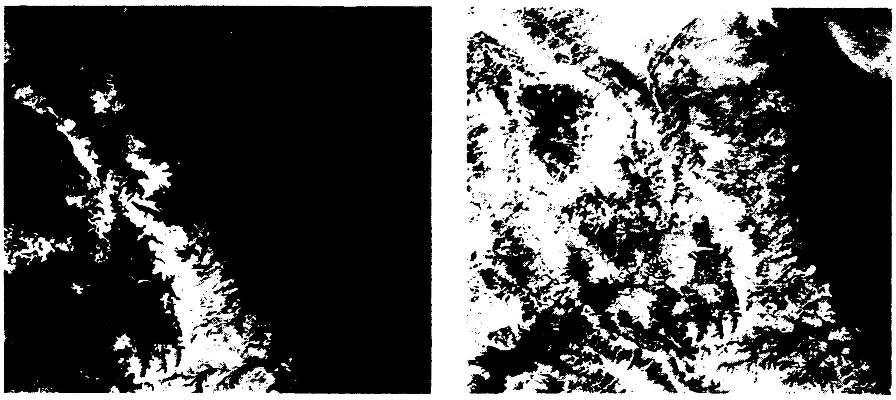
High 'Eyes' Scout for Floods



NOAA/NESDIS

Scenes of State Street in Salt Lake City have been appearing on televisions around the world. A main thoroughfare now banked with sandbags, the boulevard has recently been diverted to channel record spring flood waters through town. An unorthodox measure for dealing with rushing mountain snowmelt, it has so far prevented wholesale flooding of the city's downtown area. And city flood managers credit their ability to execute this novel urban option to the timely warning given them by the National Weather Service (NWS).

At a news briefing last week, NWS hydrologists graphically showed how they use data collected by the National Oceanic and Atmospheric Administration's three satellite systems to identify flood-sensitive areas and provide local officials information to prepare for flooding. Landsat cameras, with 30-meter resolution, took the accompanying photos (roughly 100 by 100 miles) of the same region in central Colorado. Left, taken May 1, 1976, depicts average snowpack. Right shows conditions April 16, 1983 — a 200 percent increase over norms for that date.

Since Landsat-4 revisits the same area only once every 18 days, two lower-resolution systems augment its data. NOAA's polar-orbiting satellites (NOAA-7 and -8), with 1.1-kilometer resolution, offer two day and two night views of the western United States. And GOES-6 (which became operational June 1) offers broad views of the West every 30 minutes; it is expected to become a geostationary workhorse in NOAA's high-flying fleet. GOES also interrogates remote, unmanned weather stations, periodically obtaining data on snowpack depth, its water equivalent (how wet it is), and snowpack temperature. The last provides early warning of a melt.

Based on these data, the West is being warned to brace for record melts and extensive flooding in coming weeks. Seventy percent of the region's water is snowmelt, and as with Utah, most of the West received a heavy blanketing this year. Even now, regions in the Sierra Nevada range show snow 300 percent of normal. It's not just that this year's thaw is late, which it is by about six weeks, but there has also been above-normal precipitation — throughout the country. Soil in the South and Southeast, for example, "is simply saturated," points out meteorologist Robert Clark, director of NWS's hydrology office. What's more, he believes "there's no question there's some connection" between this year's El Niño (SN: 2/26/83, p. 135) — perhaps the worst in a century — and this, "the worst weather I've seen in 40 years." — *J. Raloff*

Life under pressure: Vent microbes grow at 250°C or more

Biologists trying to recreate the environmental conditions found at deep sea vents have shown that vent bacteria thrive under pressure and at water temperatures of 250°C or more. This is more than twice the temperature that any organism has been known to tolerate in the laboratory. The finding challenges long-standing assumptions about the conditions under which life can survive and suggests new avenues through which the origin of life may be explored.

The bacteria were sampled in 1979 from 306°C water streaming from "black smokers" or sulfide chimneys along the East Pacific Rise at 21°N. John Baross of Oregon State University in Corvallis and Jody Deming of Johns Hopkins Chesapeake Bay Institute in Shadyside, Md., report in the June 2 NATURE that in lab conditions the microbes grow and produce gases including methane, hydrogen and carbon dioxide. The hottest waters known to be emitted at the vents are 350°C, and also may support communities of the bacteria, which convert inorganic chemicals into usable energy (SN: 6/19/82, p. 413).

Last year Baross and colleagues described laboratory experiments in which the bacteria lived when subjected to temperatures as high as 100°C under surface pressure. Deming joined the present study because of her expertise on the effects of pressure on bacteria. Under sufficient pressure, even very hot water can be maintained in a liquid state, rather than boiling out into water vapor. By heating the water and subjecting it to pressure 265 times that on the earth's surface (the ambient pressure at this seafloor location 2,500 meters below the sea surface) they were able to force the temperature of the enriched seawater to 250°C. The bacteria were far more productive than they had been at the lower temperature.

With existing equipment the scientists are unable to raise the temperature any higher, but there is no reason, Deming says, to believe that the microbes cannot survive under even hotter conditions. She and Baross are designing a pressure chamber that will allow them to push the temperature to 500°C or higher in an effort to determine the upper limit of conditions under which the bacteria can live.

"These results substantiate the hypothesis that microbial growth is limited not by temperature but by the existence of liquid water, assuming that all other conditions necessary for life are provided," the authors write.

The findings increase the chance that the bacteria live inside the black smokers and, possibly, deeper in the earth's crust. It also reopens the possibility that life can exist in environments, such as Venus, where it was believed that conditions were too extreme. Baross, Jack Corliss and Sarah Hoffman, also of Oregon State, have advanced a controversial hypothesis that the deep sea vents may have been a site where life originated. The bacteria at the vent systems are of a primitive type called archaebacteria, which are stable under high temperatures, and which probably evolved very early in earth history. Other reconstructions of the origin of life hold that organisms developed only after the accreting earth had cooled to moderate temperatures.

Cyril Ponnamperuma of the University of Maryland in College Park describes the possibilities raised by the recent findings as "mind-boggling." Until now, he says, laboratory work on the question of life's origins has been an attempt to recreate what happened four billion years ago. The new information suggests that the present-day vents are repeating geophysical conditions, such as heat and seawater chemistry, prevalent when life arose. He suggests that life may originate as a "continuous process." — *C. Simon*