SCIENCE NEWS®
A Science Service Publication
Vol. 115/February 3, 1979/No. 5

COVER: A team of earthquake researchers from the U.S. Geological Survey check motion along a fault with instruments sensitive to displacement of 1 mm in 10 miles. Overhead, a plane measures temperature and magnetic variations. Such efforts may one day lead to prediction of major quakes, but the task has turned out to be harder than many had expected. See p. 74. (Photo: USGS)

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Subscription rate: 1 yr., $15.50; 2 yrs., $27.00; 3 yrs., $37.50 (Add $3 a year for Canada and Mexico, $4 for all other countries.) Change of address: Four to six weeks' notice is required. Please state exactly how magazine is to be addressed. Include zip code.

Printed in U.S.A. Second class postage paid at Washington, D.C. Title registered as trademark U.S. and Canadian Patent Offices.

Published every Saturday by SCIENCE SERVICE, Inc. 1719 N St., N.W., Washington, D.C. 20036. (202-785-2255) TWX 710-822-9433 SCIEN NEWS. ISSN 0036-8423

LETTERS

Albedo changes

I read with interest the article, "Antarctic sea ice may herald ice age" (SN: 1/13/79, p. 22). Albedo changes caused by increasing sea ice in the southern hemisphere are very important in cooling the climate, as James Hays pointed out.

I would like to add that albedo changes in the northern hemisphere caused by increasing snowcover are equally important in reflecting considerable amounts of sunlight back into space and producing significant changes in the hemispheric heat balance (G. J. Kukla and H. J. Kukla, SCIENCE: Vol. 183, No. 4126, pp. 709-714). Satellite monitoring of sea ice would complement the satellite coverage of snowcover already underway by Donald Wiesnet and Michael Matson, who have noted that record-breaking snow coverage of North America and the northern hemisphere had occurred during the winter of 1977-78 (SN: 3/11/78, p. 148). And more of the same is in store for us this year, as snowcover just set a 13-year record in North America last month (December).

Richard Heim Jr.
Lincoln, Neb.

The work done by Hays is interesting and very possibly relates to the glacial cycle. However, I would question that the changes are actually caused by changes in the earth's orbit. Instead, I would suggest that the mechanism triggering the ice cap advancing and retreating is a relatively simple phenomenon, here on earth: the changing of direction of the Gulf Stream.

Despite widespread assumptions to the contrary, the ice ages are North Atlantic events, with obvious global manifestations. Recent CLIMAP data show graphically that the greatest ice sheets form on land close to the North Atlantic, where sea ice also forms.

It would be hard to imagine the Arctic ice cap extending greatly, given the present direction of the Gulf Stream.

The North Equatorial Current, which straddles the Greater Antilles, drives the Gulf Stream. Changes in the ocean level in this area produce dramatic changes in the land mass configurations, in the path of this North Equatorial Current.

The National Ocean Survey, NOAA, has sea level data back to 1890. The sea levels at 6 stations around Florida show the level rising at an average rate of about 10cm in 50 years. A rise of 10 to 20 feet, over the next 2,000 to 3,000 years would change the coastline of southern Florida substantially. Such a change, of course, is a modest sea-level change compared to the 300-foot rise in the last 18,000 years. This change in the Florida coast, along with other changes in that area, would direct the Gulf Stream to a more southerly route, perhaps more toward the Spanish coast.

Given a little erosion across what is now the Everglades, this more southerly course would continue until the sea level is lowered to a point where the Greater Bahama Bank is exposed. This would cause the Gulf Stream to split, maintaining a lower level of thermal energy being sent to the North Atlantic.

Now, the ocean continues to drop, until the Gulf Stream is pinched off to a point where its effect is reduced to a minimum. The North Equatorial Current now flows mostly to the north and east of the Antilles, again sending increasingly more heat to the North Atlantic. The ice cap then starts decreasing.

If such is the scenario, we have within our capacity the possibility of modulating these currents to maintain equilibrium, at some optimum sea level.

Edward Stilson
Maple Grove, Minn.

The dual gamma ray

In a recent issue of SCIENCE NEWS (SN: 10/7/78, p. 245) there was an article entitled "Catch 3C273: Gamma rays from a quasar." In that article (third paragraph) the statement was made that the high-energy gamma rays in question "are really high-energy particles rather than waves. . . ." This is rather confusing to me because I have always understood that photons can be described as only having an equivalent mass. On the other hand, when the term "particle" is used, it describes an entity with an actual (not equivalent) rest mass. Please explain this apparent contradiction in terms. Is it a gamma ray or a particle?

Joseph A. Counsil
Dayton, Ohio

(Gamma rays are both waves and particles. That is the basic statement of quantum mechanics. Under a given set of conditions one aspect will be more apparent than the other, but an experiment can always be devised to prove the reality of either one. There is no restriction of the word particle to an object with measurable rest mass. More and more zero mass particles are appearing. At the energies of pulsar gamma rays the particulate aspects are easier to observe than the wave aspects.—Ed.)

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