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THE VARIABILITY OF CLOUD CONDENSATION NUCLEI AND CLOUD DROPLET POPULATIONS IN CONVECTIVE CLOUDS OVER THE HIGH PLAINS: HOW OFTEN ARE CONTINENTAL CLOUDS CONTINENTAL?

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Abstract. Observations and cloud microphysical modelling suggest that hygroscopic cloud seeding can be used to enhance precipitation from continental convective clouds. Model simulations demonstrate that the effect of such treatment varies with cloud microphysical characteristics. Significant enhancement is predicted for clouds with continental cloud droplet spectra, i.e. droplet concentrations on the order of 1000 cm^{-3} . The effect on maritime clouds with droplet concentrations of the order of a few 100 s cm^{-3} or less is predicted to be much smaller. A survey of past studies of aerosols is presented along with a newly-assembled collection of observations of convective cloud droplet concentrations over the High Plains of North America. It is shown that while a majority of clouds are indeed microphysically continental, a significant fraction of clouds in this region have microphysical characteristics that are maritime or intermediate between maritime and truly continental. Practitioners of hygroscopic seeding in this region need to monitor aerosol and cloud characteristics and target microphysically continental clouds if they want to optimize the effects of their seeding. Furthermore, indiscriminant hygroscopic seeding of clouds or an evaluation of results without regard to the maritime or continental character of the target and control clouds could lead to inconclusive and/or spurious results.

REPLY TO A PAPER ENTITLED "REEXAMINATION OF HISTORICAL REGRESSION ANALYSIS APPLIED TO A RECENT IDAHO CLOUD SEEDING PROJECT"

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No Abstract Available

THE SOUTHERN OGALLALA AQUIFER RAINFALL (SOAR) PROGRAM – A NEW PRECIPITATION ENHANCEMENT PROGRAM IN WEST TEXAS AND SOUTHEASTERN NEW MEXICO

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Abstract. The Sandy Land Underground Water Conservation District, South Plains Underground Water Conservation District, and the Llano Estacado Underground Water Conservation District have participated with the High Plains Underground Water Conservation District #1 for a number of years in their precipitation enhancement program. Convinced from past assessments that precipitation enhancement is a potential water management tool, the three boards decided that a program beginning in 2002, apart from the High Plains would be beneficial. The Texas Department of Licensing and Regulation (TDLR) issued a permit on January 31, 2002 authorizing a weather modification program to conduct rainfall enhancement in Yoakum, Terry and Gaines County. Additionally, with the cooperation of the State of New Mexico, an area west of Gaines and Yoakum Counties is included in the target area. This precipitation enhancement program was named Southern Ogallala Aquifer Rainfall (SOAR) program. This document presents a brief summary of the SOAR 2003 annual report detailing an effort to systematically characterize the clouds, precipitation and the seeding effectiveness of the SOAR program. Independent evaluations show average rainfall increases of 68% and 52% in favor of a seeded cloud when compared to a matching control cloud. This results in an average estimated benefit/cost ratio of 235/1.

CLOUD SEEDING EXPERIMENTS ON WARM CLOUDS IN PAKISTAN

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Abstract. Cloud seeding experiments were conducted on warm clouds in Pakistan during the year 2000. This was the first full-fledged experimental activity taken up in Pakistan to augment precipitation through the cloud modification programme. The activity emerged as a consequence of the history's worst drought in provinces in the southern half of the country in 1999-2000. Government of Pakistan immediately felt the need of combating this most crucial catastrophe and thought of taking up the project of artificial rainfall in the country particularly in the drought vulnerable areas. This paper will attempt to give a summary of the methodology adopted in the cloud

modification experiments and the synoptic conditions under which the experiments were performed. What really was achieved out of these experiments, what were the limitations and problems and what should be the future strategies to improve the quality of such a work are the discussions contained in this study.

ICE NUCLEATING BEHAVIOUR OF AQUEOUS AND ALCOHOLIC SOLUTION OF PHLOROGLUCINOL: A LABORATORY STUDY

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Abstract: The behaviour of ice nucleation at different temperatures has been studied in case of seeding with aqueous solution and alcoholic solution of Phloroglucinol. For aqueous solution, the nucleation has been studied starting from -17.90°C and it was observed to terminate at -0.50°C . In case of alcoholic solution, the study has been started from -22.30°C and it was found to continue up to -3.50°C . The higher temperature is a cut-off temperature, but at the lower temperature end the nucleation becomes quite small, though not amounting to zero. However the peak in crystallization occurs at -13.00°C in the case of aqueous solution and the corresponding peak occurs at -17.80°C in the case of alcoholic solution. Apparently both these temperatures are close to the freezing temperature of the mixture. Besides, dendrite structure is observed in both the cases in the temperature range of -200°C to -170°C . However, hexagonal crystals have only been observed in case of aqueous solution in the temperature range of -15.0°C to -10.0°C . Cubic crystals exist dominantly in case of alcoholic solution, but rod shape crystals dominate in case of aqueous solution.

ON THE CONTRASTIVE NATURE OF WEATHER MODIFICATION KNOWLEDGE: COMMONSENSE REASONING AND COMMONSENSE KNOWLEDGE

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Abstract. Weather Modification specialists constantly face a difficult problem in their operation and research tasks. The explanation of events on the basis of data is neither completely deductive nor completely inductive. The reason is clear since it is very difficult to isolate the weather objects from their environment and their complex interactions; therefore any attempt of methodological isolation tends to destroy vital elements of their dynamics. Here I present a discussion about the role abductive inference plays in applied weather modification knowledge due to its contrastive nature, and how these general considerations are applied in Texas.

THE WEATHER MODIFICATION ASSOCIATION'S RESPONSE TO THE NATIONAL RESEARCH COUNCIL'S REPORT TITLED, "CRITICAL ISSUES IN WEATHER MODIFICATION RESEARCH" Report of a Review Panel

Panel Members: Bruce Boe, George Bomar, William R. Cotton, Byron L. Marler, Harold D. Orville (Chair), and Joseph A. Warburton

January 2004

Preface: Last fall the National Research Council of the National Academy of Sciences published a report entitled, "Critical Issues in Weather Modification Research". One of their conclusions was that "there is still no convincing scientific proof of the efficacy of international weather modification efforts. In some instances there are strong indications of induced changes, but this evidence has not been subject to tests of significance and reproducibility." The report was very disappointing, with little support for operational cloud seeding. It showed little support for hail suppression and it was extremely short on its review of winter orographic cloud seeding. At the WMA semi-annual executive board meeting held in Reno, Nevada on October 17, 2003, there was a lively discussion about the report but little detail was known. It was concluded that the WMA needed to respond to the report and its conclusions. The board voted to charge Rick Stone, its president, with forming an ad-hoc committee to review the report and develop a statement reflecting the WMA position on the report. This was done in early November, with Bruce Boe, George Bomar, William Cotton, Byron Marler, Harold Orville and Joe Warburton being appointed as members. The committee solicited input from all members of the WMA before its meeting in early December in Fort Collins. The first draft was distributed to all members and further input invited. The committee received numerous comments and many additions and changes were made. The final report was completed in early February. A press release was issued in March. This WMA report is intended to provide an informed review to the membership and to the public and is now published on the WMA web page (www.weathermodification.org) as well as being published in this current WMA Journal. In addition the report has been sent to various political leaders, policy makers, and scientists in the U.S. and abroad. Harold Orville (Committee Chair)

PROCEEDINGS OF THE JEMEZ Y SANGRE WATER PLANNING COUNCIL CLOUD SEEDING WORKSHOP

Sigmund Silber
Chair of the Council's New and Expanded Water Technologies Committee

Abstract. A description of the workshop including a summary of each presentation, panel discussion and breakout session. The workshop provided information to a wide variety of attendees who included both potential beneficiaries of cloud seeding and decision makers. Results of cloud seeding projects were presented and the issues related to assessment were discussed. Speakers and attendees addressed the question of how to view cloud seeding in the context of the recent NRC Report. A conclusion was reached to pursue a cloud seeding operational test and organizational structures were created to carry the project forward.

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