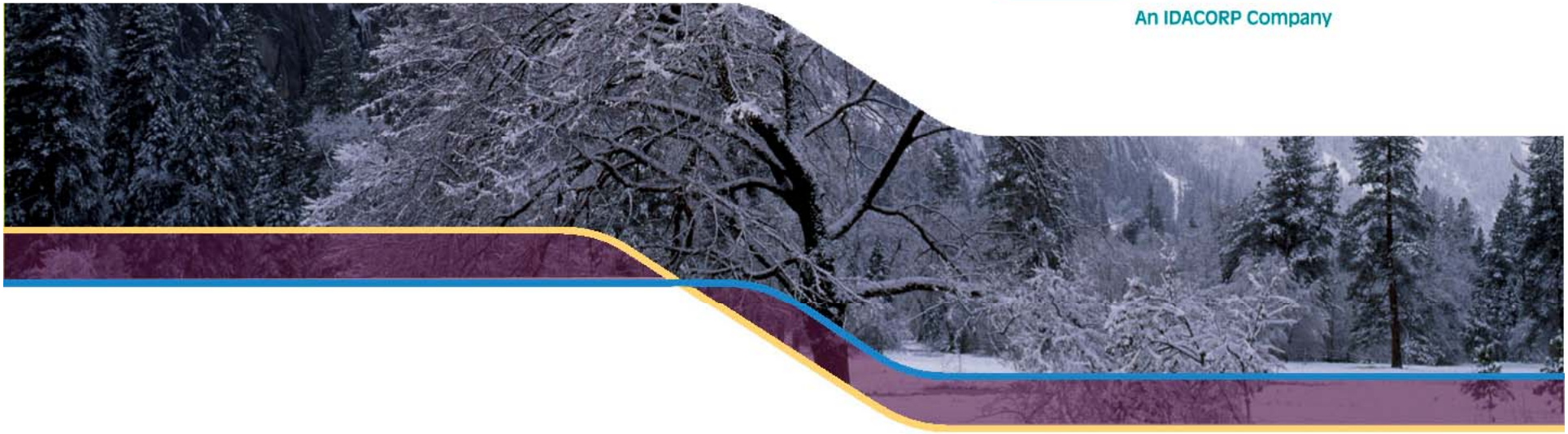


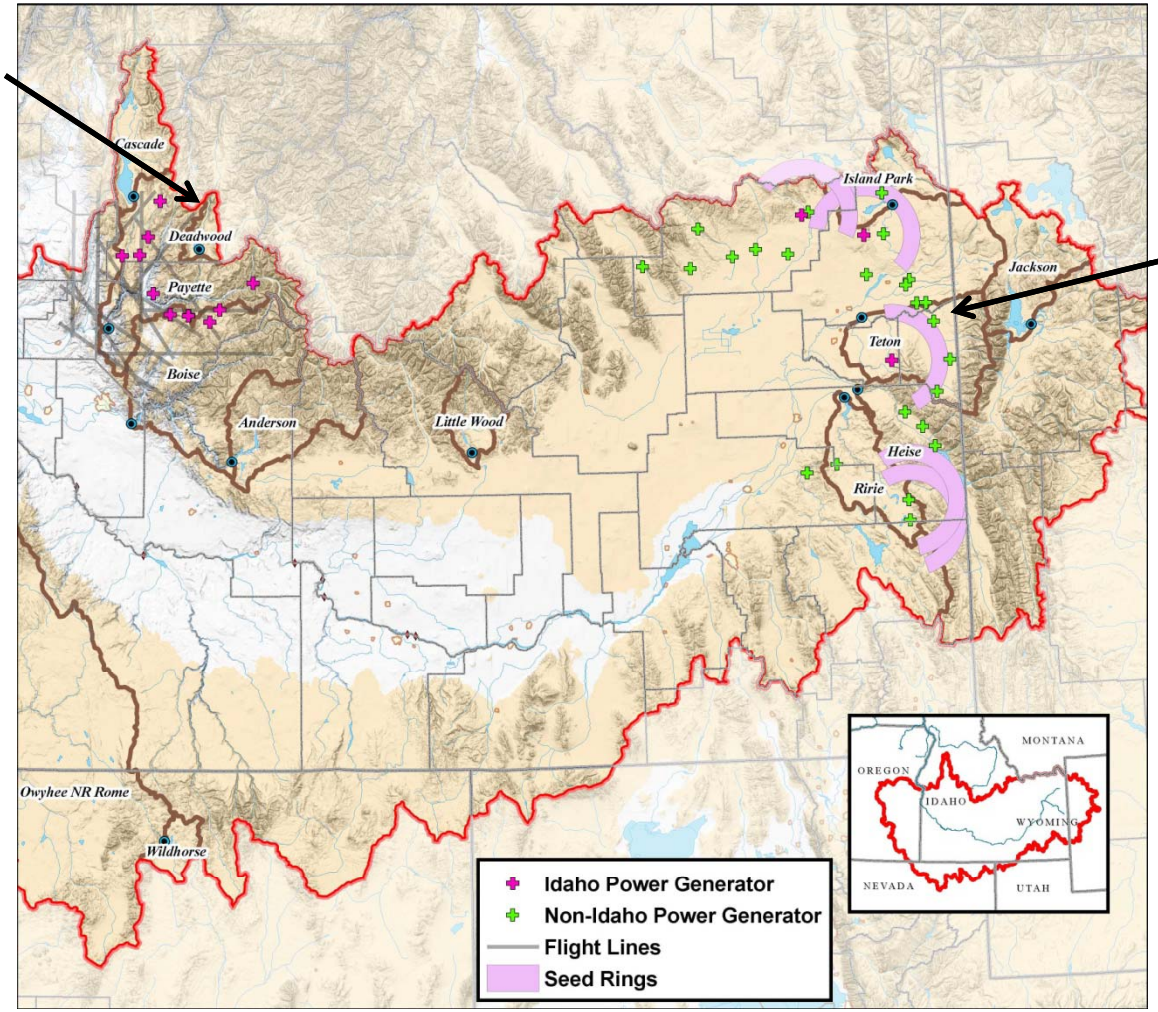
Idaho Power Company's 2009 Cloud Seeding Program Summary

Kevin Wade

Meteorological Information Systems Specialist

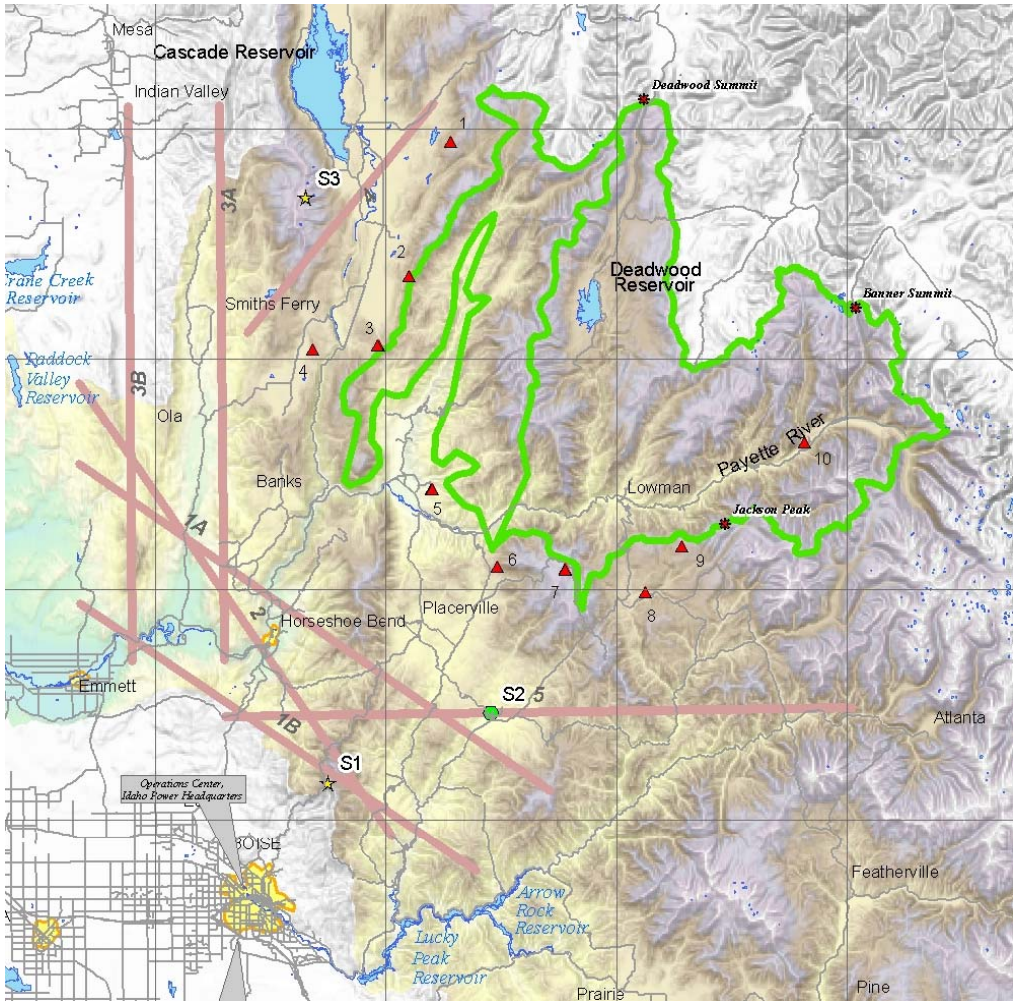
Idaho Power's Cloud Seeding Projects

Payette



Upper Snake
in cooperation with
E. Idaho HCRC&D

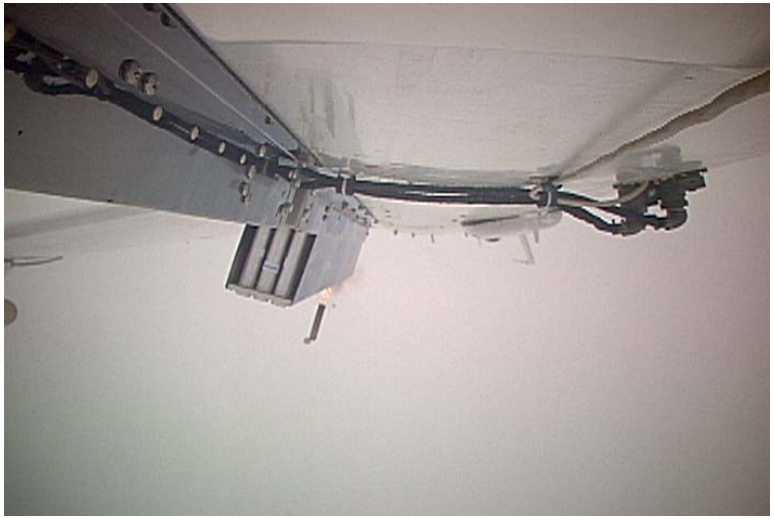
Payette Project
Airborne and Ground-based Seeding



- Seeding intended to enhance snowpack at the higher elevations above 4500’
- Target area ~ 938 sq. miles
- ~ 497 mi^2 above the 6000’ level
- 10 remote ground generators
  - private property
- Combined approach provides more opportunities for addressing storms.

Ground-based Generators

Beech King Air C90
Airborne Seeding Equipment



Payette
Operations Summary

Water Year	WY % Normal*	% TC** Benefit	Silver Iodide (grams)			Hours		Status
			Total	Air	Ground	Air	Ground	
2003	93%	16	33558	23270	10288	15.4	515	start-up (Feb-April)
2004	74%	5	21485	2803	18682	11.9	930	assessment
2005	65%	7***	27301	11122	16179	50.5	810	assessment
2006	136%	15	113173	97710	15463	48.5	768	operational
2007	56%	10	106082	76980	29102	51.3	1351	operational
2008	105%	16	61147	38740	22407	29.4	1123	operational
2009	107%****	15	50274	26110	24164	17.1	1208	operational

* Unregulated Payette Flow calculated at Horseshoe Bend

** TC = Target Control

*** DRI Trace chemistry average benefit

**** Estimated July 2009 runoff

Payette Benefit Summary

Benefits estimate using:

- USBR regression equation for Payette at Horseshoe Bend
  - Using current 2008 conditions (near normal)
- Precipitation increase of 10% from cloud seeding
- Results in approximately 100 KAF of additional Mar – Jul runoff

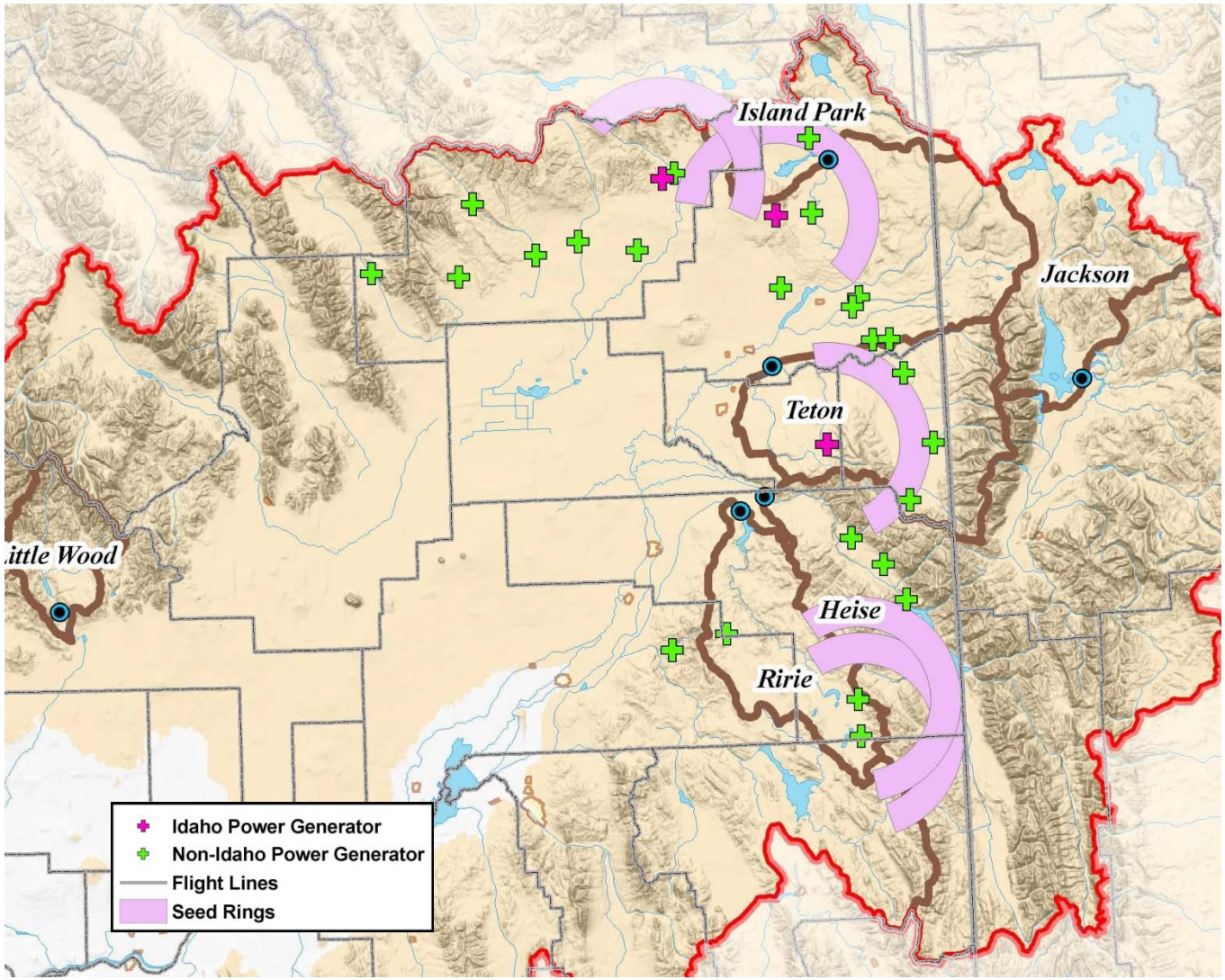
Estimated cost of additional water ≈ $8 / acre-foot

Upper Snake
Cloud Seeding Program

Water Year 2009:

- Placed 3 remote generators to augment the manual network run by the RC&D
  - IPC Operated and Maintained these units
- Provided Meteorology Support for the HFT project.
- Operated a Radiometer in Ashton, Id
- Provided a Rawinsonde and contracted and operator in Wilford, Id

Upper Snake Operations Area



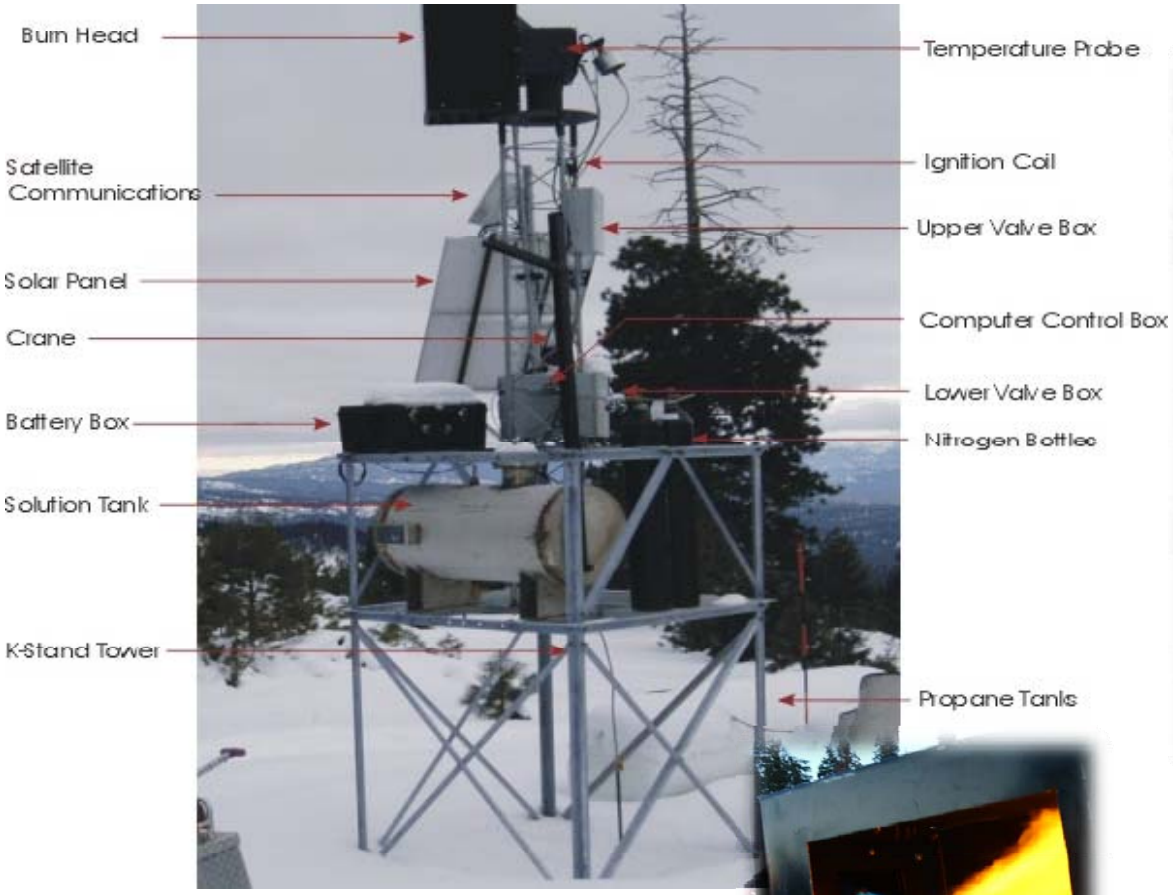
Upper Snake Generator Locations

Kirkham Hollow

Kilgore

Antelope Flat

Generator Types



IPC Remote Cloud Seeding Generator

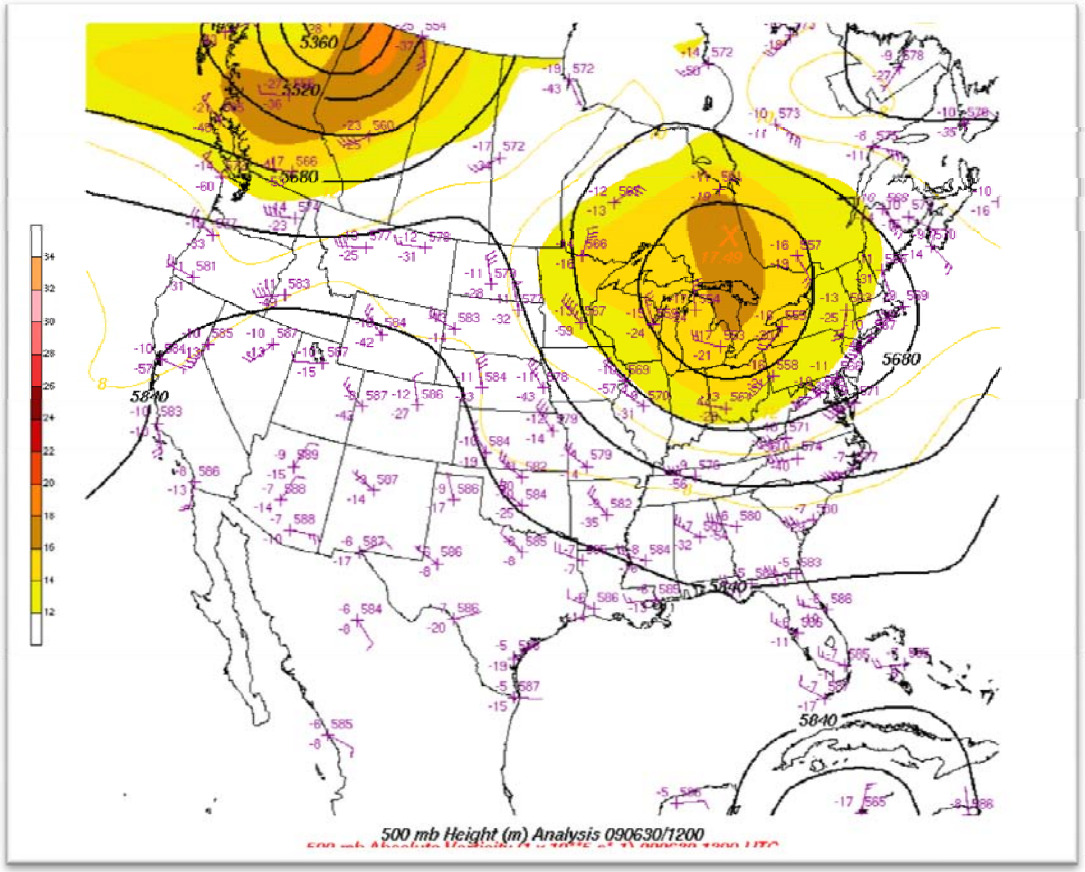
Manual Cloud Seeding Generator

Upper Snake Operations Summary

IPC Upper Snake 3 Remote Generators Ground Generator Usage for 2008-2009			
Month	**Total Hours**	**Total Silver Iodide (grams)**	**Weather Balloons (Sondes)**
2008-12	82.5	1,649	0
2009-01	56.9	1,138	10
2009-02	42.3	846	12
2009-03	137.2	2,743	15
2009-04	51.1	1,021	5
Totals	**369.9**	**7,398**	**42**

Meteorology Support

- 24/7 project support by 3 experienced cloud seeding meteorologists
- IPC generators are operated remotely from Boise
- Use public data and IPC Radiometer, Rawinsondes and Weather Stations.
- The meteorologist use this weather data to determine which generators to turn on and off to seed most effectively.



Radiometrics M3000A

Microwave Radiometer

- Radiometers measure the power radiated by the atmosphere at different wave lengths. They are passive, receive-only instruments, meaning they emit no radiation themselves.
- The wave length of the radiation identifies the source of the emission resulting in a atmospheric profile:
  - Temperature
  - Relative Humidity
  - Liquid Water

IPC's

Figure 1. MP-3000A Hyper-Spectral Temperature, Humidity and Liquid Water Profiler.

Radiometer Data

- Real time atmospheric profiling by elevation:
  - Temperature
  - Relative Humidity
  - Liquid Water
  - Vapor Density

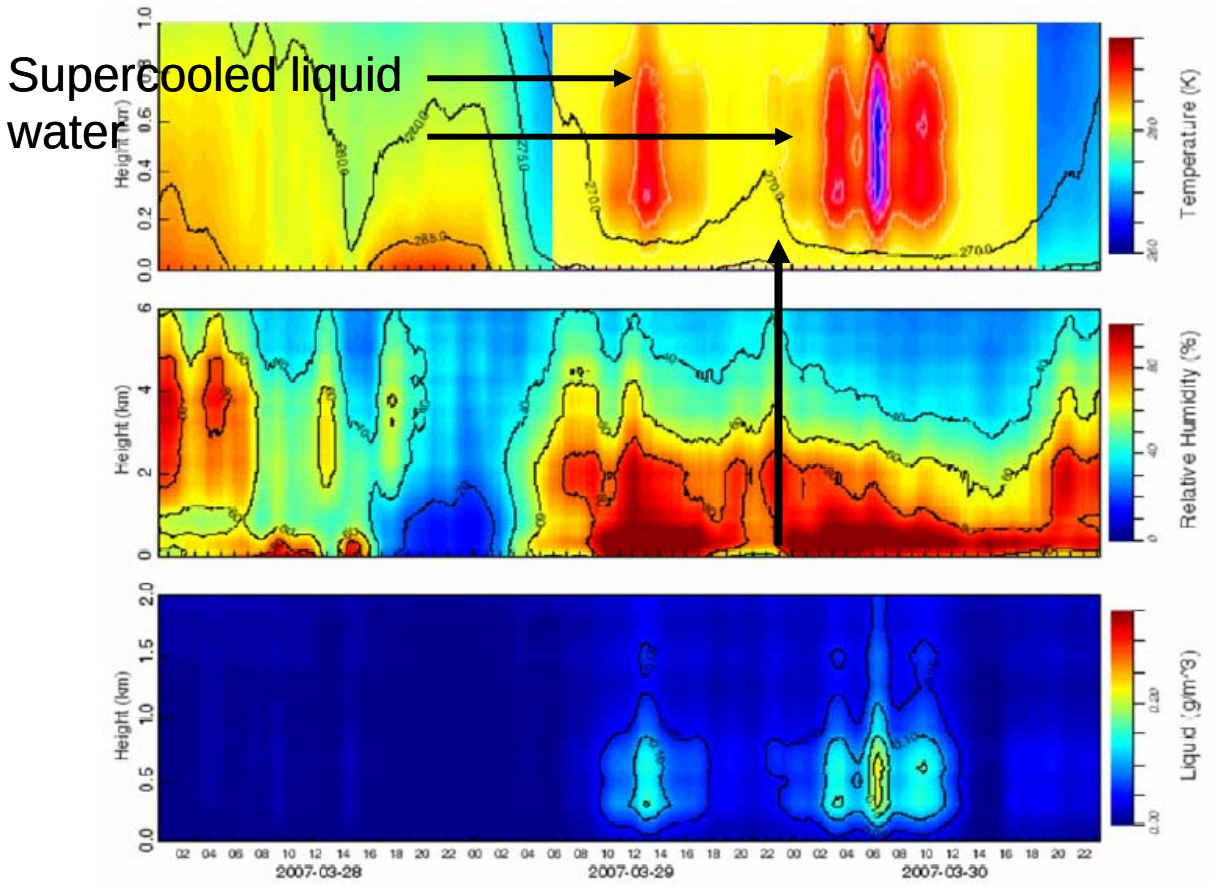
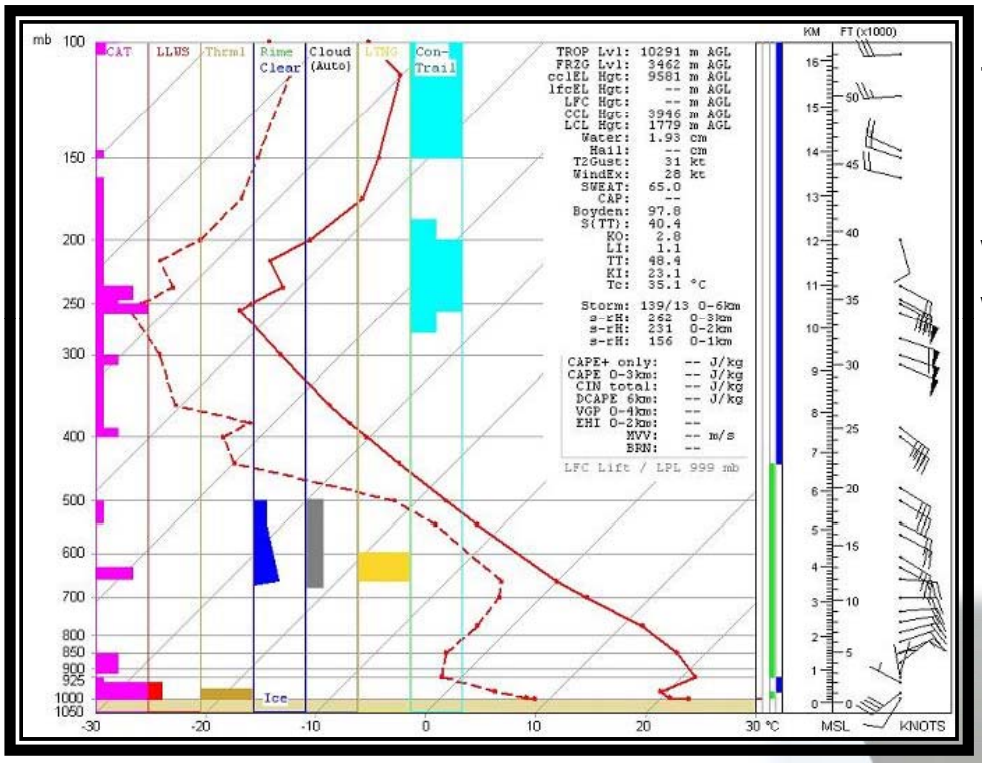


Image courtesy of Radiometrics

Rawinsonde



Temperature
Relative Humidity
Pressure
Wind Direction
Wind Speed

Up to 60,000’

2010 Objectives

- Redesign remote generators summer 2009
  - Less Maintenance
  - Safety
  - Faster and easier to deploy
  - More cost effective
  - New generators will replace current units in the Payette
- Add 7 to the Upper Snake for a total of 10 remotes
  - IPC and RC&D are working on the locations.
- Continued meteorology support
  - Rawinsonde

Monitoring & Evaluation

- Traditional Target Control Analysis
  - Statistical comparison of precipitation (seeded versus non-seeded areas)
- Trace Chemistry Analysis
  - Snow chemistry sampling
- Cloud Physics Analysis
  - Sampling clouds at altitude
- Stream Flow Analysis
  - Statistical comparison of runoff (seeded versus non-seeded areas)
- Stream Flow Modeling
  - Using a flow simulation model account for runoff