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Summary and Conclusions

Research in the area of planned weather modification for the period reviewed represents a move away from purely statistical evaluations for seeding effects, to studies oriented toward monitoring physical processes under natural and seeded conditions. This was a primary recommendation made by in the *Weather Modification Advisory Board Report* [1978] that needs to be maintained. By so doing, it will become possible to learn more about natural cloud and precipitation processes, improve seeding hypotheses, and to provide the physical evidence to either uphold or inform against statistical evaluations.

At the time of the last review, a number of new and powerful instruments and cloud models for physically oriented experiments were just beginning to emerge. These tools were put to very good use and were the reason for much progress. However, there is still much to do. Expanded use of present and emerging instrumentation technologies is called for. The ability to forecast clouds and precipitation is not currently at the spatial and time accuracy necessary for planned weather modification. Specific modification hypotheses have evolved, but they need to be thoroughly tested, and then modified or abandoned as the findings warrant. Aircraft measurements have provided important physical evidence about in-cloud conditions, but very large uncertainties still exist in quantifying the spatial and temporal character of the cloud and precipitation particle population. Much more work needs to be done with tracers to monitor the evolution of precipitation processes from a LaGrangian frame of reference. The National Weather Service Doppler radar network, advanced satellite observations, and other measurement networks offer exciting new possibilities to answer difficult questions about natural cloud systems and how they are altered through cloud seeding.

The development of a scientifically accepted cloud seeding technology is probably several years away. However, it should be possible to convincingly establish that seeding has worked as expected in at least a few steps of the physical chain of events hypothesized in the conceptual models. This is evident in much of the research that was reviewed. Planned weather modification offers the unique opportunity to actively experiment with clouds, and in so doing, not only allow for progress toward the long-range goal of, for example, purposefully enhancing precipitation or suppressing hail, but it also allows for progress toward improving knowledge about natural cloud and precipitation processes.

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