Space

Latitude gradient in the solar wind

By combining data from three earth-orbiting satellites and one Venus probe, scientists at Jet Propulsion Laboratory have concluded that the speed and density of the solar wind vary for different solar latitudes. The velocity, in fact, report Edward J. Rhodes Jr. and Edward J. Smith in the JOURNAL OF GEOPHYSICAL RESEARCH (80:917), may increase by as much as 36,000 kilometers per hour for each degree above or below the sun's equator.

The findings were calculated by comparing solar wind velocities recorded by the Mariner 5 spacecraft on its way to Venus with those recorded by the Explorer 33, 34 and 35 satellites in earth orbit, during several 27-day solar rotation cycles in 1967. The Explorers varied from about one to seven degrees of north solar latitude, while Mariner provided data from about four degrees north to two degrees south. Mariner and the Explorers were sometimes as much as six degrees of latitude apart, at which times they recorded solar wind velocities that differed by up to 30 percent.

These findings by themselves do not rule out the possibility that the solar wind simply gets faster with distance from the sun. But other researchers (Intriligator and Neugebauer), have found a lack of significant correlation between velocities measured by Pioneer 9 and Orbiting Geophysical Observatory 5, which were widely separated in radial distance from the sun but differed by only 0.2 to 0.5 degrees of solar latitude. Pioneer 10 and 11 have also failed to show an overall radial increase in solar wind velocity, says Smith, and in fact, both the Pioneer 9-OGO 5 and Pioneer 10-11 researchers have found that high-velocity streams tend to slow down with distance from the sun.

Rhodes and Smith also reanalyzed four years of data from earth-orbiting Vela satellites, which turned out to show an average velocity gradient of about 43,000 kilometers per second per solar latitude degree.

Following a field line

Soviet and French scientists have recently completed a joint experiment called Project Araks, designed to study the varying effects produced by charged particles striking earth's magnetic lines of force at different angles. According to Izvestiya, two French sounding rockets were launched on Jan. 26 and Feb. 15 from remote Kerguelen Island in the Indian Ocean, which is the southern end of a field line whose northern conjugate point is at Arkhangelskaya Oblast in the Soviet Union. At altitudes ranging from 150 to 200 kilometers, the rockets released 27 KeV and 15 KeV electrons at different angles to the field line, while instruments aboard the rockets radioed data on changing particle fluxes and field conditions. Optical observations of auroral effects were made from Arkhangelskaya Oblast as well as from a specially equipped aircraft, while radar and radiospectral data were collected from two other Soviet sites.

At the same time, according to B. N. Petrov, chairman of the Council on International Cooperation in the Field of Space Exploration and Use of the Soviet Academy of Sciences, U.S. researchers on Kerguelen Island monitored X-rays produced "during the braking of the artificially injected electrons in [the] dense layers of the atmosphere." Araks data are still in preliminary stages, but "in general," says Petrov, "it can be said that the experiment went off very successfully."

Zoology

Chemical signal for watery rendevous

From a sperm's perspective, an egg cell is a pretty large target. But when both sperm and egg are dumped into the wet infinity of the ocean, finding each other is difficult. Luckily, natural selection has found a way to increase the chances of their union. It seems that some marine animals—maybe all—have evolved a chemical attraction system between eggs and sperm. This system, called chemotaxis, had previously been reported in lower marine animals such as the marine coelenterate *Campanularia*. Now it has been reported in a primitive marine chordate, *Ciona*, implying the researcher states, the system may be widespread.

Biologist Richard L. Miller of Tampa University reports his finding of chemotaxis in a chordate in the March 20 NATURE. Extracts from *Ciona* eggs or from water in which the eggs were allowed to stand for a few hours drove *Ciona* sperm wild, Miller found. Where before they swam in lazy circles on a glass slide, when egg or egg water extracts were added, they swam rapidly toward the source, a pipette. The extracts are species-specific, too, Miller says, and had no effect on other species of the same subphyllum.

Ciona eggs are shed into the sea before fertilization, and apparently give off a powerful attractant. The assumption that eggs and sperm rendezvous by chance in watery environments "may have to be reevaluated," Miller says.

Penguins: Thermal control with blood

How a penguin stays warm all winter, but survives summer's heat while breeding or molting, prompted P. G. H. Frost of the University of Cape Town, South Africa, and his colleagues to dissect and study Jackass penguins (*Spheniscus demersus*). By filling a penguin's blood vessels with dye, then injecting them with a crystic resin, which hardens, the zoologist were able to determine where the bird's blood goes, illustrated in the JOURNAL OF ZOOLOGY (175:231). X-ray photography confirmed their supposition: The penguin's wing vessels branch, forming a pair of twin arteries and veins, with an extra marginal vein for cooling during heat stress. Increased surface area between artery and vein increases heat exchange; if the bird gets too hot, blood rushes through the marginal vein, while peripheral blood vessels widen, maximizing heat loss.

Penguins are able to face freezing winds because a similar, massive network of blood vessels warm the eyes, nasal passages and surface jaw muscles. In the lower leg, absent of feathers, veins are also more numerous, and terminate near the skin, where warmth is needed most.

Dinosaurs: Gone, but not really

Dinosaurophiles can stop grieving the extinction of those long, lost leviathans. It's spring and a billion living expressions of dinosaurness will migrate north once again. Robert T. Bakker of Harvard reviews his ideas on dinosaurs in the April SCIENTIFIC AMERICAN. Birds are descended from dinosaurs and Bakker theorizes that many dinosaurs had characteristics of living birds, such as warm blood and feathers or a similar insulating system. Why, then, did birds survive and dinosaurs die out? A previous theory holds that they died from the cold when temperatures dropped 65 million years ago (SN: 7/22/72, p. 53). More likely, Bakker says now, is that as habitats decreased and competition increased among land animals, only smaller mammals and birds could adjust. But, says Bakker, birds still carry forth the dinosaur biology.