# earth sciences

## Rotation of upper atmosphere

The rate of rotation of the upper atmosphere, which can be inferred from changes in inclinations of satellite orbits to the equator, has been found to exceed that of the earth in some places (SN: 5/29/71, p. 369). The rotation rate increases from about 1.1 revolutions per day at a height of 200 kilometers to about 1.4 revolutions per day at 350 kilometers.

The increase in rotation rate does not, however, continue above 350 kilometers, says D. G. King-Hele of the Royal Aircraft Establishment in England. Recent satellite data show, he reports in the Oct. 1 NATURE, that rotation rate decreases again to about 1.0 revolution per day at 420 kilometers and 0.7 revolution at 500 kilometers.

The wind pattern in the upper atmosphere influences its heating, he points out, and calculations now in progress should yield information on variations in wind speed in these rotation zones. He says preliminary data suggest that the rotation rate sometimes departs greatly from its average value.

## The big creep

An earthquake results when stress built up along a fracture in the earth's crust is suddenly and violently released. The stress can also be relieved by gradual movement, called creep, along the fault.

Last week the National Oceanic and Atmospheric Administration's Earthquake Mechanism Laboratory announced that it had recorded a cluster of creep movements along several branches of the San Andreas Fault system in California. One creep event was the largest ever recorded. In a single day, there was a movement of nine millimeters along the Hayward-Calaveras Fault near Hollister. This compares with an annual average of about ten millimeters.

The six-kilometer-long rupture in the earth's crust created by the large creep was directly measured by a dense network of instruments installed during the past several years. Another network recorded five creep events on the main San Andreas Fault during the same period. Seismologists believe that such peaceful releases of stress reduce the probability of earthquakes.

## Warm mother earth

Until recently, the heat flowing from the earth's interior has not been measured as thoroughly as other geophysical parameters, such as magnetic and gravity anomalies. Partly because of the heat's potential as an energy source (SN: 11/20/70, p. 415), and partly because it is now recognized as essential to physical and chemical models of the earth, this variable has received increasing attention.

In the Sept. 10 JOURNAL of GEOPHYSICAL RESEARCH, five U.S. Geological Survey researchers report the results of subsurface temperature measurements in 150 boreholes at about 100 sites in the western United States. Estimates of vertical heat flux in these holes, say J. H. Sass and his colleagues, confirm that heat flow is generally high in the region. Heat flow was low to normal on the Pacific northwestern coast and the northwestern Columbia plateaus, low in the western Sierra Nevada, and high in the northern and southern Rockies.

# astronomy

## Interplanetary and terrestrial magnetism

In the last two years at least two scientists have suggested that the interplanetary magnetic field should influence the earth's magnetic field in a particular way. Namely, if the earth happens to be in a sector of the interplanetary field where the polarity points away from the sun, a broad minimum should appear in the vertical component of the terrestrial field at a station near the north magnetic pole such as Thule, Greenland (geomagnetic latitude 86.8 degrees N), for a few hours near local noon; an increase should appear in the horizontal component for a station a little farther south, for example, Godhavn (77.5 degrees N).

If the earth passes into an interplanetary sector with polarity toward the sun, the terrestrial effect reverses.

To test this hypothesis two Danish scientists, Eigil Friis-Christensen and Knud Larsen of the Meteorologisk Institut at Charlottenlund, attempted to determine the configuration of the interplanetary field from records of the terrestrial field at Thule and Godhavn. Their results were compared with direct satellite measurements by John M. Wilcox and Walter Gonzales of Stanford University and David S. Colburn of the NASA's Ames Research Center.

In the Sept. 20 NATURE PHYSICAL SCIENCES they report a close correspondence between the two kinds of determination. Thus, they say, terrestrial records could be used to chart the history of the interplanetary field over several past sunspot cycles.

## Quasar redshifts not random

Observed quasar redshifts appear to cluster about certain numbers at intervals of about 0.06. Certain speculations about the structure of the universe and the nature of quasars have been hung on these periodicities.

The interpretations of the periodic clustering were based on the idea that the quasars whose redshifts have been measured represent a random sample of all the quasars there are, and therefore a periodicity in the measurements represents a real periodicity in the redshifts of the quasars. In the Sept. 27 NATURE PHYSICAL SCIENCE R. C. Roeder of the University of Toronto warns that this may not be so.

Roeder notes that the quasar redshifts cluster about values at which particularly bright emission lines are shifted from the ultraviolet into the visible range in which the spectra are recorded. He suggests therefore that the measured redshifts are not a random sample but a selective one that favors redshift values that bring particularly bright lines into the visible range.

## Interstellar formamide

To the previous list of interstellar molecules formamide ($NH_2CHO$) is now added. It was found in the direction of the cloud Sagittarius B2 and possibly Sagittarius A, by R. H. Rubin, G. W. Swenson Jr., R. C. Benson, H. L. Tigelaar and W. H. Flygare of the University of Illinois.

Reporting in the Oct. 1 ASTROPHYSICAL JOURNAL LETTERS, they point out that this is the first interstellar compound that contains hydrogen, carbon, nitrogen and oxygen in one molecule.