small temperature inversion and humidity decrease at 350 m which is located between the two layers of maximum insect density. The apparent localization of insect flight elevations above and below the region of changing atmospheric structure may result from the influence of certain atmospheric conditions or winds (wind information was not available during this test period), or, more likely, may represent different species of insects.

These results suggest that the FM-CW radar is capable of simultaneously sensing insects and atmospheric structure and that insect flight is influenced by atmospheric structure. Correlations between atmospheric structure and insect activity were detected in both arid and humid locations.

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Intracellular Recordings from Single Rods and Cones in the Mudpuppy Retina

Abstract. *Mudpuppy rod and cone responses differ both in time course of recovery and in absolute sensitivity. Rods are about 25 times more sensitive than cones and appear to generate a larger voltage per quantum absorbed. Comparison of mudpuppy receptor sensitivities to those of other vertebrates suggests that the difference in sensitivity between rods and cones may be a general phenomenon.*

Most vertebrate retinas contain two kinds of photoreceptors—rods and cones. These photoreceptors, together with the interneurons that process receptor signals, form two relatively independent visual systems. Much has been learned about the different properties of these two (often called the scotopic and photopic) systems (*1*), but little is known about the differences between the two kinds of photoreceptors themselves. For example, it is well known that rod vision is more sensitive than cone vision, but much of this difference may be due to differences in the connections of interneurons that process the two kinds of receptor signals. It is not yet known whether the photoreceptors themselves differ in sensitivity. Previous investigations have suggested that rod and cone responses may have different time courses of recovery (*2*), but this difference has not yet been demonstrated directly.

In order to compare the responses and sensitivities of rods and cones, the signals of the rods must be isolated from those of the cones, and the signals of the receptors must be isolated from those of other visual neurons. One way to do this is to record intracellularly from single photoreceptors. Intracellular recordings have been made from single rods and cones (*3*), but the responses of both kinds of photoreceptors have not yet been recorded from the same retina. This report will describe recordings from both the rods and cones, made from the retina of the mudpuppy, *Necturus maculosus*. This animal was chosen for these experiments because it has large retinal cells and because it appears to have only one rod pigment (λ_{max} about 525 nm) and only one cone pigment (λ_{max} about 575 nm) (*4*). Our recordings confirm that rod and cone responses differ greatly in their time course of recovery after brief flashes of light; they also show that single rods are more sensitive than single cones.

Eyes from dark-adapted mudpuppies were enucleated in dim red light. The cornea and lens were dissected away, and the eyecup was placed on moist cotton. Before the insertion of each micropipette, the retina was allowed to dark-adapt further until the threshold for the b-wave of the electroretinogram stabilized (approximately 10 minutes) (*5*). Fine micropipettes, 200 to 800 megohms in resistance as measured in the vitreous, and filled either with 1*M* potassium acetate or 2*M* potassium chloride, were used to penetrate photoreceptors. The retina was illuminated from above with one of two dual-beam photostimulators (*6*). The last lens in the light beam of both stimulators had a small diameter and long focal length, so that the light illuminating the retina was nearly collimated (*7*). Since penetrations were always made into the central region of the eyecup, the light from the photostimulators was approximately parallel to the long axis of the receptors whose responses were measured.

The penetration of a photoreceptor was signaled by a sudden negative shift in potential (~30 mv). Receptor responses could be distinguished from those of other cells in the retina by their small receptive fields, short absolute latencies, fast rise times, and characteristic waveforms to brief flashes of light (*8*). Spectral sensitivity curves, constructed by measuring intensity-response curves at a number of different wavelengths, were used to separate