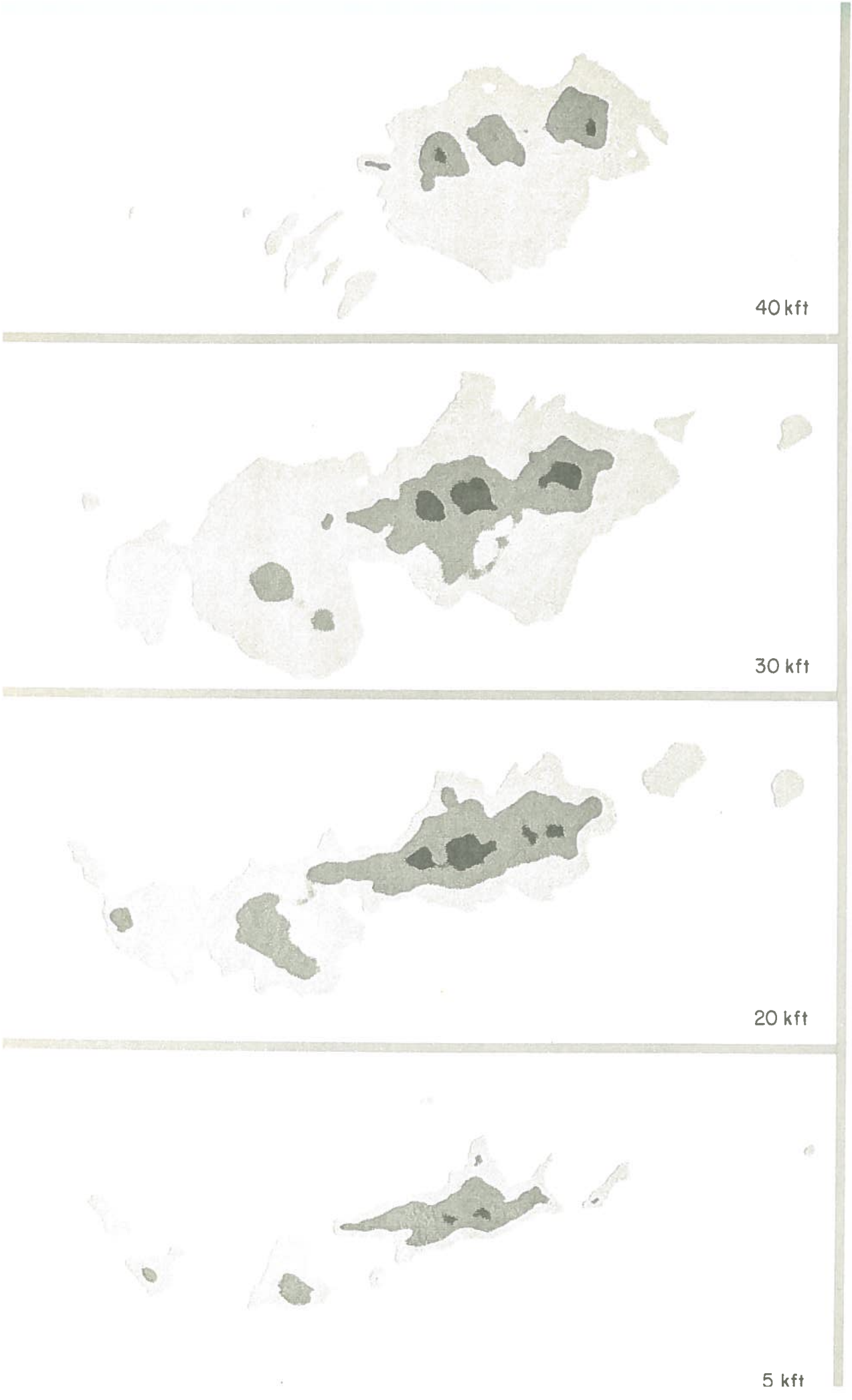

40 kft
18 JULY 1964
30 kft
2057 EST
20 kft
MONTREAL
5 kft
SCALE
0
20 NMI

The McGill Radar Weather Observatory

The Stormy Weather Group already has a weather radar that has met its requirements in many respects. Control and display equipment developed by the Group have been added to a CPS-9 weather radar, on loan from the United States Air Force since 1954. The result is a fully automated system that displays the three dimensional structure of all the rain and snow-storms that pass. It does this on sets of upper-level maps repeated every few minutes. The maps appear in real time (practically) on facsimile paper, with seven shades of grey showing the intensity of the rain or snow. The maps are also recorded on archival film, and most research is done by analyzing these maps some time after the event. Sensitivity is very good: rates of rainfall and snowfall down to 0.1 millimetres of water per hour are detected and recorded to a range of about 100 miles. Resolution is good by traditional standards, with a beamwidth of about one degree.

The CPS-9 is wearing out; our mode of operation is easy on the mechanism, but the number of hours logged has become fantastic. Messrs. Seidenfuss and Claassen (the two senior technicians who maintain the set) have become full-time specialists in geriatrics. A replacement is needed, and the technicians will be happy to change their speciality.

The one change considered vital, in going to new equipment, was to change back from the 3.2-cm wavelength of the CPS-9 to the 10-cm wavelength with which we began 25 years ago. Use of the shorter wavelength had given the CPS-9 its excellent sensitivity and good resolution, but had introduced attenuation. In the course of its passage through a storm, the beam of radiation must be reduced at least a little bit, to yield the scattered-back radar signal. But at wavelength 3.2 cm, the reduction may be by a factor 100 or 1000 or even more. This results in a distorted picture, and correction for this distortion is not quite feasible. We have gone about as far as we can go with radar records of storms that are distorted in this way.

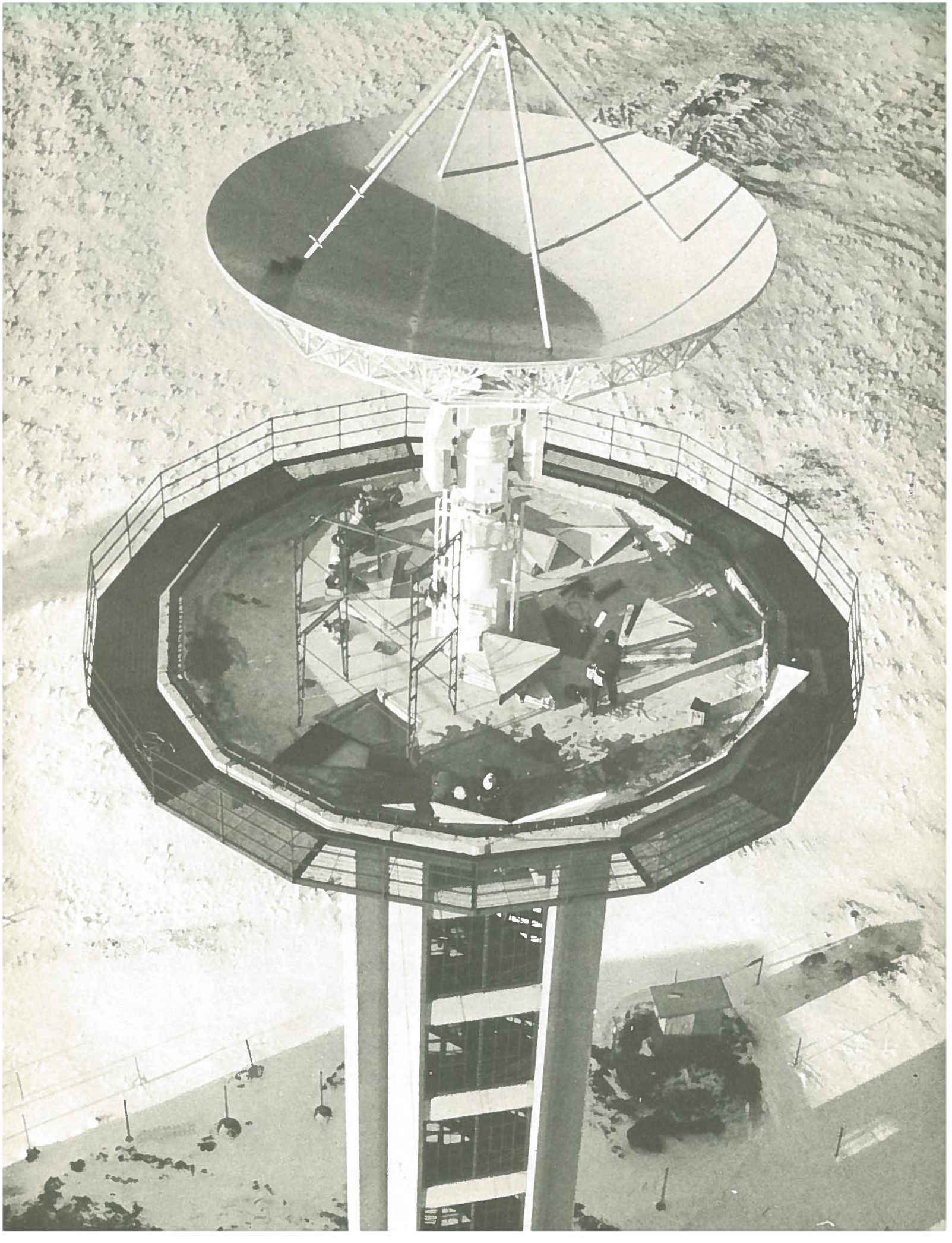
Figure opposite:
Constant Altitude Plan Position Indication (CAPPI) of a large storm north of the CPS-9 radar. Darkening shades of grey indicate rainfall rates 1.5, 25 and 400 mm h^{-1}.

The new radar has been given an antenna three times as big, in linear extent, so that the beamwidth and related resolution of the CPS-9 will be maintained while the wavelength is made three times as long. With the larger antenna and a more powerful transmitter and a more sensitive receiver, the sensitivity too will be maintained, almost. The new antenna and its drive system are better as well as bigger, and they are covered by a radome so that the regular programmed motion is not disturbed by the wind.

The new FPS-18 transmitter, again on loan from the USAF, uses large Klystron tubes in place of the more compact magnetrons of the CPS-9. This makes it fit company for the maze of microwave communication links around and about Montreal. The more sophisticated Klystron circuits allow us to become more sophisticated in our storm studies too.

The new data-processing equipment is still being developed (by us, as was that used with the CPS-9). We aspire to magnetic recording on tapes and perhaps discs or drums, in place of photographic film. (Maintenance of rapid-access film processing has been quite a trial, especially since we depend quantitatively on the grey-scale of the film.) And we hope to improve on the present facsimile writing on paper, and possibly to use television monitors at the display output. Our output must be intelligible to computers, but we are insistent on there being outputs directly meaningful to people, too.

The pedestal of the new antenna rests on a platform at the top of an 86-foot tower, so that the beam is nicely above the tree tops. The 48-foot radome is built on the same platform, with a walkway outside it that can be used for sky photography. The adjacent building has two storeys, the lower for equipment and the upper for research offices and data analysis. A word of thanks should go to the architect, Mr. George Eber. The Stormy Weather Group is grateful, also, to its own engineers, Mr. Ernest Ballantyne and Mr. Richard Fetter. Having installed the radar and made it work, they are now immersed in developing the system of data-processing.



RADAR SPECIFICATIONS

Frequency	2880 Mhz (10.4 cm wavelength)
Peak power output	1 megawatt
Pulse width	1 microsecond
Pulse repetition frequency	300 pps
Receiver sensitivity	-108 dbm
Receiver noise figure	3.5 db
Azimuth rotation time	9 sec
Elevation cycle time (0° → 21°)	216 sec

ANTENNA SPECIFICATIONS

Reflector	30-foot diameter parabolic
Gain	45 to 46 db at waveguide input
Beam width	0.8°
Side lobes	-20 to -22 db