Earth Science

Reservoirs speed up Earth's spin

People have stored so much water in artificial reservoirs in recent decades that they have subtly altered the planet's rotation. Water impoundment has shortened the length of the day and shifted Earth's spin axis by tiny amounts, reports Benjamin Fong Chao, a geophysicist at NASA's Goddard Space Flight Center in Greenbelt, Md.

Over the last 40 years, people have pooled roughly 10 trillion tons of water in reservoirs, most of them located in the Northern Hemisphere. The process has shifted water from the oceans to the continents, tending to reduce mass around Earth's equator and increase mass in the northern part of the globe.

The shift has quickened Earth's spin by placing water closer to the axis of rotation, much as a skater might bring his or her arms close to the body in order to spin faster.

Geophysicists measure changes in Earth's spin in terms of the length of the day. A faster spin shortens the day. "Due to the reservoir effect, the day 40 years ago was longer than today by about 8 millionths of a second," says Chao.

This change is only one-hundredth the size of annual fluctuations in day length caused by natural forces, says Chao, who reports his findings in the Dec. 15, 1995 GEOPHYSICAL RESEARCH LETTERS. Earth's spin slows down and speeds up in response to many factors, including atmospheric pressure systems and ocean currents.

Because reservoirs are not placed symmetrically around the globe, water storage has also changed the planet's axis. Since 1940, impoundment has pushed the axis of rotation about 60 centimeters away from the North Pole toward western Canada.

Such a shift is significant, says Chao. It equals 5 percent of the natural axis drift over the last 100 years. The creation of reservoirs, he says, "is the only human activity that's big enough to cause any appreciable change in these global phenomena."

Antarctic warmth kills ice shelves

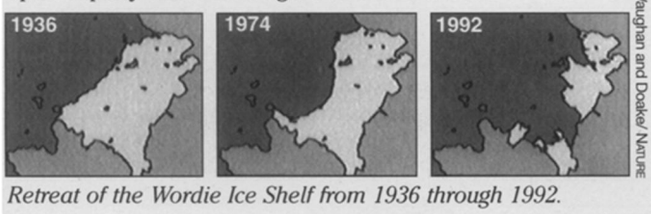
Ice shelves along the coast of Antarctica may play the role of the canary in a coal mine when it comes to global warming. The ice shelves—floating sheets of ice extending from the coast—are extremely sensitive to changing conditions and fall apart when temperatures rise above a critical point, report David G. Vaughan and Christopher S.M. Doake of the British Antarctic Survey in Cambridge, England.

In the last 50 years, four ice shelves have collapsed along the Antarctic Peninsula. At the same time, temperatures along the peninsula have climbed 2.5°C, a warming rate much faster than that seen in the rest of the continent.

In the Jan. 25 NATURE, Vaughan and Doake note that the ice shelves suffered when the mean annual temperature exceeded -5°C. This represents the limit for ice shelf existence, they claim.

The scientists cannot say whether the recent Antarctic warmth is natural or a product of greenhouse gas pollution. If the trend continues, ice shelves closer to the pole will disintegrate, they predict. If conditions cool, though, ice shelves could regrow.

In the Feb. 9 SCIENCE, researchers from Austria and Argentina discuss the most recent collapse, which claimed part of the Larsen Ice Shelf in January 1995. From this event, they conclude that ice shelves may retreat slowly at first and then fall apart rapidly after reaching a critical limit.



Vaughan and Doake/ NATURE

Retreat of the Wordie Ice Shelf from 1936 through 1992.

Nutrition

Fat: If you can't bear to pare it

As a former head of the largest federal human nutrition research laboratory once noted, "The problem with fat is that it tastes so good." This observation goes a long way toward explaining why so many people eat more fat than they need—indeed, far more than is healthy for the heart. Now, a pair of Australian studies in the January AMERICAN JOURNAL OF CLINICAL NUTRITION suggests potential strategies for satisfying the craving with foods prepared from uncommon sources of fat.

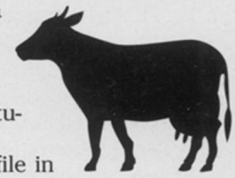
Gillian E. Caughey of Royal Adelaide Hospital in South Australia and her coworkers played with the type—but not the quantity—of fat in the diet in hopes of cutting the body's production of human necrosis factor-alpha (TNF-alpha) and interleukin-1-beta (IL-1-beta). These hormonelike proteins, which help regulate the intensity and duration of immune responses, appear to foster both rheumatoid arthritis and atherosclerosis.

Because white blood cells rich in omega-3 fatty acids tend to produce fewer of these compounds, Caughey's team tailored the diets of 28 men and women to derive most of their fat from either flax oil, rich in omega-3s, or sunflower oil, high in other polyunsaturates. After 4 weeks, concentrations of alpha-linolenic acid and eicosopentenoic acid—two types of omega 3s—in the blood of people eating sunflower oil remained comparable to amounts when the study began. But among flax oil diners, concentrations of these fats had tripled and doubled, respectively.

The researchers then began supplementing both groups daily with nine fish oil capsules—a premier source of omega-3 fats. After 4 weeks, total omega-3 amounts in blood had climbed in both groups to roughly double their starting values.

As the blood cells' omega-3 increased, Caughey and her colleagues recorded the large drops in TNF-alpha and IL-1-beta they had hoped for. While the study confirmed that fish oil is a more potent agent for bringing about these beneficial changes, the authors point out that switching flax for other vegetable oils "is easier and cheaper to implement across a population, particularly one . . . not attuned to fish consumption."

A second trial looked at the effects on blood cholesterol of products made from the milk of cows fed special rations. Not only did the feed contain twice the normal amount of fat, but that fat was derived primarily from canola and soybeans—rich in heart-friendly monounsaturates (SN: 6/9/90, p. 367). Moreover, the fat was encapsulated, so it reached the gut, where these monounsaturates could be absorbed, intact.



This tinkering produced a new fat profile in the cows' milk. It contained about 70 percent less saturated fat and nearly 40 percent more monounsaturates. Manny Noakes of the Commonwealth Scientific and Industrial Research Organization in Adelaide and her colleagues incorporated cheese, ice cream, and other dairy products made from this milk into the diets of 33 volunteers. After 3 weeks, these men and women exhibited striking changes in their blood lipids, compared to readings after a similar period when they had dined on foods made from conventional milk. Leading the beneficial changes was a 4.3 percent average drop in cholesterol concentrations. Such a drop, if applied across a population, could lower the risk of coronary heart disease by about 9 percent, Noakes and her colleagues observe.

Unlike the flax oil, this milk is not yet commercially available, though an Australian firm is looking into development of it. Because cows on the modified-fat rations produce more milk than other cows, Noakes anticipates that consumers would have to pay little extra for products made from it.