



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Partitioning the Causative Factors of Evapo-sublimation

Focus Categories: CP, G&G, SW, WS

Keywords: 18, 80, 88, 116, 151, 223

Duration: The work will begin as soon as the grant is awarded and will conclude by 31 December 1999, at which time it will be reported in the appropriate outlets.

FY 1999 Federal Funds: \$10,000

FY 1999 non-Federal Funds: \$20,157

Principal Investigators' Names and University: Charles C. Avery and Leland R. Dexter, Northern Arizona University

Congressional District of the University Where the Research is to be Conducted: Districts 3 & 6

Statement of Critical Regional or State Water Problems

It has been demonstrated that sixty to seventy-five percent of the useable water resources for the western states originate as snowfall. Considering surface water supplies only, this figure is probably valid for Arizona. Direct melting of the snow upon contact with the ground is very rare and the accumulated water commonly sits for some length of time as snowcover prior to melt. While the water sits as snowcover, it is exposed to vapor loss through a number of relatively poorly described and poorly quantified pathways. We refer to the combination of all of these vapor losses as evapo-sublimation abstractions. Figure illustrates a number of these pathways:

Field studies we have conducted previously in northern Arizona suggest 1.5 mm of snow water equivalent are lost during an average clear winter day with light breezes from a planar continuous snowcover. Accumulated over a winter season with a large proportion of clear days, the amount of potential loss can represent a substantial portion of the snowpack. This loss can substantially reduce the accumulated water resources. Current water resource forecasting neglects the variability inherent in these ablation-side abstractions and runoff forecasting depends on current conditions as measured in the field. Consequently the ratio of snowfall to runoff is meaningless. Those who maintain snowmelt and run-off models and issue run-off forecasts will benefit from a better understanding of these physical relationships.

Statement of Results or Benefits

The results of this work will include a better methodology for examining evapo-sublimation processes in a controlled, laboratory setting. In addition, the work will result in data and analysis that will begin to quantify the relationships involved in this poorly understood process. Beneficiaries include not only those responsible for current modeling and forecasts, but all those who rely on them in making decisions regarding management of surface water supplies, including water utilities, farmers, ranchers, and wildlife managers.

Nature, Scope, and Objectives of the Research

We have designed and constructed a cold-chamber based "sublimimeter" for analysis of evapo-sublimation in a controlled setting. Initial testing of the chamber revealed some design flaws; the chamber has been re-designed and the problems appear to have been resolved. This experimental design and analysis will allow us to explicitly separate (partition) critical evapo-sublimation variables, identify specific sub-problems for future analysis and construct better physically based models of e-s.