

Numerical Simulations of Snowpack Augmentation for Drought Mitigation Studies in the Colorado Rocky Mountains

Summary of Project Kickoff Meeting CSU ACRC – Riehl Conference Room October 22, 2003

List of Attendees

| | | | |
|-----------------|------------|--------------|--|
| Joe Busto | CWCB | 303-866-4807 | joe.busto@state.co.us |
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| Becky Dechant | DWD | 303-628-6538 | BeckyDechant@DenverWater.org |
| Bill Cotton | CSU | 970-491-8593 | cotton@atmos.colostate.edu |
| Brenda Thompson | CSU | 970-491-8593 | brenda@atmos.colostate.edu |
| Paul Mielke | CSU | 970-491-6465 | mielke@stat.colostate.edu |
| Ray McAuelly | CSU | 970-491-8341 | raymc@atmos.colostate.edu |
| Gustavo Carrio | CSU | 970-491-8500 | carrio@atmos.colostate.edu |

Project Status and Payments

Status of WDMP Grant from the U.S. Bureau of Reclamation to CWCB: signed

Status of CWCB-CSU IGA/SOW: Agreed to by Joe Busto and CSU Team – in final processing at the CWCB

Payments against Grant funds: Reclamation will make monthly payments for the work that has been completed – CSU will prepare monthly invoices for deliverables completed as listed in the SOW, and email this information to Joe Busto/CWCB and Curt Hartzell/project coordinator. These monthly invoices from CSU will be reviewed asap and forwarded to Reclamation for payment.

Clarifications and Action Items by Task

Task 1 – *Set up RAMS over the Denver Water Department operational cloud seeding areas and over the locations of the ground-based generators.*

Ray basically has the RAMS set up for the project area; he has expanded it slightly from the 240x240 km grid proposed. In addition to the grids, the required figure will include topography that is easy to visualize, WWC ice-nuclei generator sites, NRCS Snotel & snowcourse sites, ski area precipitation gauge sites, NWS precipitation measurement sites (gauge and cooperative observer), and any other precipitation observation sites located within or surrounding the project's target area for operational seeding.

Action - Ray will prepare a list of observation sites that he has and email it out to the project participants for review.

Action - Larry will contact the ski areas in central Colorado and Climax Mine and request copies of observations they make during the 2003-2004 winter season. These data will be sent to Ray at CSU for use in project evaluations.

Action - Ray will coordinate with Ross, who will prepare the topographic background for the project figure (deliverable 1).

Action - Ross will prepare a list of latitude and longitude points that approximate the project's target area, and email it to Ray for use in the project figure (deliverable 1) and with RAMS products on the CSU Web site.

Task 2 – *Implement algorithms simulating cloud seeding generators as sources of IFN at specified ground-based sites.*

Gustavo stated that he is basically done with the algorithms in RAMS that will be used on this project for simulating cloud seeding. Larry has already provided CSU with the WWC generator locations, range of seeding rates, and WWC generator output calibration curve of activity (effectiveness-temperature).

Action - Gustavo will run a test case using these algorithms in RAMS (probably February 4, 2003). Larry will provide any additional data needed to run this test case. Results will be provided to Joe, Curt and others as additional evidence of the completion of deliverable 2.

Task 3 – *Perform simulations of Lagrangian transport of seeding materials on selected days covering a range of wind and stability regimes.*

Action - Decisions need to be made on the data and observations sites that are needed for drawing conclusions and making evaluations as proposed. The data collected, quality controlled, and archived for project use apply to not only Task 3, but also to Tasks 4 and 5. Everyone on the project team involved with these tasks should provide recommendations on the data that need to be collected.

Action - Ray will develop the methodology for collecting, quality controlling, and archiving the data to fulfill the requirement of Solicitation Section B.2.2, "Data taken during the investigation and used in drawing conclusions and making evaluations shall be contained in a Data Appendix to the final report." It was agreed at the meeting that this data appendix should be provided on a CD submitted with the final report. The data should be archived in near real time and available for viewing by project participants. Perhaps there could be an initial data file and a second quality controlled data file that will be subsequently used in the evaluations.

Action - Ray will contact the NRCS to find out when their final quality controlled Snotel data will be available. The Snotel data that will be used in the evaluations are the daily accumulations from the precipitation storage gauges that are recorded around midnight local time. The NRCS final data and corresponding real-time Snotel accumulations quality controlled by experienced project staff should be compared before selecting which set to use.

The Lagrangian analyses will be for selected days and selected generator sites for various observed wind and stability regimes during operational cloud seeding periods. The text on page II-4 of the proposal that implies that such analyses will be done “for each forecast period” is incorrect; the correct text is stated near the top of page II-13. The Grant funding does not allow for Lagrangian analyses to be performed on each forecast period during which operational cloud seeding was done.

Task 4 – *Perform forecasts for seeded and non-seeded days.*

Action - Ray stated that the automatic RAMS forecast runs for the project should start on November 1, 2003. Model output from these non-seed precipitation forecasts runs will be posted on the CSU Web site, as stated at the bottom of page II-17 in the proposal.

The text in the proposal on page II-21, paragraph 1, states that the estimated precipitation will be automatically “emailed” to WWC; this is incorrect. CSU will send emails to WWC ONLY if RAMS does not receive the 00Z data for the non-seed run or if RAMS has a problem. The RAMS will provide precipitation estimates to 0.01” resolution for comparison with observed precipitation.

Action - Shortly after the end of each calendar month during the DWD 2003-2004 winter-season operational cloud seeding program, WWC will email a list containing all generator operation information (dates, times, rates by site) to the CWCB, CSU and Curt/project coordinator. It is understood that these monthly lists could include some estimates due to generator operators not submitting their operations logs to WWC in a timely manner. Larry is encouraged to inform the generator operators for the DWD program of the importance of submitting timely and accurate seeding logs.

Action - The RAMS seed runs will be made by Ray after the WWC monthly seeding information has been received. The precipitations estimates from the second seed run will be archived for comparison with the estimates from the first non-seed forecast run, and observations from Snotel and Gauge measurement sites.

It is likely that two different 24-hour comparisons will be required, one corresponding to about 06-08Z (around midnight for Snotel and NWS gauge sites) and the second about 12-14Z (morning when coop observers and ski areas make their observations). The difference in observation times is important for 24-hour comparisons; however, comparisons will also be made for monthly and seasonal totals.

Changes in deliverables for Task 4:

Deliverable 4.2 – The requirement to “automatically email estimated precipitation accumulations” needs to be eliminated. Therefore, text should be changed to, “Operational CSU RAMS Web site containing the full suite of products needed for input to Western Weather Consultants’ operational cloud seeding decision making, and for the proposed research studies.”

Deliverable 4.3 – Change “Automatically” to “Manually.” This pertains to developing the procedure to archive the generator operations (including estimates) provided by WWC and later updating the list when estimates are replaced with reported information.

Task 5 - *Perform evaluations of model predictions of precipitation using MRBP.*

Paul distributed some relevant handouts, and stated his conviction based on past statistical analyses that winter-season orographic cloud seeding works. He also stated that the “identified month” stated in the proposal for the MRBP analysis does NOT have to be a calendar month or 30-consecutive days. The “month” really relates to 30 days, which can be made up of selected storm periods, i.e., there can be breaks in the data record. The 30-day limit in the proposal was required due to funding limitations.

Action – Gustavo, Ray, Paul, Larry (and others if they want to provide input) should collaborate on the selection of precipitation data sites that should be “free” from all seeding operations/effects in Colorado. A restriction in the selection of these “free from seeding” sites is that they must be located at least 10 km in from the boundary of the RAMS 3-km grid specified in Task 1. The same project personnel should also collaborate on the selection of precipitation sites expected to be within the coverage of seeded plumes. These precipitation site selections should probably be made near the beginning of the research project, i.e., during November 2003.

Clarification for Deliverable 5.1 – The updated MRBP analysis code with documentation should be provided on a CD. Also, the “selection of the month” represents 30 days with precipitation events that do not have to be consecutive.

Task 6 – *Research study supervision and reports.*

Deliverable 6.2 requires the participation in a midterm project meeting. Solicitation Section B.2.3 states that this meeting should be held “approximately three to six months after the initiation of the project,” which will be around November 1, 2003. Two periods were suggested for this meeting: either around mid-January 2004 about one week before the AMS Annual Meeting; or around mid-February after the AMS Annual meeting.

Action – Brenda will find out and inform the project team of the exact dates for the AMS Annual Meeting; Curt will check with Reclamation staff to determine their preference and if they have conflicts; and all project participants should email Joe and Curt if they have any conflicts around these two periods.

Action - The CSU Team should prepare their draft first-quarterly project report and email it to Joe and Curt around mid-January 2004 before the start of the AMS Annual Meeting.

Action – Joe will initiate conference calls around mid-November and mid-December 2003 for the project team to discuss progress on action items, any problems, and future plans.