

**NORTH AMERICAN WEATHER CONSULTANTS**  
**RESEARCH ORIENTED WEATHER MODIFICATION PROGRAMS AND STUDIES**  
**Partial Listing (through April 2011)**

<p><b>Project:</b>        <b>Analysis of Mountain Ridge Ice Detector Measurements in Utah During the 2009-2010 Winter Season</b></p> <p>Sponsor:        Utah Division of Water Resources</p> <p>Task:             Evaluate the occurrence and meteorological conditions associated with rime icing, to enhance ground-based seeding opportunity recognition</p> <p>Time Period:    2009-2010</p>	<p><b>Project:</b>        <b>Santa Barbara Cloud Seeding Project in Coastal Southern California: Summary of Results and Their Implications</b></p> <p>Sponsor:        Santa Barbara County Water Agency (journal article)</p> <p>Task:             Summary of Cloud Seeding Programs conducted in Santa Barbara County over a 50-year period</p> <p>Time Period:    2004-2005</p>
<p><b>Project:</b>        <b>Weather Modification Feasibility Study for the Upper Snake River Basin in Idaho</b></p> <p>Sponsor:        Idaho Water Resource Board</p> <p>Task:             Evaluate winter cloud seeding potential for portions of the Upper Snake River watershed in Idaho, and develop a preliminary seeding project design</p> <p>Time Period:    2007-2008</p>	<p><b>Project:</b>        <b>Analysis of Downwind Seeding Effects in Utah</b></p> <p>Sponsor:        In-house study (journal article)</p> <p>Task:             Investigate possible seeding effects downwind of a long-standing seeding program in central and southern Utah</p> <p>Time Period:    2002-2003</p>
<p><b>Project:</b>        <b>Weather Modification Feasibility Study for Salt River and Wyoming Ranges, Wyoming</b></p> <p>Sponsor:        Wyoming Water Development Commission</p> <p>Task:             Evaluate winter cloud seeding potential for the Salt River and Wyoming Ranges in western Wyoming, and develop a preliminary seeding project design</p> <p>Time Period:    2005-2006</p>	<p><b>Project:</b>        <b>Climatological Analysis of the Feasibility of Conducting Ground-Based Seeding Operations in the Uinta Mountains of Utah</b></p> <p>Sponsor:        Uintah and Duchesne Counties, Utah</p> <p>Task:             Analyze precipitation, wind, and temperature data to determine if/when ground-based seeding operations are practical, and potential site locations</p> <p>Time Period:    2002</p>
<p><b>Project:</b>        <b>Potential Use of Winter Cloud Seeding Programs to Augment the Flow of the Colorado River</b></p> <p>Sponsor:        Upper Colorado River Commission</p> <p>Task:             Provide a thorough discussion of various cloud seeding options and their potential to augment the flow of the Colorado River, based on the results of similar programs in the western U.S.</p> <p>Time Period:    2006</p>	<p><b>Project:</b>        <b>Climatology of Fog Events, Bingham Mine, Utah</b></p> <p>Sponsor:        Kennecott Utah Copper Corporation</p> <p>Task:             Examine winter fog events in the Bingham Canyon Mine and determine the feasibility of improving visibility during those events through seeding.</p> <p>Time Period:    1997</p>
<p><b>Project:</b>        <b>Observations of Rime Icing in the Wasatch Mountains of Utah: Implications for Winter Season Cloud Seeding</b></p> <p>Sponsor:        In-house study (journal article)</p> <p>Task:             Evaluate data from an icing sensor in the Wasatch Mountains above Salt Lake City, in order to analyze the existence and amount of supercooled water in various storm situations. The amount of supercooled water is directly related to the seedability of a given storm situation. Issues related to the transport of seeding material from ground-based sites, to the necessary in-cloud locations, were also examined.</p> <p>Time Period:    2004-2006</p>	<p><b>Project:</b>        <b>Climatological Analysis of the Feasibility of Using Ground Based Seeding Generators in West Texas</b></p> <p>Sponsor:        High Plains Underground Water Conservation District No. 1</p> <p>Task:             Analyze rawinsonde data during precipitation periods in west Texas to assess the feasibility of transport of ground released seeding material into cloud regions &lt; -5°C.</p> <p>Time Period:    1996</p>
<p><b>Project:</b>        <b>Is Air Pollution Impacting Winter Orographic Precipitation in Utah?</b></p> <p>Sponsor:        In-house study (journal article)</p> <p>Task:             Investigate possible impacts of air pollution on winter precipitation in Utah, to complement similar studies in Israel and California</p> <p>Time Period:    2004-2005</p>	<p><b>Project:</b>        <b>Summertime Cloud Seeding and SF<sub>6</sub> Tracer Tests</b></p> <p>Sponsor:        Taiwan Central Weather Bureau</p> <p>Task:             Experimental testing of both airborne and ground based seeding in Central and Southern Taiwan plus SF<sub>6</sub> tracer tests.</p> <p>Time Period:    1994</p>
	<p><b>Project:</b>        <b>Utah/NOAA Cooperative Research</b></p> <p>Sponsor:        Utah Division of Water Resources</p> <p>Task:             Participation in field data collection and data analysis of various data collected since the 1983 field season. Primary emphasis is upon the determination of the availability of supercooled liquid water for operational cloud seeding potential</p>

and the transport and diffusion of seeding material utilizing sulfur hexafluoride tracer techniques. Funding provided by the National Oceanic and Atmospheric Administration (NOAA).  
 Time Period: 1983 – 1994

**Project:** **North Dakota/NOAA Cooperative Research**  
 Sponsor: North Dakota Weather Modification Advisory Board  
 Task: Coordinate and supervise data collection tasks including radar and cloud physics and perform data analysis. An additional task has been the study of transport and diffusion of seeding material through aerial, gaseous-tracer releases and tracking, utilizing sulfur hexafluoride tracer techniques. Funding provided by the National Oceanic and Atmospheric Administration (NOAA).  
 Time Period: 1982 – 1993

**Project:** **Liquid Propane Cloud Seeding Dispenser**  
 Sponsor: Bureau of Reclamation  
 Task: Design, fabrication and testing of a prototype liquid propane cloud seeding dispenser. Prototype included a computer interface remotely controlled capability.  
 Time Period: 1989

**Project:** **Wintertime Sulfur Hexafluoride Tracer Tests**  
 Sponsor: California Department of Water Resources  
 Task: Conduct and training in sulfur hexafluoride tracer programs to depict transport and dispersion from a mountaintop liquid propane dispenser location.  
 Time Period: 1989 – 1993

**Project:** **Summertime Sulfur Hexafluoride Tracer Tests**  
 Sponsor: Taiwan Central Weather Bureau  
 Task: Surface and airborne tracking of a ground released tracer plume to ascertain the viability of using ground based silver iodide generators to effectively seed summer cumulus clouds in the Tsengwen Dam drainage area in Taiwan.  
 Time Period: 1992

**Project:** **Design, Review and Analysis of the Sierra Cooperative Pilot Project (SCPP)**  
 Sponsor: Bureau of Reclamation  
 Task: Computer model development of a real-time cloud seeding model, evaluation of an operational seeding programs effectiveness in the SCPP area, analyses of SCPP field data. SCPP was a winter weather modification research program conducted in the American River Basin of California.  
 Time Period: 1978 - 1987

**Project:** **Colorado River Augmentation Demonstration Program (CRADP)**  
 Sponsor: Bureau of Reclamation  
 Task: Meteorological data collection, atmospheric tracer studies utilizing sulfur hexafluoride, and analysis support to the CRADP a wintertime research program conducted in the Grand Mesa area of Colorado and the Mogollon Rim Area of Arizona.  
 Time Period: 1985 - 1987

**Project:** **Feather River Basin Cloud Seeding Feasibility Study**  
 Sponsor: California Department of Water Resources

Task: Feasibility and preliminary design study of a cloud seeding program in portions of the Feather River Basin in the northern Sierra Nevada of California.  
 Time Period: 1986 - 87

**Project:** **Santa Barbara - Seeding Climatology**  
 Sponsor: Santa Barbara County Water Agency  
 Task: Estimation of the winter cloud seeding potential for the period 1920-1950 in the Cachuma Lake Drainage of Santa Barbara County, California.  
 Time Period: 1987

**Project:** **Morocco Rawinsonde Installation and Training**  
 Sponsor: Bureau of Reclamation  
 Task: Install and conduct annual preventative maintenance upon Moroccan RD-65 radiosonde equipment. Train Moroccan personnel on the procedures to be used in rawinsonde operations. This included the preparation of a Field Manual. Funding provided through USAID.  
 Time Period: 1984 – 1987

**Project:** **Meteorological Services for an Airborne Tracer Study**  
 Sponsor: Desert Research Institute  
 Task: Provision and operation of an airborne real-time tracer gas (SF<sub>6</sub>) detector for detection of simulated ground based seeding plumes  
 Time Period: 1985

**Project:** **Morocco Air Traffic Control Training**  
 Sponsor: Bureau of Reclamation  
 Task: Train Moroccan personnel in controlling cloud seeding aircraft. This task included the preparation of a French training manual and personnel instruction (classroom and field). Funding provided through USAID.  
 Time Period: 1984 - 1985

**Project:** **Salt River Drought Study**  
 Sponsor: Bureau of Reclamation Arizona Salt River Project  
 Task: Re-evaluation of the Colorado River Basin Pilot Project data comparing results for different seedability criteria. Analysis of potential application of cloud seeding for the Salt River Project area during drought and design of a standby cloud seeding program.  
 Time Period: 1982

**Project:** **Experimental Seeding Tests**  
 Sponsor: National Science Foundation, University of Utah  
 Task: Compare metaldehyde and silver iodide through airborne seeding tests in supercooled stratus clouds.  
 Time Period: 1981 - 1982

**Project:** **Utah Drought Study**  
 Sponsor: Bureau of Reclamation and Utah Division of Water Resources  
 Task: Study of meteorology of drought and design of a standby cloud seeding program for the State of Utah.  
 Time Period: 1981 - 1982

**Project:** **A Design Study for a Cloud Seeding Program in Utah**  
 Sponsor: State of Utah, Division of Water Resources  
 Task: Design to upgrade an on-going operational

Time Period:	snowfall enhancement project in Utah. 1978	Time Period:	1974
<b>Project:</b>	<b>Uinta Radar Study</b>	<b>Project:</b>	<b>Downwind Effects</b>
Sponsor:	Bureau of Reclamation and Utah Division of Water Resources	Sponsor:	National Oceanic and Atmospheric Administration, Environmental Research Laboratories
Task:	Development of a Radar Climatology of winter storm structure in the Uinta Basin of Utah.	Task:	A development of methodology to detect the downwind effects of summertime cloud seeding programs in the Great Plains.
Time Period:	1977 - 1978	Time Period:	1973 - 1974
<b>Project:</b>	<b>Method for Estimating Areal Precipitation in Mountainous Areas</b>	<b>Project:</b>	<b>Twelve Basin Investigation</b>
Sponsor:	National Oceanic and Atmospheric Administration	Sponsor:	Bureau of Reclamation
Task:	Development and testing of a method for predicting the distribution of precipitation over a mountainous watershed.	Task:	Analysis of potential increases in precipitation and streamflow from winter cloud seeding over 12 major river basins of the western United States.
Time Period:	1977	Time Period:	1972 - 1973
<b>Project:</b>	<b>SCPP Radar Climatology</b>	<b>Project:</b>	<b>Regional Weather Modification Systems Evaluation in Southeast Asia</b>
Sponsor:	Bureau of Reclamation	Sponsor:	Air Force Cambridge Laboratory
Task:	Radar site surveys, data acquisition and analysis of winter storms affecting the American River Basin of the Sierra Nevada of California.	Task:	Application of cloud seeding models to a mountain pass target area under typical monsoon conditions in southeast Asia.
Time Period:	1976 - 1978	Time Period:	1972
<b>Project:</b>	<b>Analysis of Radar Data</b>	<b>Project:</b>	<b>Santa Barbara Convective Band Seeding</b>
Sponsor:	Texas Department of Water Resources	Sponsor:	Naval Weapons Center at China Lake
Task:	Analysis of digitized M-33 radar data collected in support of Project HIPLEX, a summertime weather modification research program funded by the Bureau of Reclamation and conducted in the Big Spring area of Texas.	Task:	Design, operation, and evaluation of a randomized winter research cloud seeding program conducted in Santa Barbara County, California. Both ground and airborne cloud seeding methods were tested.
Time Period:	1976 - 1978	Time Period:	1967 - 1974
<b>Project:</b>	<b>Colorado River Basin Pilot Project (CRBPP)</b>	<b>Project:</b>	<b>Downwind Effects of Santa Barbara Convective Band Seeding</b>
Sponsor:	Bureau of Reclamation	Sponsor:	Bureau of Reclamation
Task:	A comprehensive evaluation of the effects of cloud seeding in a winter weather modification research program funded by the Bureau of Reclamation and conducted in southwestern Colorado.	Task:	Study of extra area effects of seeding of the Santa Barbara Research Program. Study included field data collection and subsequent analysis of data from a large precipitation gauge network.
Time Period:	1972 - 1976	Time Period:	1968 - 1975
<b>Project:</b>	<b>Skagit River Basin Design</b>	<b>Project:</b>	<b>Large Scale Effects of Cloud Seeding</b>
Sponsor:	Seattle City Light Co.	Sponsor:	Bureau of Reclamation
Task:	A feasibility assessment and design study for a winter cloud seeding project in the Skagit River Basin in northern Washington.	Task:	Study of extra-area seeding effects from four long term winter cloud seeding projects conducted in the western United States.
Time Period:	1975	Time Period:	1966 - 1969
<b>Project:</b>	<b>South Dakota Rawinsonde Analysis</b>	<b>Project:</b>	<b>Design of a Southern Sierra Seeding Test Program</b>
Sponsor:	South Dakota Division of Weather Modification	Sponsor:	Fresno State College Foundation
Task:	A study of diurnal variation of convective cloud activity in South Dakota.	Task:	Development of a plan for testing various seeding modes in winter storms in the Sierra Nevada of California. Funding provided by the Bureau of Reclamation.
Time Period:	1975	Time Period:	1966 - 1968
<b>Project:</b>	<b>Potential Precipitation Increases</b>	<b>Project:</b>	<b>Nevada Atmospheric Research Project</b>
Sponsor:	Bureau of Reclamation	Sponsor:	Nevada State Department of Conservation and Natural Resources
Task:	An analysis of potential increases in precipitation resulting from a winter cloud seeding program in the Blue Mountains of Northeast Oregon and Southeast Washington.	Task:	Operations and evaluation of winter cloud seeding programs using a randomized crossover design.
Time Period:	1974	Time Period:	1961 - 1968
<b>Project:</b>	<b>Seeding Area of Effect</b>	<b>Project:</b>	<b>Design for an Atmospheric Water Resources Research Experiment in the Hungry Horse</b>
Sponsor:	Sacramento Municipal Utility District (SMUD)		
Task:	A computerized evaluation of the areas of effect from an existing ground generator network utilized in a winter cloud seeding program conducted in the American River Basin of California.		

**Area of Western Montana**

Sponsor: Bureau of Reclamation  
Task: Development of a design for the initiation and operation of a winter cloud seeding experiment in Montana.  
Time Period: 1966

**Project: Special Satellite Cloud Photograph Catalog**  
Sponsor: US Navy Weather Research Facility  
Task: Comparison of Tiros cloud television photographs with conventional meteorological analysis.  
Time Period: 1963 - 1964

**Project: Mesoscale Analysis of Existing Meteorological Network Data**  
Sponsor: US Weather Bureau  
Task: Investigate means of adapting existing airways and synoptic data to mesoscale analysis.  
Time Period: 1962

**Project: Investigation of Cloud-Water Budget of Pacific Storms**  
Sponsor: National Science Foundation  
Task: A mesoscale analysis of Pacific storms.  
Time Period: 1962