Smoke Rings

Jim Moore served as the forecaster for the first three years of the Sierra Cooperative Pilot Project (SCPP), a Bureau of Reclamation research project headquartered in Auburn, California to determine if cloud seeding could enhance the central Sierra Nevada snowpack. He racked up an impressive series of correct forecasts during this period. He used his training and skill acquired at Florida State University to interpret the images from a new instrument available to forecasters – real-time satellite observations – which allowed him to see waves and cloud features in the atmosphere several days upstream from California over the Pacific Ocean.

The SCPP forecast office had a direct downlink and could print out infrared and visible satellite images every thirty minutes. In addition, we had a fast land-line from our project radar site positioned about thirty miles away near Lincoln, California in the Sacramento Valley. The radar images were recorded on a slow-playing tape recorder which could be replayed at a higher speed to visualize the formation and movement of precipitation patterns within a 200-mile radius of the radar.

During the early years of the SCPP we came to recognize the sequence of radar patterns preceding and following the storm fronts which marched across the Sierra Nevada. We called this series of radar images, Precipitation Echo Types (PETS), or, " *The Pet Parade*," after a similar name for the television show in the '60s called "*The Zoo Parade*." We attempted to characterize the seedability of Sierra Nevada storms by these echo types.

Jim had gotten so good at forecasting the movement and timing of storms, fronts, and echo types that he could often forecast the beginning of precipitation or the position of a feature of a storm within an accuracy of less than an hour for up to three days in the future. Part of this accuracy for the first few years was since the jet stream was generally zonal across the eastern Pacific, and storms did not deviate or change intensity much from near the latitude of Hawaii to the Sierra

Nevada. All Jim had to do was calculate the speed of the storms and track them at a constant rate until they intersected our project area.

However, in the early '80s the storms tended to track more through the Gulf of Alaska and travel southeastward into an upper-level trough near the West Coast of the U.S. These types of storms tended to be harder to forecast because they took more complicated trajectories and changed intensity. Some storms would even stall off the Coast and take several days to enter California. We called one of these storms that sat off the Coast for three days before it decided to continue its trek across the Sierra Nevada, the "Turtle."

Later in the SCPP after I had left the project to teach college, it was found that some of the Precipitation Echo Types (PETS) had more seedability than others. It was also found that the ability to forecast the timing and the short duration of the seedable types became part of the difficulty in conducting seeding operations. Unless the seeding aircraft was on continuous standby, it could not respond in time before the seedable PETS had changed to unseedable PETS. Even then, only small seeding effects were expected because most clouds in the Sierra Nevada had naturally abundant ice crystal concentrations.

On Sunday morning May 18, 1980 while Jim was in the SCPP forecast office on our day off, reviewing weather conditions during a potential flooding situation in the SCPP project area, he noticed a strange cloud formation over the southwestern portion of Washington State. A large ring of clouds about one hundred miles in diameter had formed on one of the visible satellite images. An hour later the ring was less distinct, but a plume of clouds extended eastward from the location where the ring had been earlier. This plume continued to grow larger and extend father eastward in later images that day.

We were fascinated by the ring and the plume, thinking it was some new strange cloud pattern. We were too busy with other concerns about SCPP to worry

about it at the time. However, just after lunch, we received a report from one of the project scientists that a newscaster on the noon news had announced that Mount St. Helens had suddenly erupted that morning northeast of Portland, spewing ash into the sky and sending mudslides down its sides. The top half of the mountain had been pulverized in the eruption and smoke and ash were being thrust into the stratosphere and drifting as far downwind as Pasco, Washington near the Eastern end of the State.

What we had seen on the satellite images then made sense. The initial ring of cloud surrounding Mount St. Helens was a decompression cloud caused by the explosion. This ring expanded outward rapidly from the mountain. We had seen the development of the "Smoke Ring," about mid-way through its propagation. The plume later was the ash and smoke that was lofted into the jet stream and spread downwind to the East.

The eruption at Mount St. Helens was not only an interesting atmospheric phenomenon but created a major example of how catastrophic processes of the past have occurred in geologic and biologic processes of the Northwest.

Although small in comparison to several other historic volcanic events, the mudflows from Mount St. Helens cut canyons into solid rock in a matter of minutes, laid down new laminated strata in a matter of seconds, and almost instantaneously reformed nearby Spirit Lake. The Lake was covered with over 100,000 logs ripped from the lower slopes of the mountain. All these processes occurred in a faster time frame than had ever been observed before. Dr. Steven Austin reported on the significance of these observations in his video, “Mount St. Helens: Modern Day Evidence for the World-Wide Flood.”

I didn’t know at the time when we saw the smoke rings near Portland, that this observation would form the connection between my involvement for over fifteen prior years on research in cloud physics and rainmaking, and my new field

of teaching and research on Scientific Creationism for the next thirty years. In the Summer of 1982 I left the SCPP and moved to San Diego where I taught at the ICR Graduate School and conducted research on paleoclimatology. I also worked with Dr. Austin on his field research and led tours to Grand Canyon, Mount St. Helens, and Yellowstone National Parks, illustrating how catastrophic earth processes can produce major changes over a very brief period of time that may appear to have occurred over millions of years.