Another pertinent numerical experiment, suggested by Jule Charney of the Massachusetts Institute of Technology, is being conducted with a general circulation model at the Goddard Institute of Space Studies (GISS). Charney has proposed that, because deserts have a higher albedo (reflect more of the sun's radiation) than does soil covered by vegetation, they induce sinking motions in the atmosphere which serve to enhance the dryness of the desert climate —in essence that deserts, once started, feed back on themselves. Thus local changes in albedo, whether of natural or man-made origin, might cause substantial local changes in climate. Charney believes that this mechanism may have particular relevance to the current drought in the southern margin of the Sahara, the Sahel, which in summer is largely isolated from global weather patterns that might otherwise contravene the effect.

There is evidence that overgrazing in arid regions can cause large increases in the surface albedo, and hence possibly trigger the onset of desert-like conditions and drought. In the GISS numerical experiment, an increase in albedo of about 0.2 was specified for the Sahel and the effects on the simulated weather patterns were noted. Preliminary results, according to Charney, include a 40 percent reduction in rainfall and cloud cover in the region, consistent with the proposed mechanism. Whether this is indeed the main cause of the Sahelian drought, as Charney suggests, will have to await further work, but the findings do serve to point out the potential importance of biogeophysical feedbacks in establishing climate.

In addition to particular applications, the models themselves are gradually being improved. Among the more important developments with general circulation models is the recent demonstration by both the GFDL and GISS groups that their models are capable of simulating seasonal changes, which are just climate changes on a short time scale. Other efforts are directed to constructing general circulation models of the oceans—a problem that is still far from resolution—which could then be coupled with the atmospheric models. Still other researchers have focused on finding better ways to model the effects of phenomena, such as cumulus clouds, which are too small to appear explicitly in a general circulation model.

The existing models, however, have a number of limitations. Foremost among these is the almost prohibitive amount of computer time required to simulate atmospheric phenomena over the time scales of interest in climate studies. The version of the GFDL model used by Shukla, for example, is global in extent and has 7140 grid points (with a spacing of about 270 kilometers between grid points) at each of 11 separate levels. With each time step of the model, new values for a variety of functions must be computed at each grid point. About 1 or 2 hours of computing is required to simulate a 24-hour day with most general circulation models, and they are thus limited with existing computers to experiments involving periods up to a few years. Smaller one- and two-dimensional models (requiring usually 1 minute or less to simulate a 24-hour day) must be used for studies of long-range climate change.

The computer-time constraints of the larger models are exacerbated by a statistical limitation recently pointed

Speaking of Science

Skunks: On the Scent of a Myth

He was crossing the road, late one night;
He didn't look left, and he didn't look right;
He didn't see the station wagon car;
The skunk got squashed, and there you are,

You've got your dead skunk in the middle of the road,
Dead skunk in the middle of the road,
Dead skunk in the middle of the road,
*Stinkin' to high heaven.**

For ages, it seems, biology textbooks have been telling us that the peculiar odor of the American striped skunk, either squashed or scared, is produced by *n*-butyl mercaptan. But like many another piece of folklore, as another song says, "It ain't necessarily so." In fact, according to Kenneth K. Anderson and David T. Bernstein of the University of New Hampshire, Durham, the striped skunk (*Mephitis mephitis*) doesn't even have *n*-butyl mercaptan. Instead, they last week told the 168th national meeting of the American Chemical Society, the main components are crotyl mercaptan, isopentyl mercaptan, and methyl crotyl disulfide, in the ratio of 4 to 4 to 3.

Anderson is a sulfur chemist with an interest in chemical ecology and communication among animals; he also has a rather puckish sense of humor. Bernstein was a graduate student with the need for a thesis topic. Together they decided that it would be interesting—and fun—to check the work of the late Thomas Bell Aldrich of Johns Hopkins University, who in 1897 first suggested that *n*-butyl mercaptan was the offending substance.

They first tried trapping the skunks themselves but, perhaps luckily, they succeeded in capturing only "a few pussycats." After it was later pointed out to them that skunks carry rabies, and not wanting to take their work home with them, they decided that it would be more discreet to obtain their raw materials from a friend who raised skunks. After that, it was simply a matter of putting the material through a gas chromatograph, obtaining a few spectra, and making some derivatives.

Their findings scarcely represent a major change in the order of things, since the only difference between *n*-butyl mercaptan and crotyl mercaptan is a double bond. But they do have a possible use. Every year, Anderson says, veterinarians and dog owners are plagued by dogs who have met a skunk from the wrong end. Now that the chemical constituents have been properly identified, he adds, it might be possible to develop a chemically sound method to de-scent them. Tomato juice, the traditional remedy, will have to move aside.

—THOMAS H. MAUGH II