his colleagues call "cold fronts aloft." In the group's model, which is controversial, these fronts do not extend to the surface, where fronts are conventionally plotted, but they are still capable of triggering violent weather.

In one case, says Hobbs, the NMC missed forecasting destructive surface winds driven in part by a cold front aloft. "Perhaps because the Weather Service was viewing it in terms of the Norwegian model and tracking surface fronts," says Hobbs, "they had missed quite severe weather that tracked with the upper front."

Whether or not cold fronts aloft or any of the other half-dozen proposed variants of the Norwegian model's fronts survive to enter general use, there is a whole class of smaller weather features that researchers would like to see more often on NMC's maps. In the Norwegian model, weather develops along lines hundreds or thousands of kilometers long as the warm air on one side of a front is pushed upward by the cold air on the other side, triggering rain and snow. But Steven Koch of NASA's Goddard Space Flight Center in Greenbelt, Maryland, reminded workshop participants that smaller features—the so-called mesoscale systems that have drawn attention in recent years—can also generate interesting weather, far from any classical front. A case in point is something called a dry line, which divides moist air from dry. There's no symbol on weather maps for dry lines, but they are enough to trigger major tornado outbreaks over Oklahoma.

Still, there's no one best way to relabel the weather map, meteorologists say. Those who would prefer no fronts, especially research meteorologists who want to make up their own minds, will probably go with color-coded depictions of varying atmospheric properties—temperature for example—to help guide the eye to critical regions (see figure). Computer workstations are making that kind of display more widely available, as well as easing the analysis of the data. Traditionally, drawing weather maps has been a time-consuming matter involving paper and pencil, acetate overlays, and grease pencils.

Uccellini and his colleagues in the operations division of NMC, who must provide detailed guidance to everyone from the man-in-the-street to local Weather Service forecasters, are taking a more conservative approach. They're eagerly trading in their grease pencils for workstations but are holding off an attack on 75 years of weather map tradition. Fronts will still be labeled, and the labeling of mesoscale features will be considered on a case by case basis. Sanders can understand the cautious pace: "Because of our intimate relation to our customers, we have to take them into account even though it runs counter to our scientific inclinations." ■ RICHARD A. KERR

Now All Astronomers Need Is the Maple Syrup

Radio astronomers searching the outer reaches of the universe believe they have discovered a flapjack fit for a cosmic Paul Bunyan. Peering four-fifths of the way back to the Big Bang with the Very Large Array (VLA), the 27-antenna radio telescope on the Plains of San Agustin in New Mexico, Juan Uson, Durgadas Bagri, and Timothy Cornwell of the National Radio Astronomy Observatory have spotted a vast, flattened structure of hydrogen that, they calculate, contains as much mass as a present-day cluster of galaxies.

The mass similarity is no coincidence, the investigators think. They believe their gassy pancake is the progenitor of a cluster of galaxies. If so, the observation would be the first direct evidence to support a controversial theory proposed in the 1970s by Yakov Zel'dovich of the University of Moscow: namely that clusters and superclusters of galaxies took shape as clouds of primordial gas well before the birth of their constituent galaxies and stars.

Many astronomers are intrigued by the observation. "It's an impressive result," says theorist Joseph Silk of the University of California, Berkeley. But not everyone is convinced that Uson and his colleagues have seen an embryo galactic cluster. And even astronomers who accept the observation at face value aren't ready to endorse Zel'dovich's "top down" notion of the formation of these giant cosmic structures on the strength of a single sighting.

Although Zel'dovich's theory was warmly received soon after it was proposed, it fell from favor in the 1980s. A major reason, notes Princeton cosmologist James Peebles, is that "there are galaxies that are not in big collections—our own galaxy is an example." Peebles and many other cosmologists think these strays formed on their own in a "bottom up" process, in which smaller structures like galaxies formed first and only later migrated into larger clusters (see *Science*, 22 November, p. 1106).

But Uson and his colleagues didn't give up on the Zel'dovich model, and they saw a way to test it directly with the VLA. "This is one part of cosmology where there were no data, but we felt they might lie within our sensitivity," Uson recalls. Zel'dovich had proposed that soon after the Big Bang, the primordial gas broke up into vast clouds, which gradually collapsed along their shortest dimension into sheets—so-called Zel'dovich pancakes—before fragmenting into protogalaxies. In 1984, receivers sensitive to the radio wavelengths that should emanate from hydrogen clouds in the infant universe, at red shifts of 3.2 to 3.6, began to be retrofitted to the VLA. Uson and his colleagues saw their opportunity to mount a concerted search for Zel'dovich's postulated pancakes.

Over the past 3 years, they've aimed the VLA in 12 different directions; they detected their first candidate pancake this spring. As they describe it in this week's *Physical Review Letters*, the cloud is some 3 million light-years across, and it's probably still a pancake in the making. "As far as we can tell," says Uson, "it's collapsing mostly along the line of sight." From the flux of radio emissions, he and his colleagues estimate that this primordial cloud wields the mass of 100 trillion suns.

Those dimensions are close to what Zel'dovich predicted for his progenitor structures, but Peebles is skeptical about the match-up. "I believe the observation," he says, "but I'm still not convinced that it's a Zel'dovich pancake." Instead of a vast, smooth cloud of gas, he says, "I could imagine that they're seeing a collection of young galaxies, each of which has a lot of atomic hydrogen." In that case, the "cloud" could have taken shape in good bottom-up fashion, when galaxies that had formed on their own flocked together.

Even if the structure does turn out to be a true Zel'dovich pancake—a smooth sheet of gas that has not yet broken up into finer-scale structures—Silk says he still would not reconsider the top-down theory. The bottom-up scenario leaves room for a few very large-scale structures to form in the early universe, and Silk thinks the Uson group may simply have been lucky enough to catch one. He does grant, however, that "if the universe were swimming with these things, one might have to take another look at the top-down theory." That's a possibility that Uson and his colleagues mean to test, as they push on with their pancake search. ■ TIM APPENZELLER