Combined forces create Southwest drought

Hot, crop-killing weather ruled the Southwest and Great Plains of the United States during the first half of 1996, with record books in Texas and Oklahoma proving it the driest winter and spring since record keeping began in 1895.

In a move to explain the precipitation deficit, meteorologists at the National Weather Service's Climate Prediction Center in Camp Springs, Md., released a report on the drought last month. Although Arizona, Nebraska, New Mexico, Oklahoma, and Texas bore the brunt of the dry spell, researchers said it was part of an unusual weather pattern that affected the whole Northern Hemisphere during late 1995 and early 1996.

The first puzzle piece that they found was a wide area of relatively cool water last year across the central Pacific Ocean. Dubbed La Niña by climate scientists, the lower-than-normal water temperatures are the flip side of the better-known El Niño, which elevates water temperatures in the same region. Both deviations can influence weather on a global scale.

La Niña alters thunderstorm activity over the central Pacific, sending the seasonal storm track and jet stream to the north and stationing a high-pressure dome over the Southwest, according to Gerald Bell, a coauthor of the report. This northbound jet stream triggered above-normal rainfall and flooding in the Pacific Northwest.

The report finds another missing piece in a unique wind circulation pattern over the North Atlantic that increased the drought's scope. Like El Niño, this North Atlantic Oscillation has opposite phases. The so-called negative phase is linked to lower-than-normal atmospheric pressure in the mid-Atlantic and a weakening stream of Gulf moisture into the United States, says James Hurrell of the National Center for Atmospheric Research in Boulder, Colo. Along with Pacific storms, moisture from the Gulf of Mexico is the major source of rain for Plains states like Nebraska and Oklahoma.

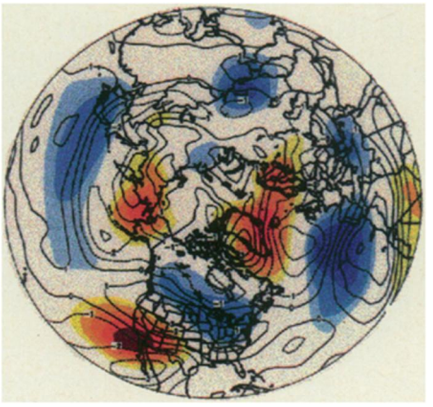
"It's probably happened before," says Rich Tinker, lead author of the report, "but I don't think we've seen the two feed each other to the extent we've seen this year."

Tinker notes that both pieces of the puzzle bucked atmospheric trends that have prevailed for close to 20 years. Since the late 1970s, El Niño has been active, as has the positive phase of the North Atlantic Oscillation.

Though they can now see remote forces affecting local climates, researchers say the kind of early warning that could save billions of dollars in crops is still a long way off. Knowledge of planetwide patterns like La Niña can enhance local predictions, says Hurrell, but they don't guarantee 100 percent accuracy. The atmosphere still cooks up surprises for climatologists who dare to forecast long-term trends, he adds.

June rains in some dry areas were not sufficient to reverse the shortfall, Tinker says. Whether the drought persists will depend on the vigor of the region's late summer rainy season. — *E. Skindrud*

Climate Prediction Center/NWS



Northern Hemisphere weather patterns for Oct. 1995 through May 1996 included elevated atmospheric pressure over the Southwest (red) and a zone of low pressure over the mid-Atlantic (blue).

Right brain takes memories personally

Notable events from one's past, such as a cherished childhood birthday party or a hospital stay for a serious injury, can inspire lasting memories. The ability to revive recollections of this sort depends on a network of brain regions located mainly in the right hemisphere, according to a new brain-scan study.

A distinct "module" of interconnected structures in the brain's outer, cortical layer and in other areas of the cerebrum may orchestrate mental encores of past experiences, contend Gereon R. Fink, a neuroscientist at the Institute of Neurology in London, and his colleagues. A clump of tissue in the right temporal cortex, near the ear, appears to serve as a hub in this module, Fink's group argues.

Their findings agree with reports of near-total memory loss of newly acquired information after injuries to the temporal cortex. The new work also elaborates on brain scans indicating that part of the right frontal cortex aids in the retrieval of personal memories (SN: 3/26/94, p. 199).

"Several sets of findings now point to predominantly right cortical activation during autobiographical memory retrieval," asserts Endel Tulving, a psychologist at the Rotman Research Institute of Baycrest Centre in Ontario. "No one has a good explanation yet for why this pattern of activation occurs."

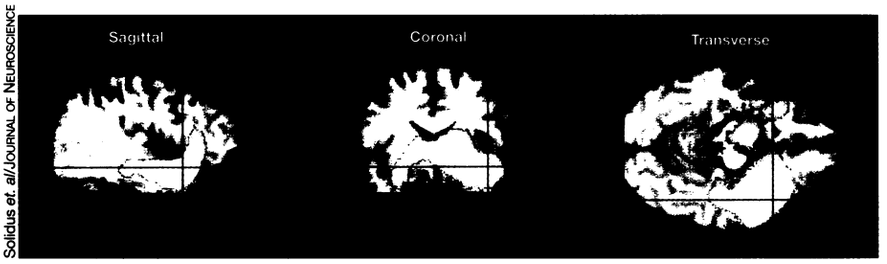
Fink's group examined blood-flow changes in the brains of seven healthy men, ages 21 to 37, as they lay under a positron emission tomography (PET) scanner.

For a first round of PET scans, each volunteer rested with his eyes closed. During a second round, they listened to sentences—which they had read an hour before the trial began—describing events from another person's life. After hearing a sentence, volunteers imagined the person's experience in that situation.

In a third round of scans, the men listened to sentences outlining events from their own lives, which they had provided in interviews conducted several weeks prior to the PET session. On hearing these utterances, volunteers thought about what had happened to them and how they felt in each instance.

Comparisons of blood-flow data under the three conditions revealed brain areas uniquely activated by the emergence of autobiographical memories, the scientists assert in the July 1 JOURNAL OF NEUROSCIENCE. Right-brain regions predominated, including parts of the temporal and frontal cortex, the hippocampus (which has been linked to memory functions), the amygdala (which helps to regulate emotion), and the cerebellum (a structure at the base of the brain). — *B. Bower*

Solidus et. al/JOURNAL OF NEUROSCIENCE



Side (sagittal), back (coronal), and overhead (transverse) images show largely right-brain activation linked to autobiographical memory.