

# Slope Flows and Cold Air Pools

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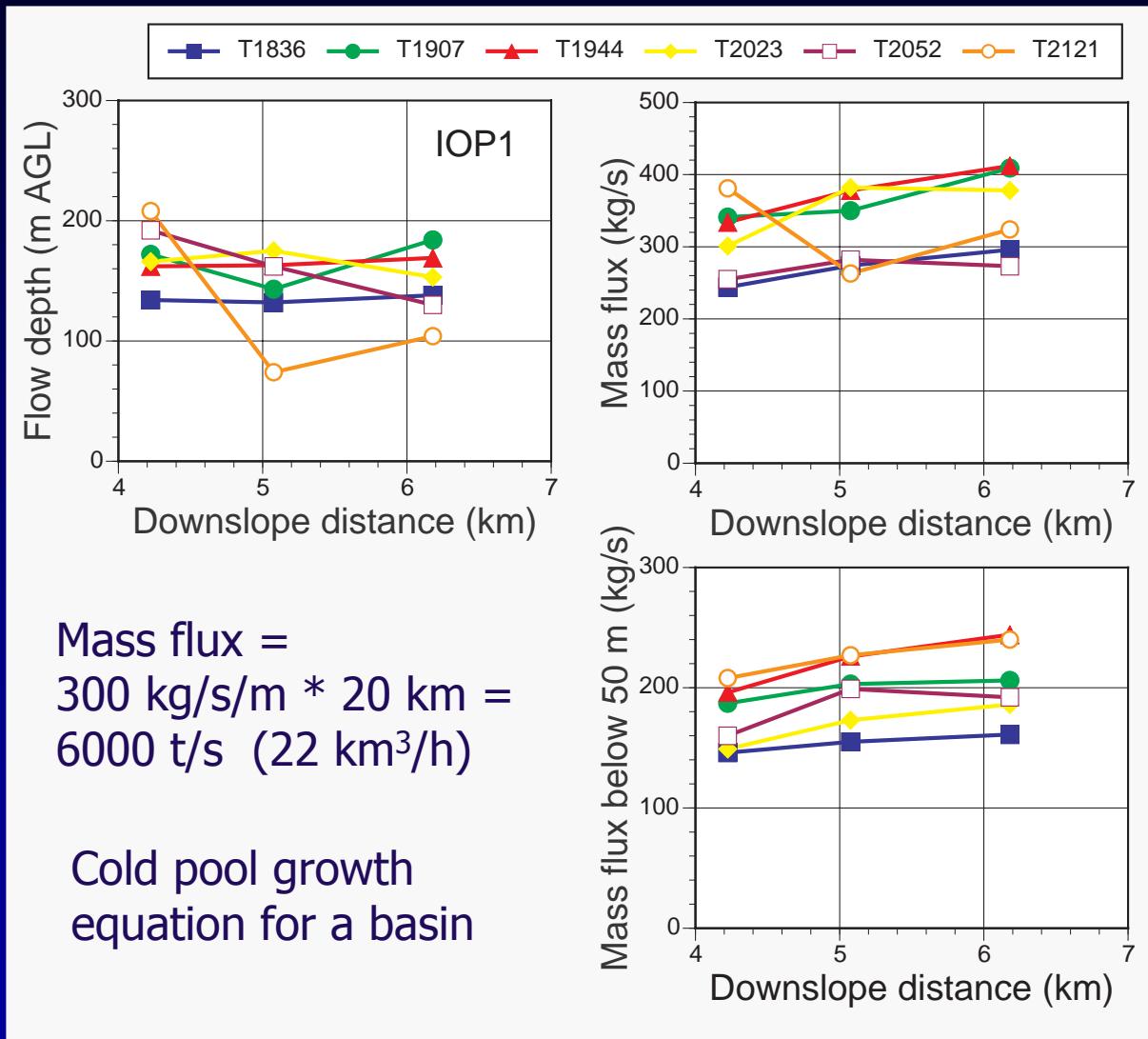
Pacific Northwest National Laboratory  
Richland, WA USA

Thomas Haiden

Central Institute for Meteorology and Geophysics  
Vienna, Austria

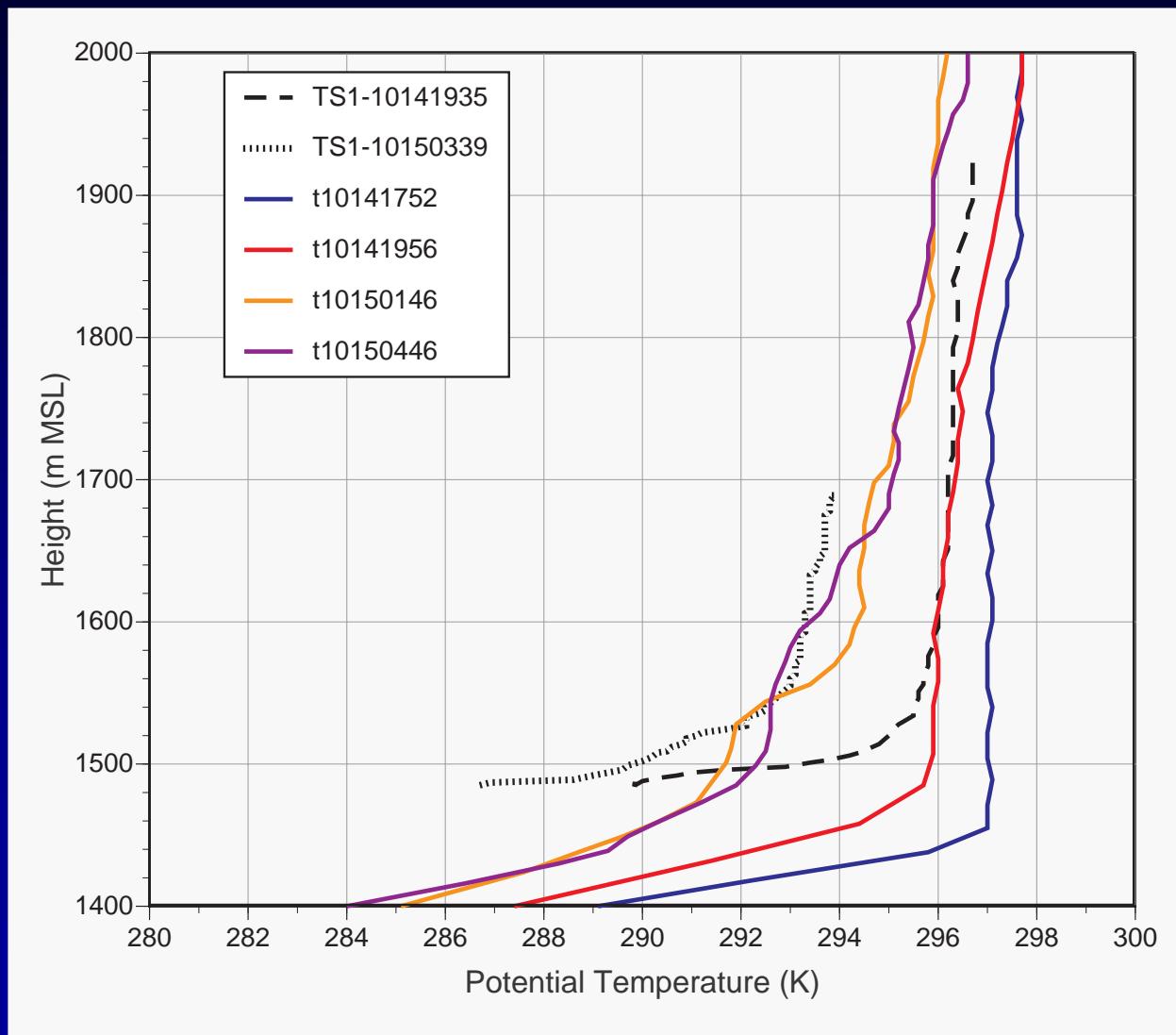
17-19 September 2002, Salt Lake City, UT

# Mass fluxes, 2 Oct 2000



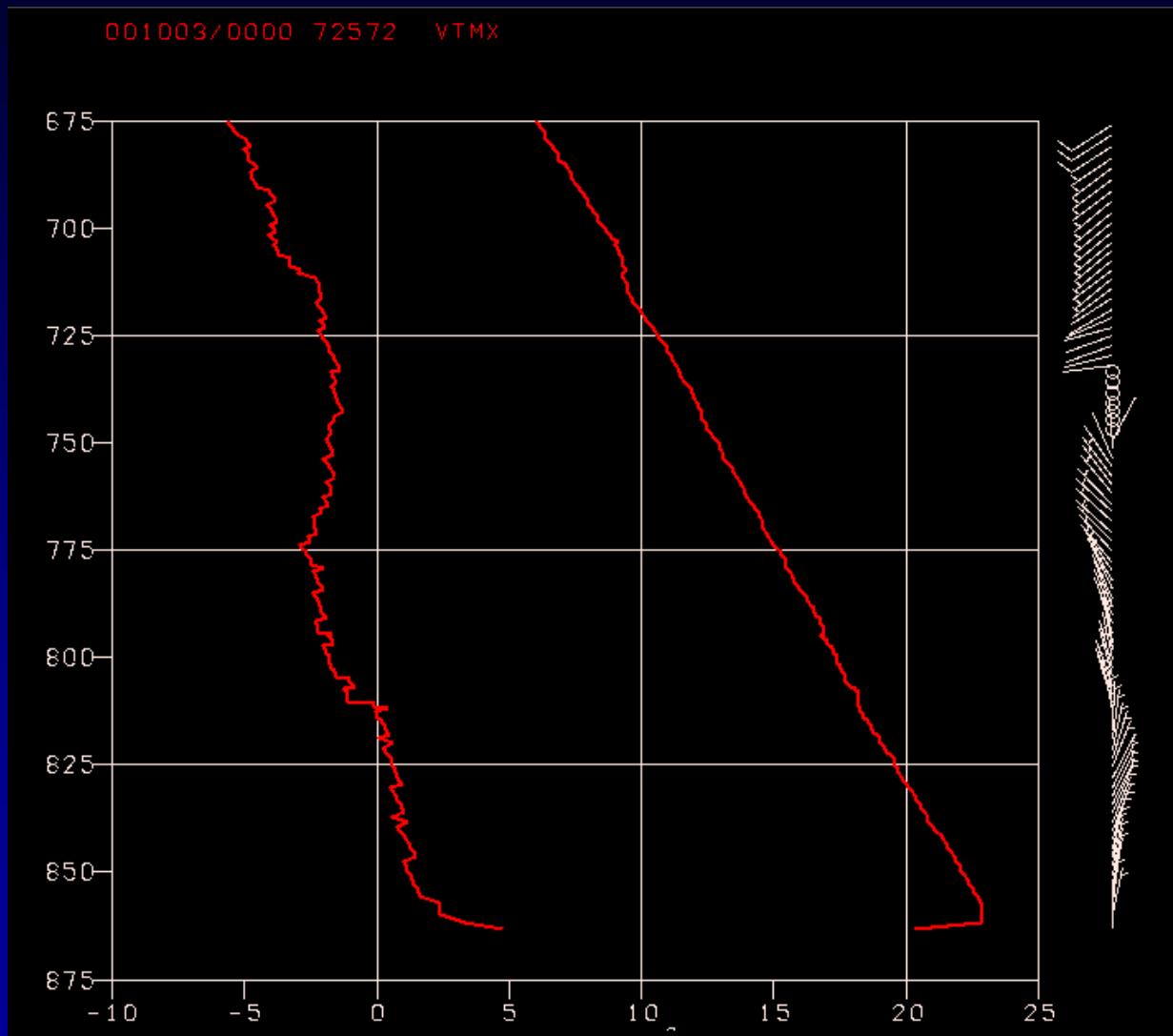
Effect of  
ambient stability  
on slope flows

# Valley center vs slope pt soundings, 14-15 Oct 2000



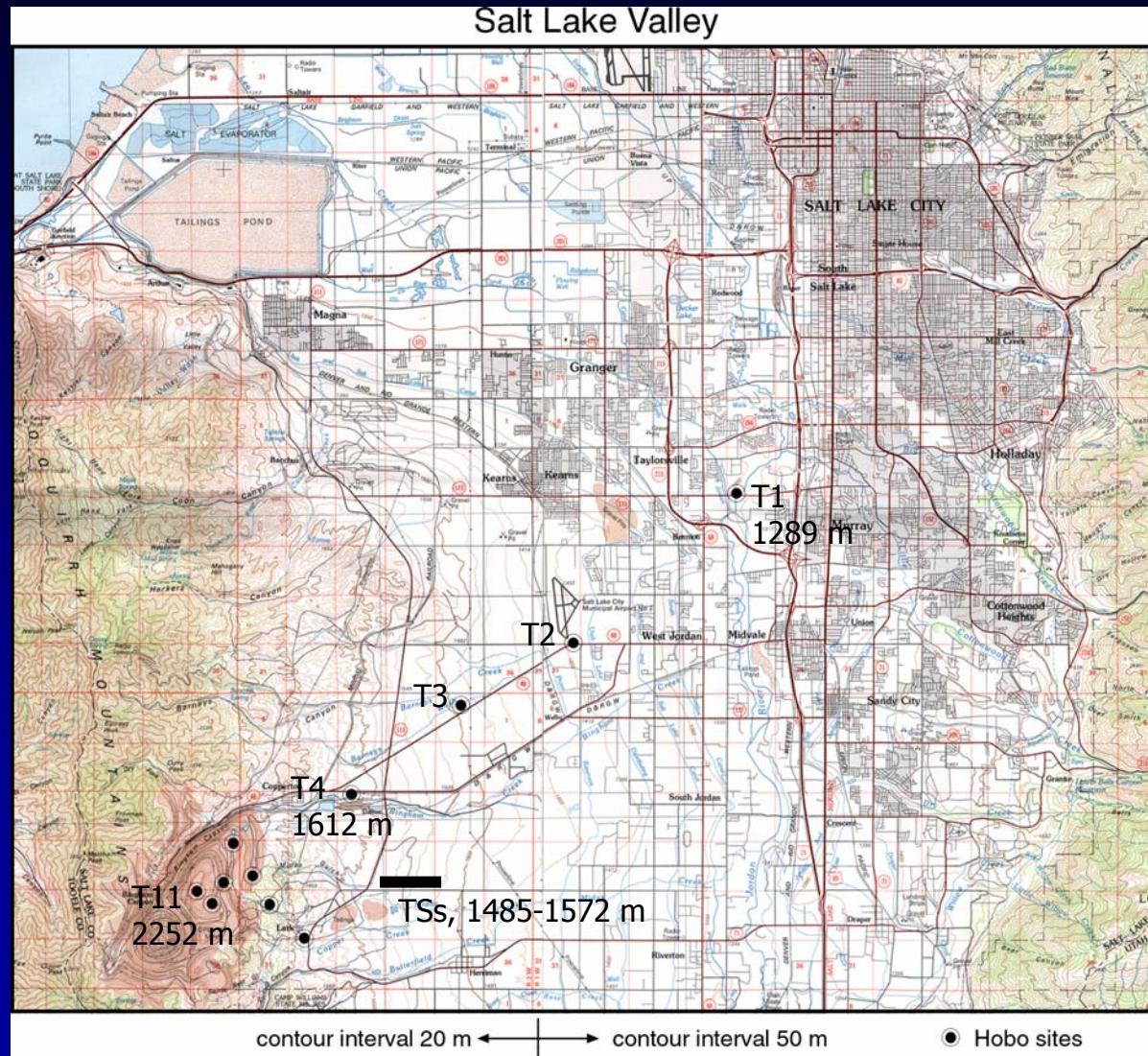
# Wheeler animation

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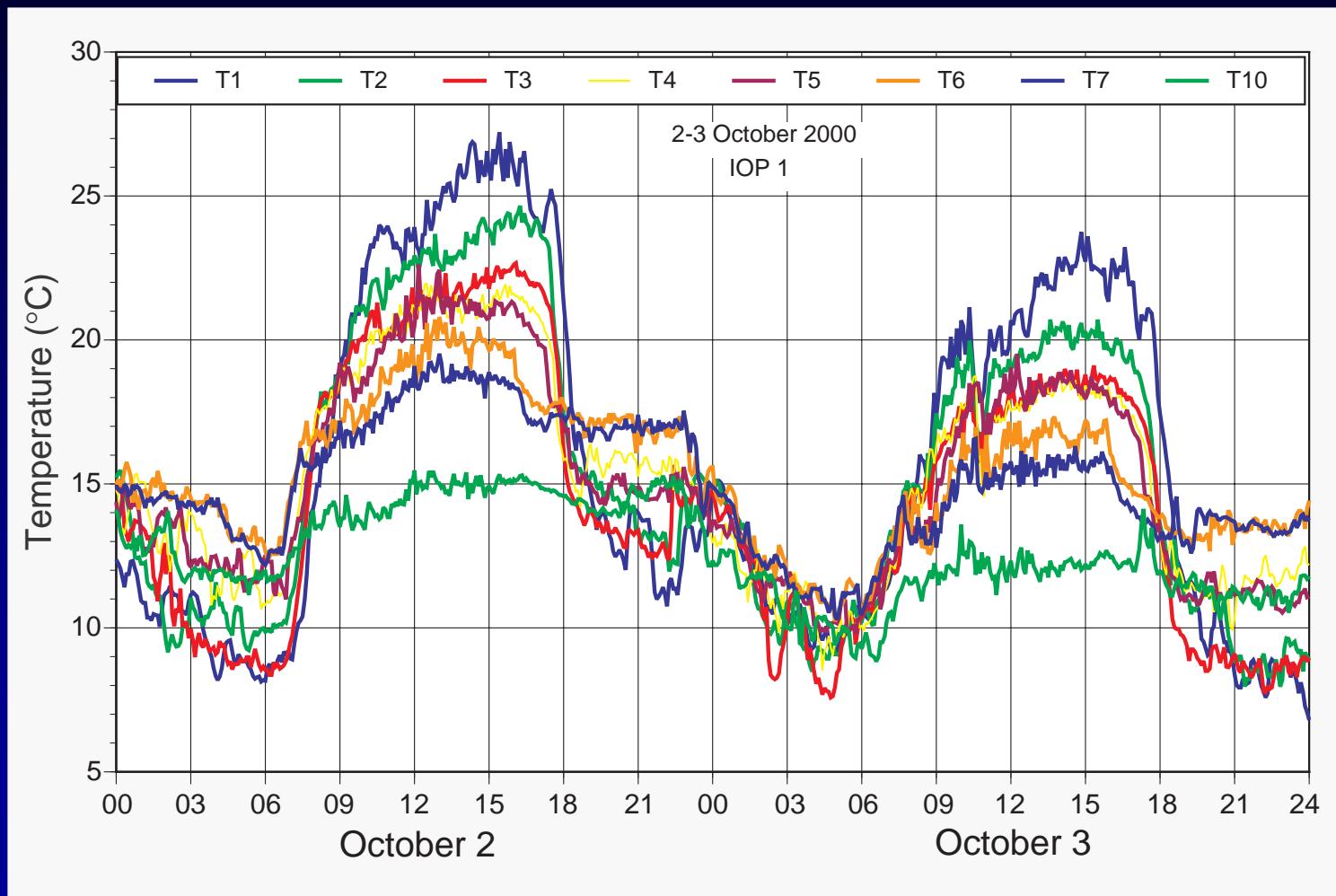
Data from U Utah

# Hobo sites

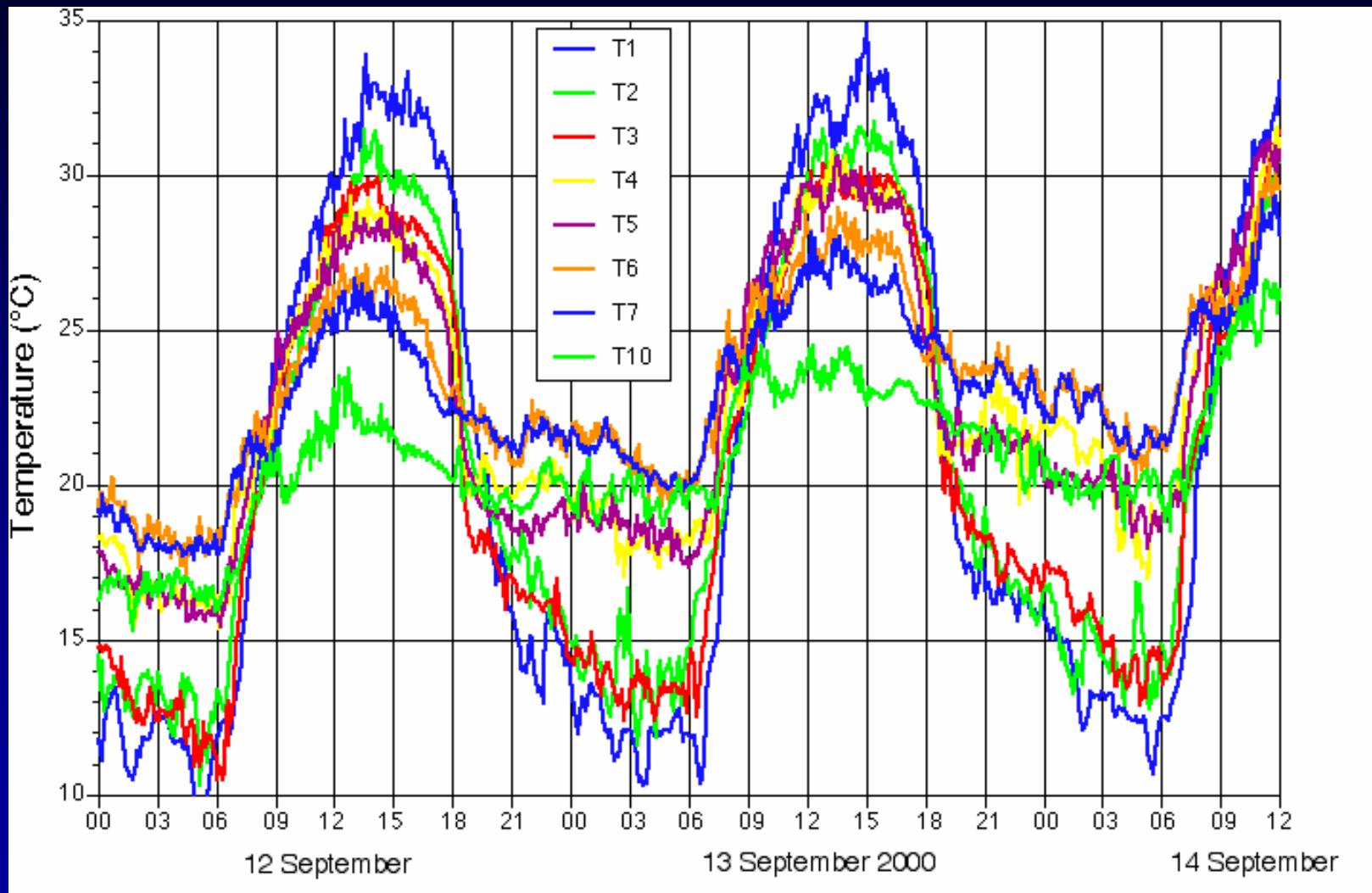


POR: 01/17/00 to 03/22/01  
5-min data, 11 sites  
on KUC land  
John Horel, U Utah students

# 2-3 October 2000 Hobos

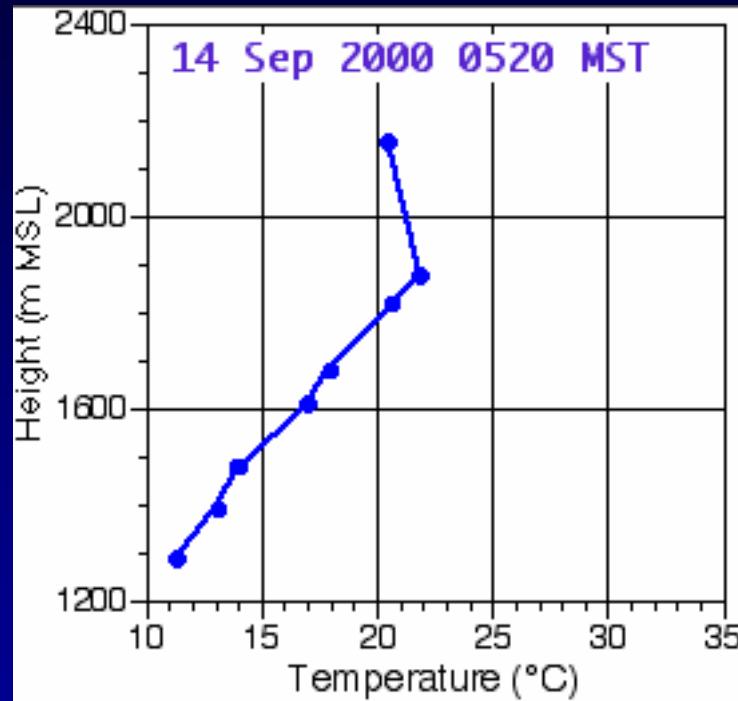
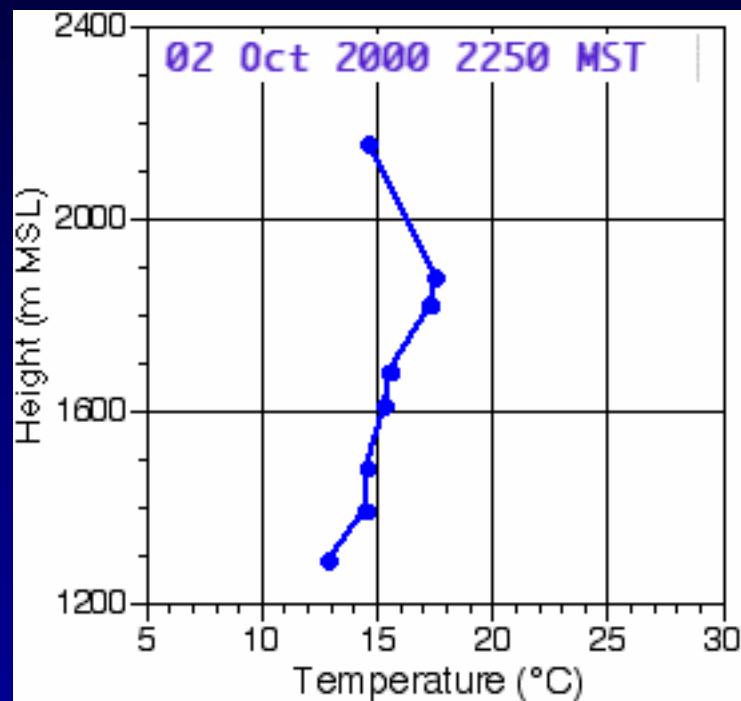


# 13-14 September 2000 Hobos

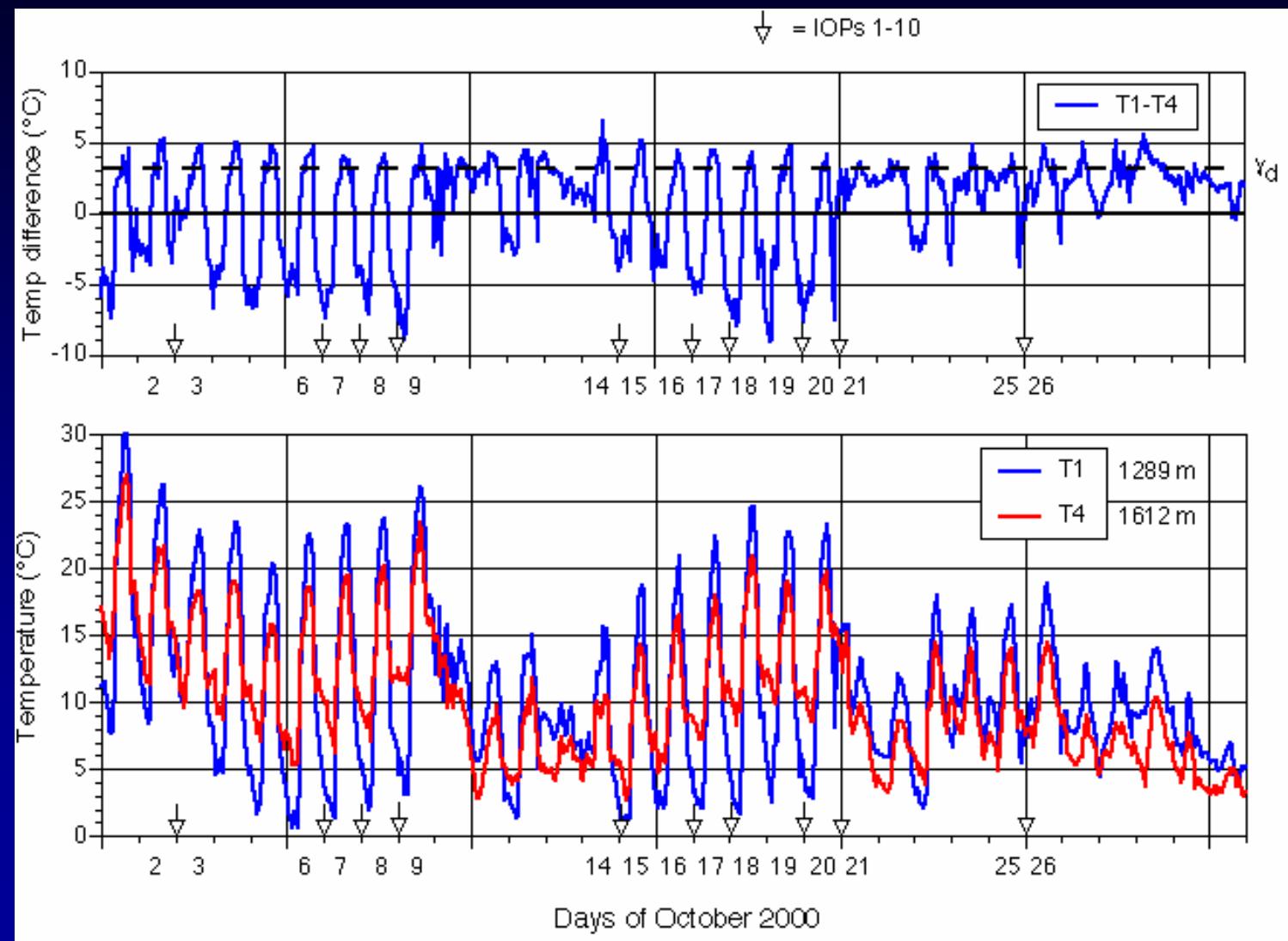


# Hobo profiles

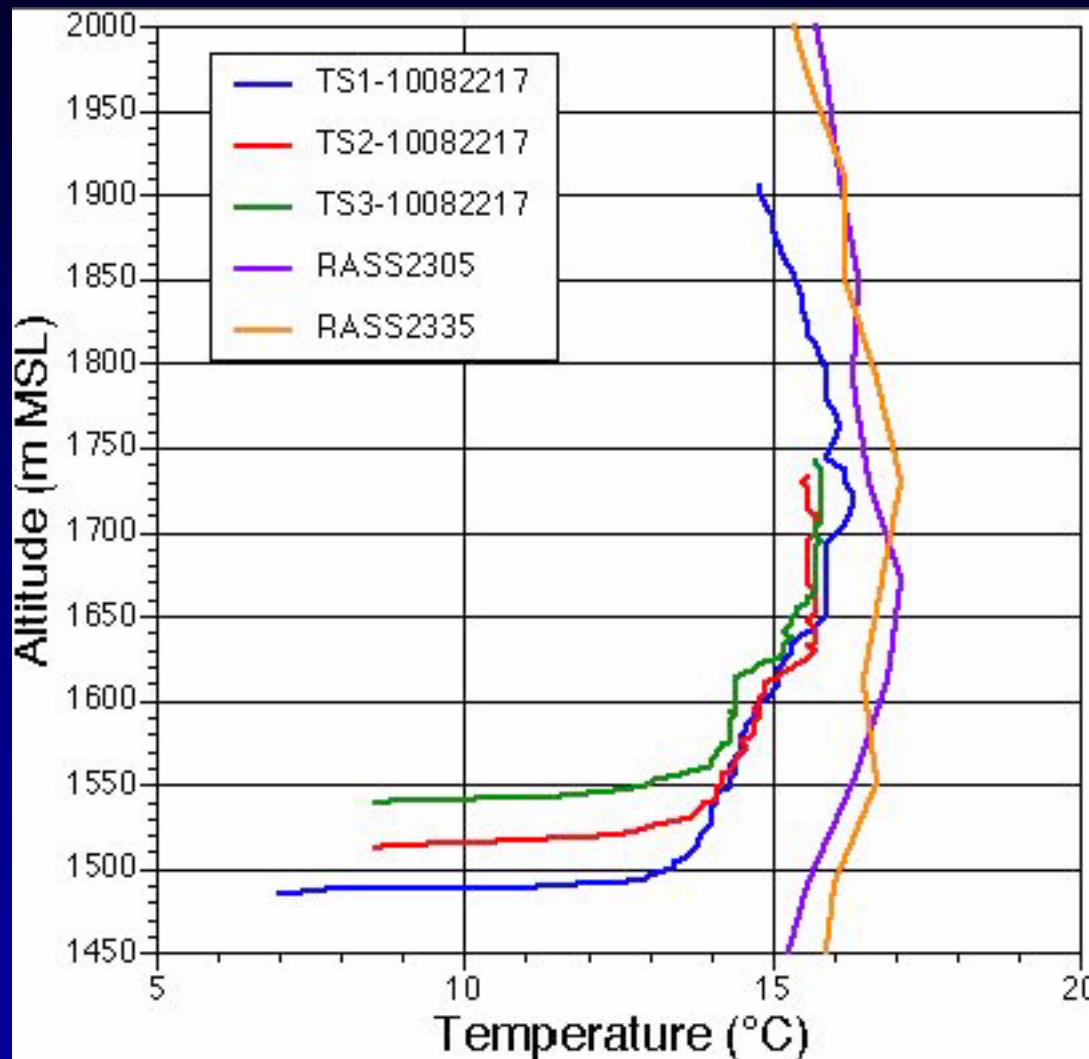
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# Hobos

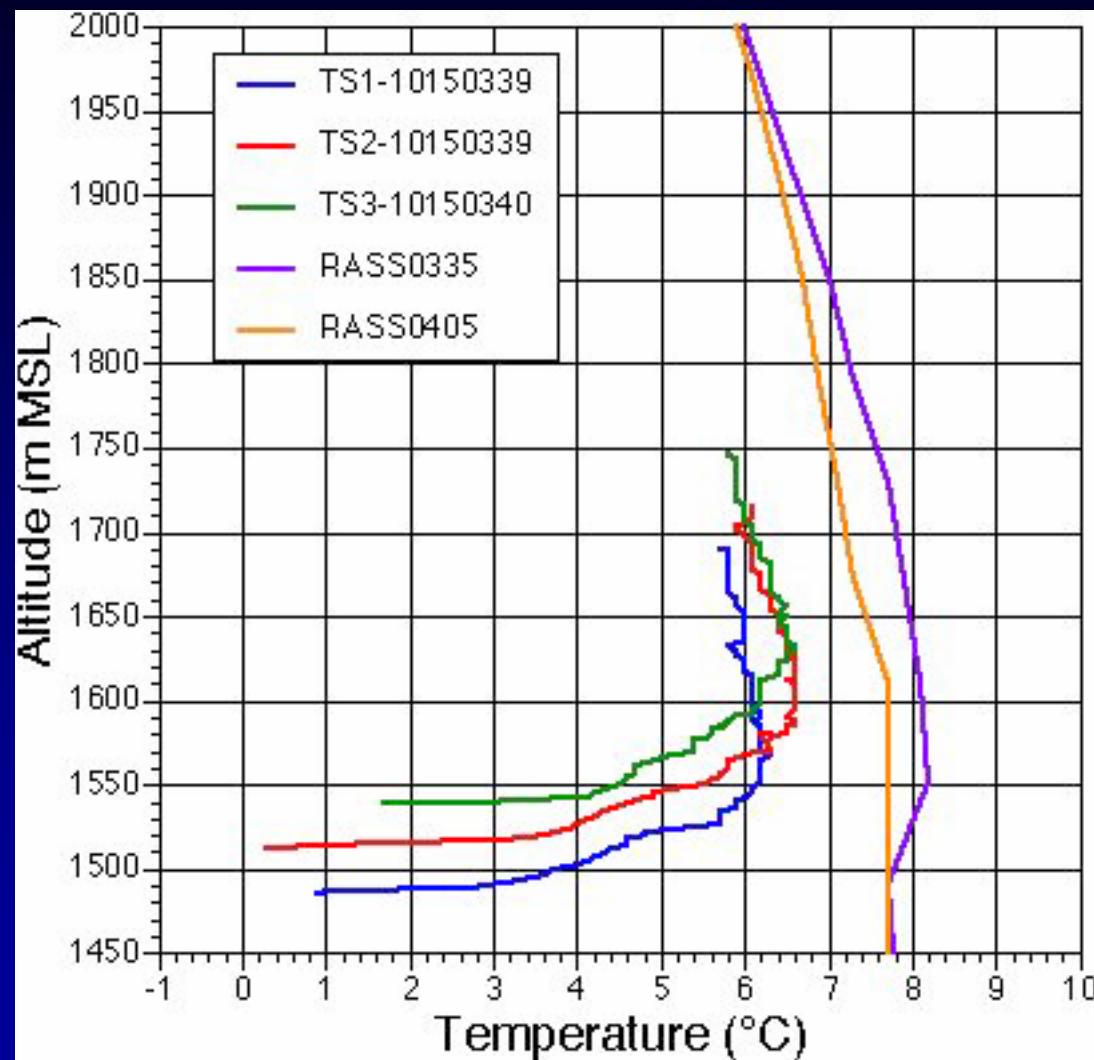


# Stability determined from RASS, IOP4



Data from Will Shaw/Chris Doran, PNL

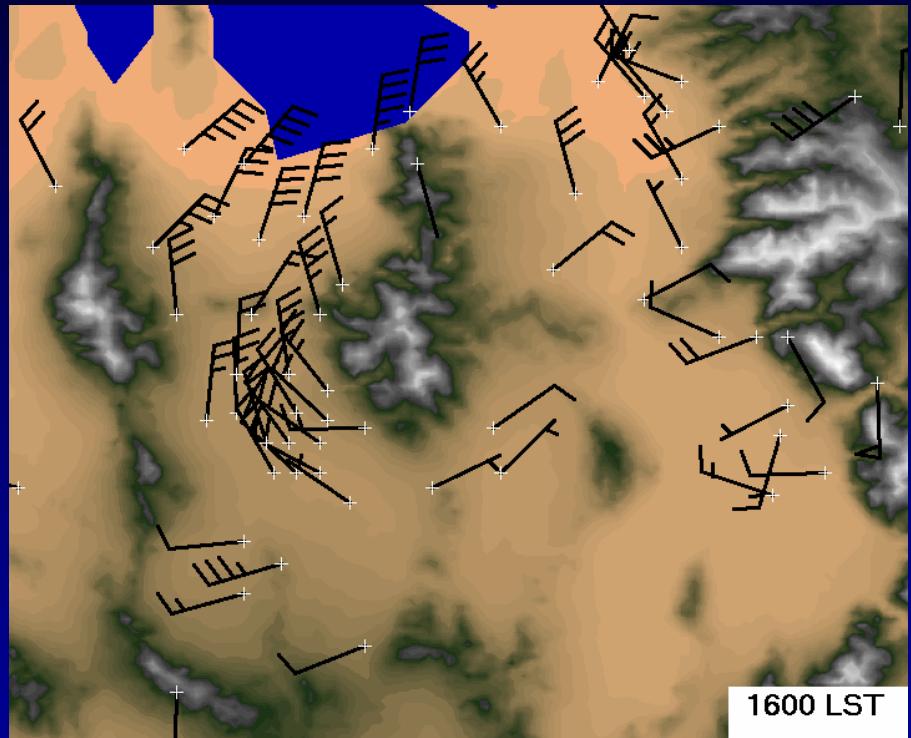
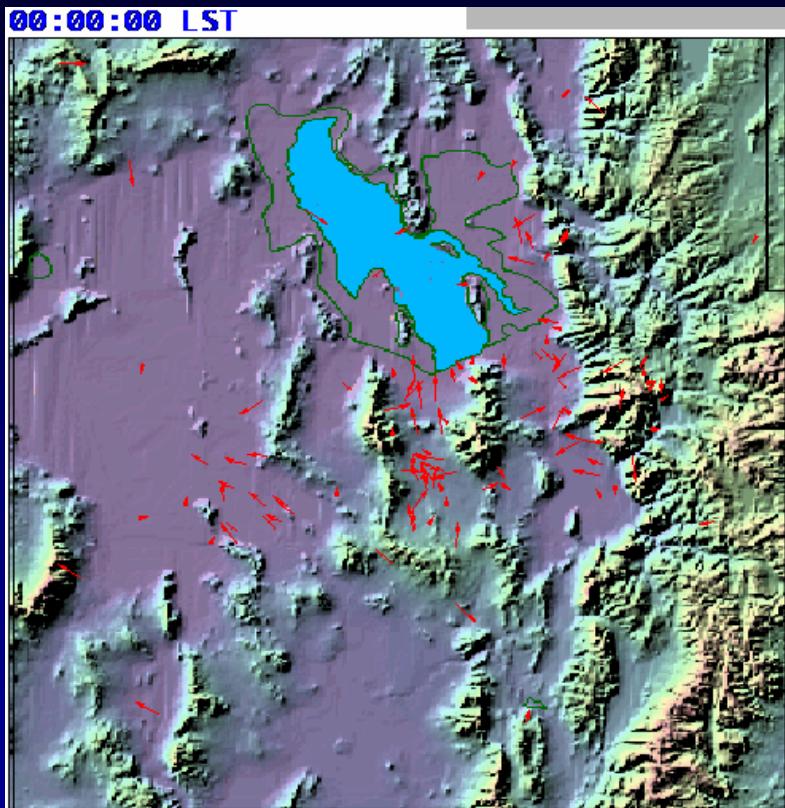
# Stability determined from RASS, IOP5



Data from Will Shaw/Chris Doran, PNL

# Thermally Driven Wind Field and Channeling in the Salt Lake Valley

# Fair weather day winds



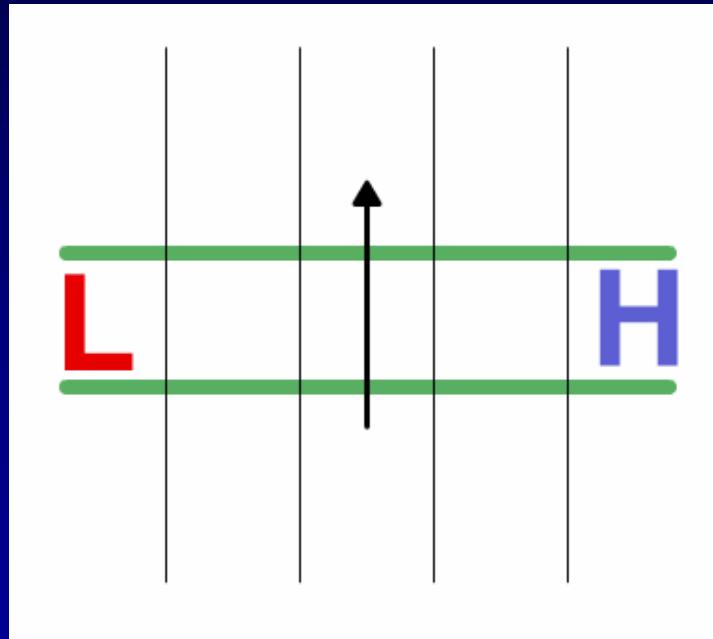
1 fletch = 1 m/s  
700 mb winds  $\leq$  7 m/s  
Daily tot Srad  $\geq$  65% of theor  
POR = JJA 1997-2000

Stewart, J. Q., C. D. Whiteman, W. J. Steenburgh, and X. Bian, 2001: A climatological study of thermally driven wind systems of the US Intermountain West. *Bull. Amer. Meteor. Soc.*, **83**, 699-708.

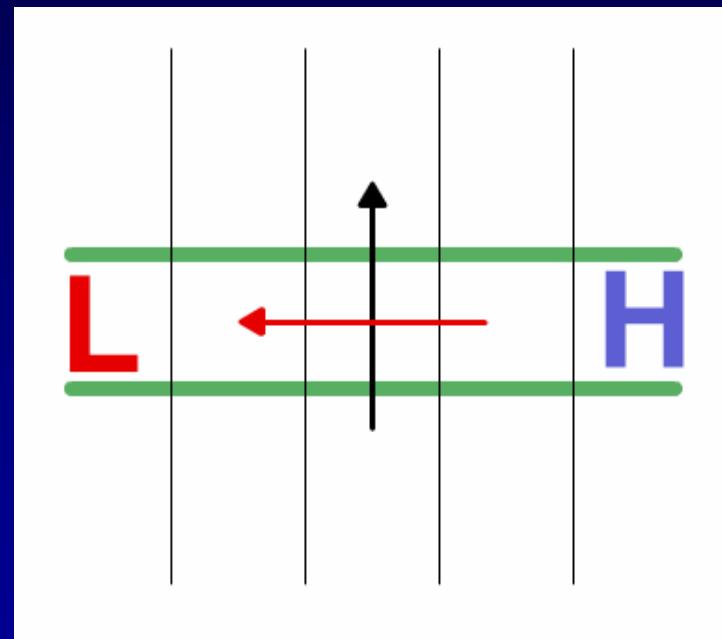
# Channeling

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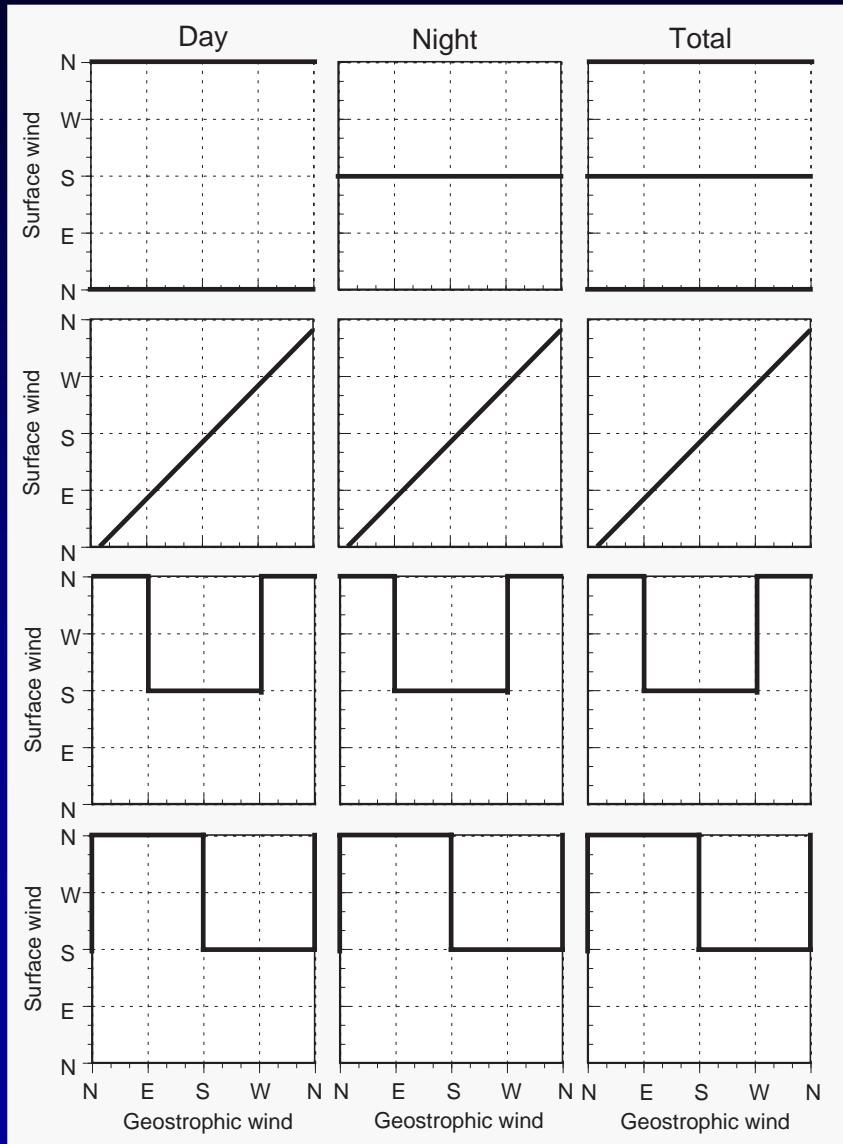
Forced Channeling



Pressure Driven Channeling



# Wind direction joint frequency distributions



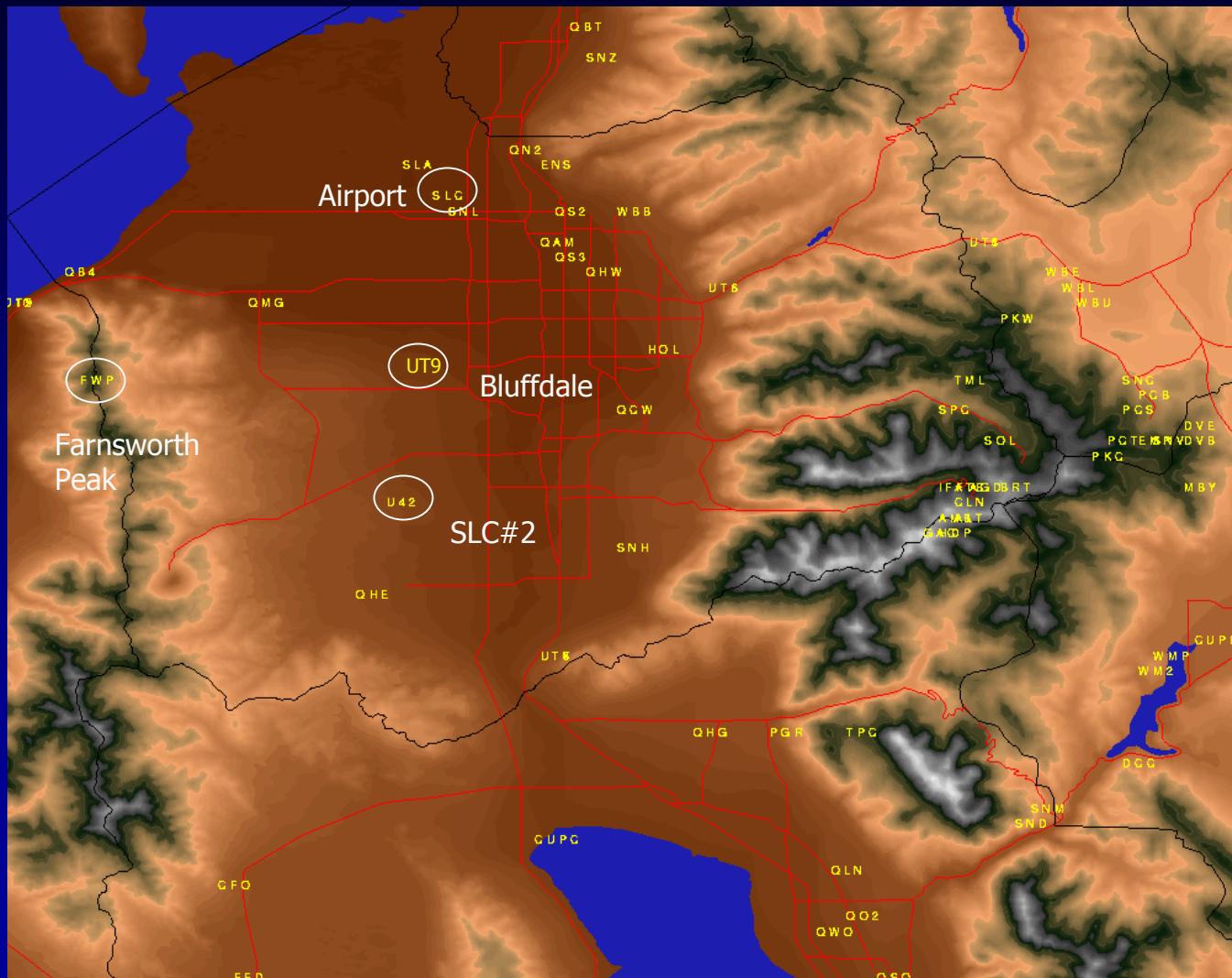
Thermally Driven Flows

Downward Momentum Transport

Forced Channeling

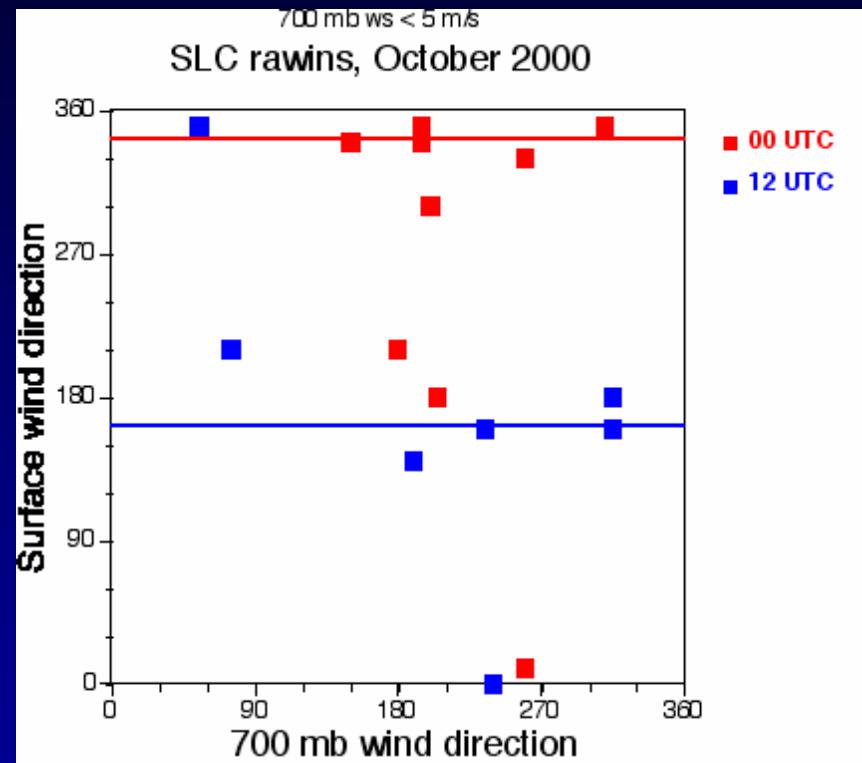
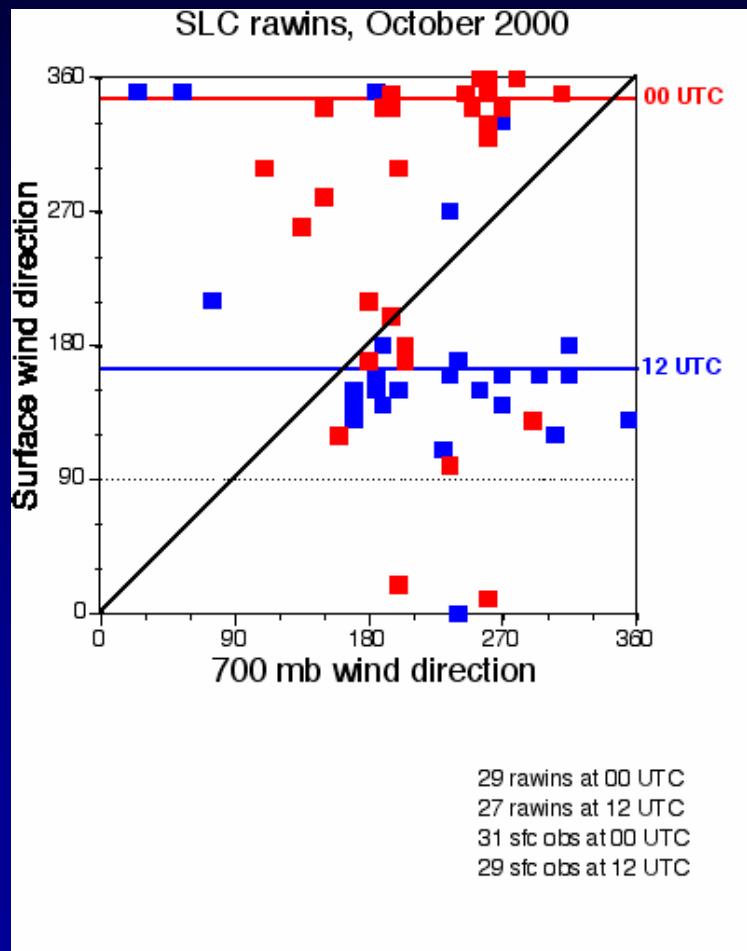
Pressure Driven Channeling

# Sites Used in Channeling Analysis



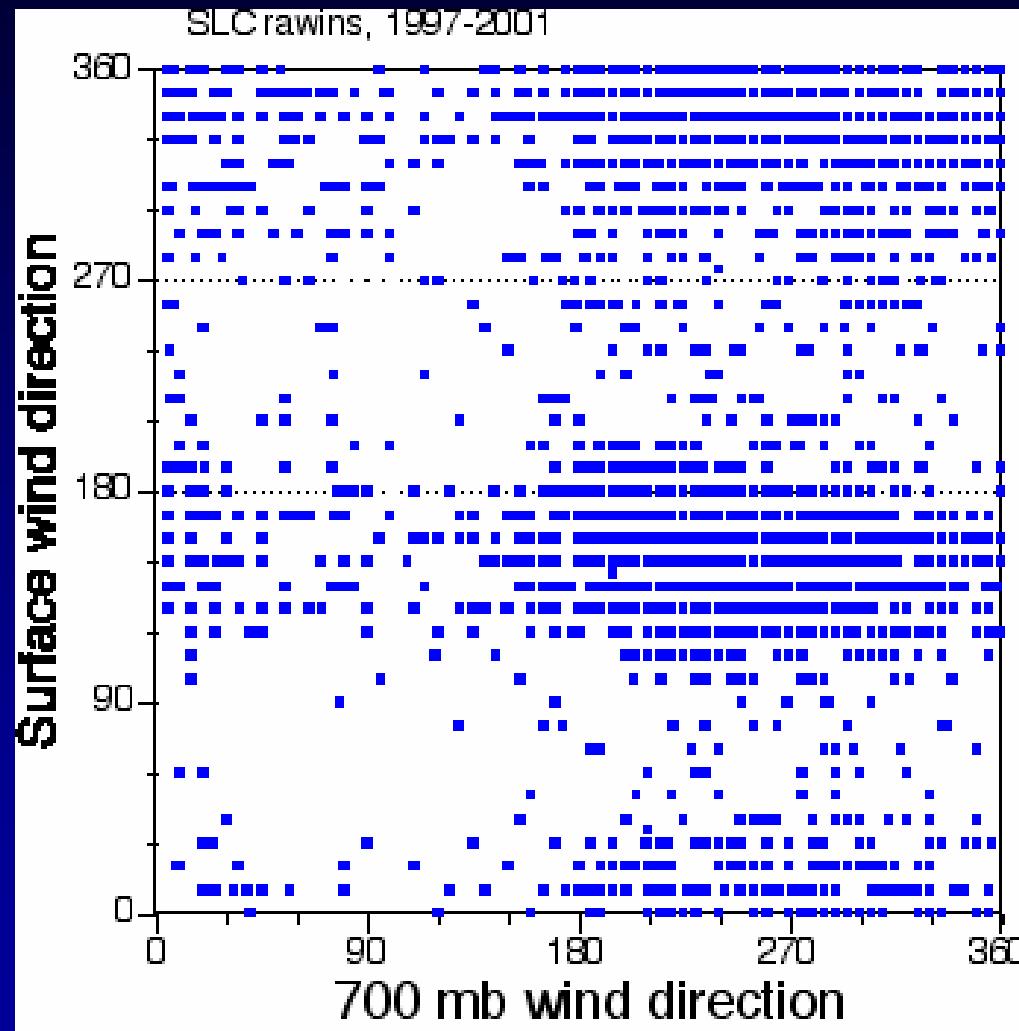
From MesoWest website

# October SLC rawinsondes



NWS data

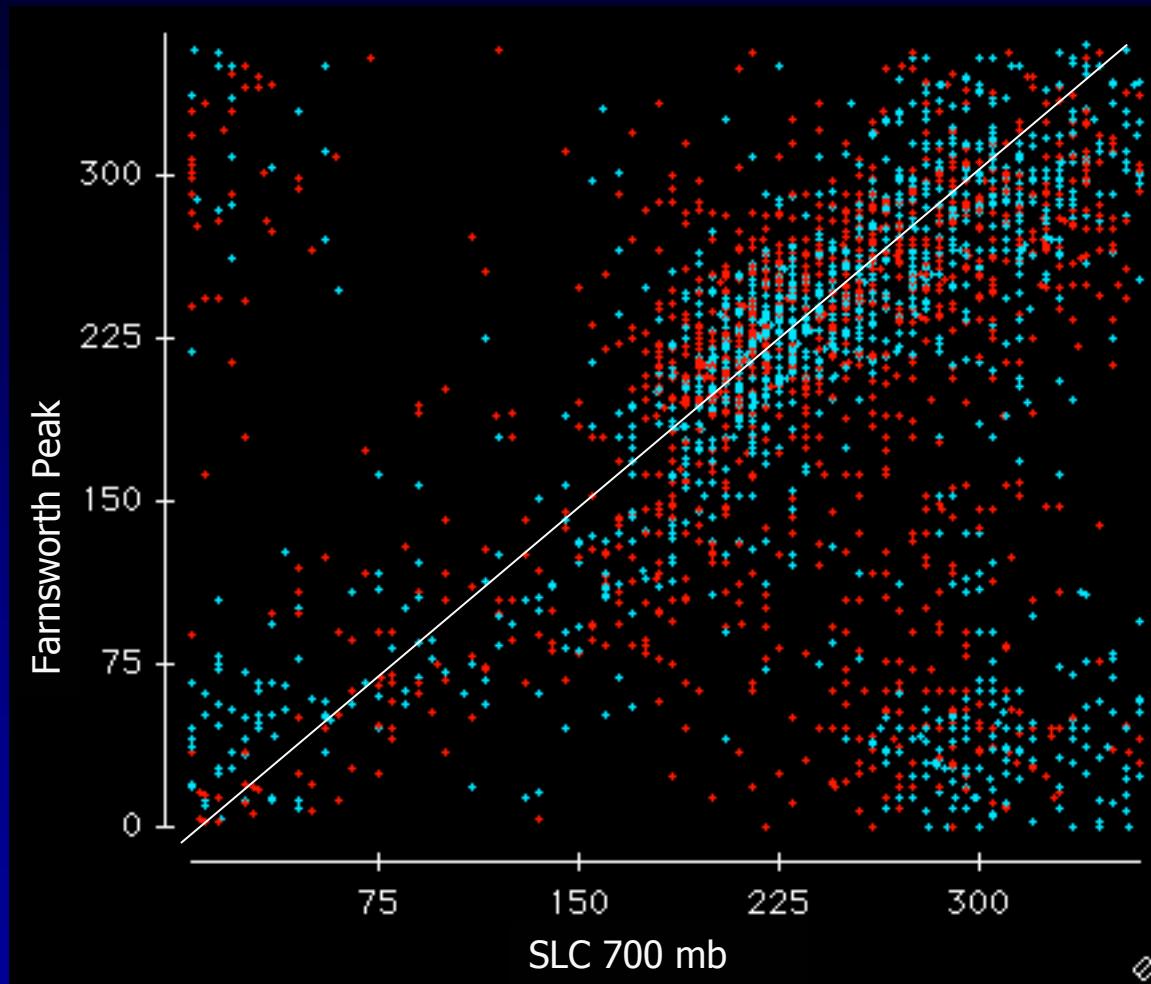
# SLC rawinsondes, 1997-2001



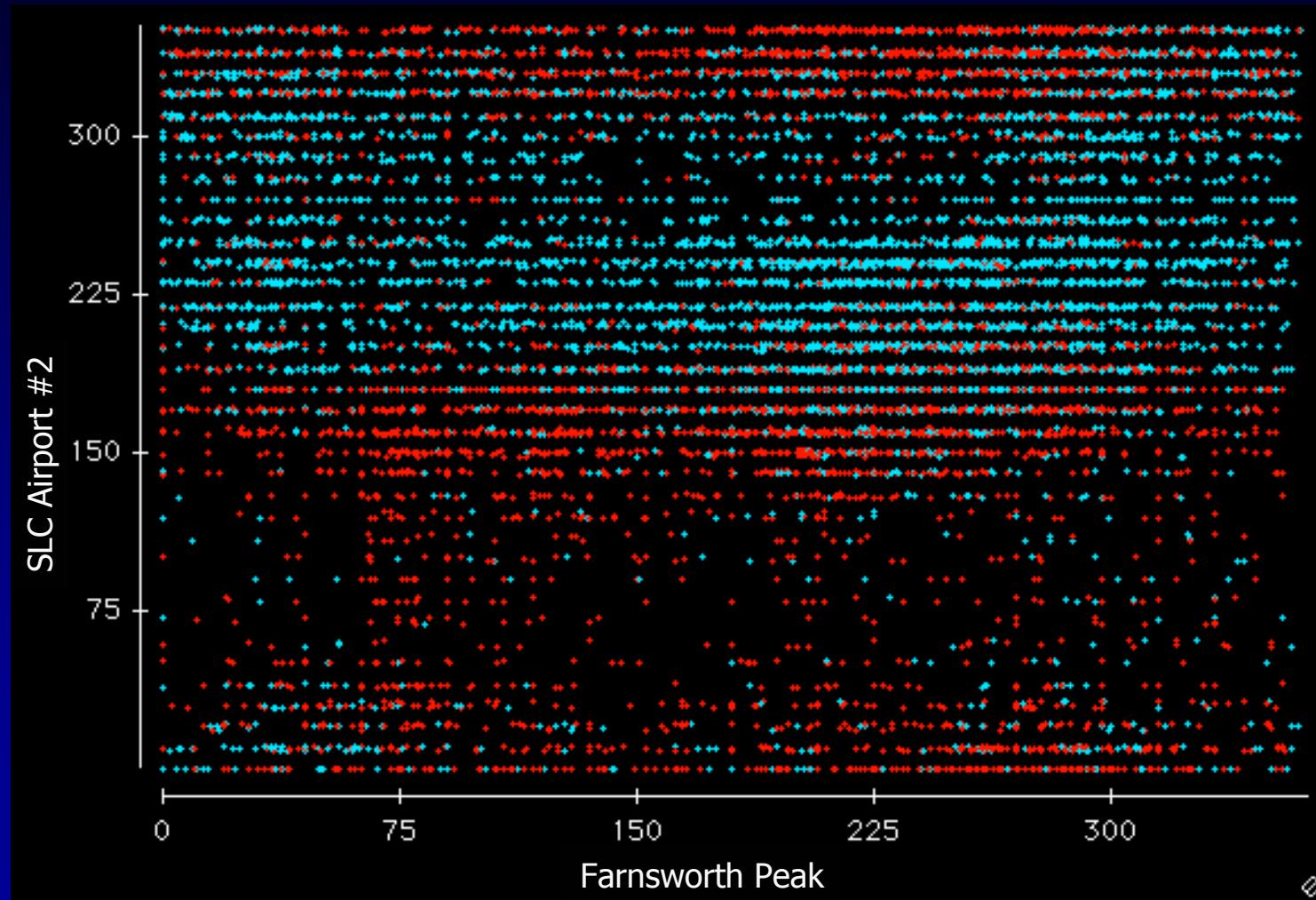
NWS data

# FWP vs SLC

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# Farnsworth Peak vs SLC#2



Red = day  
Blue = night

MesoWest data

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# Mid-Winter Cold Pool in the Salt Lake Valley

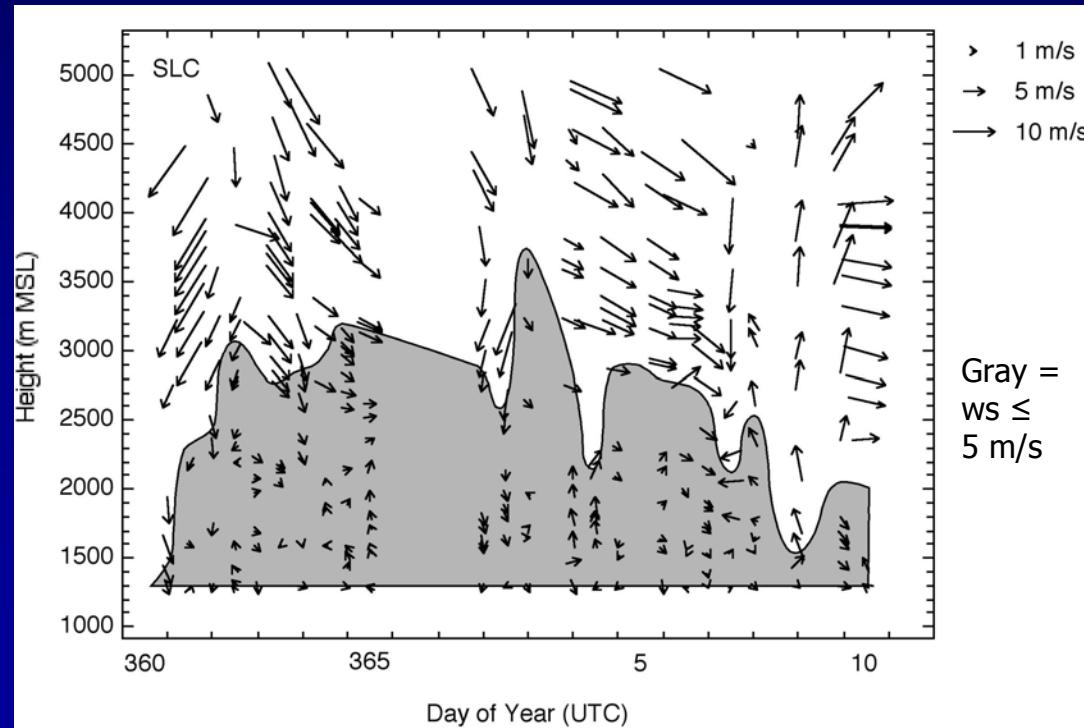
26 December 2000 - 9 January 2001

# Persistent Cold Pool

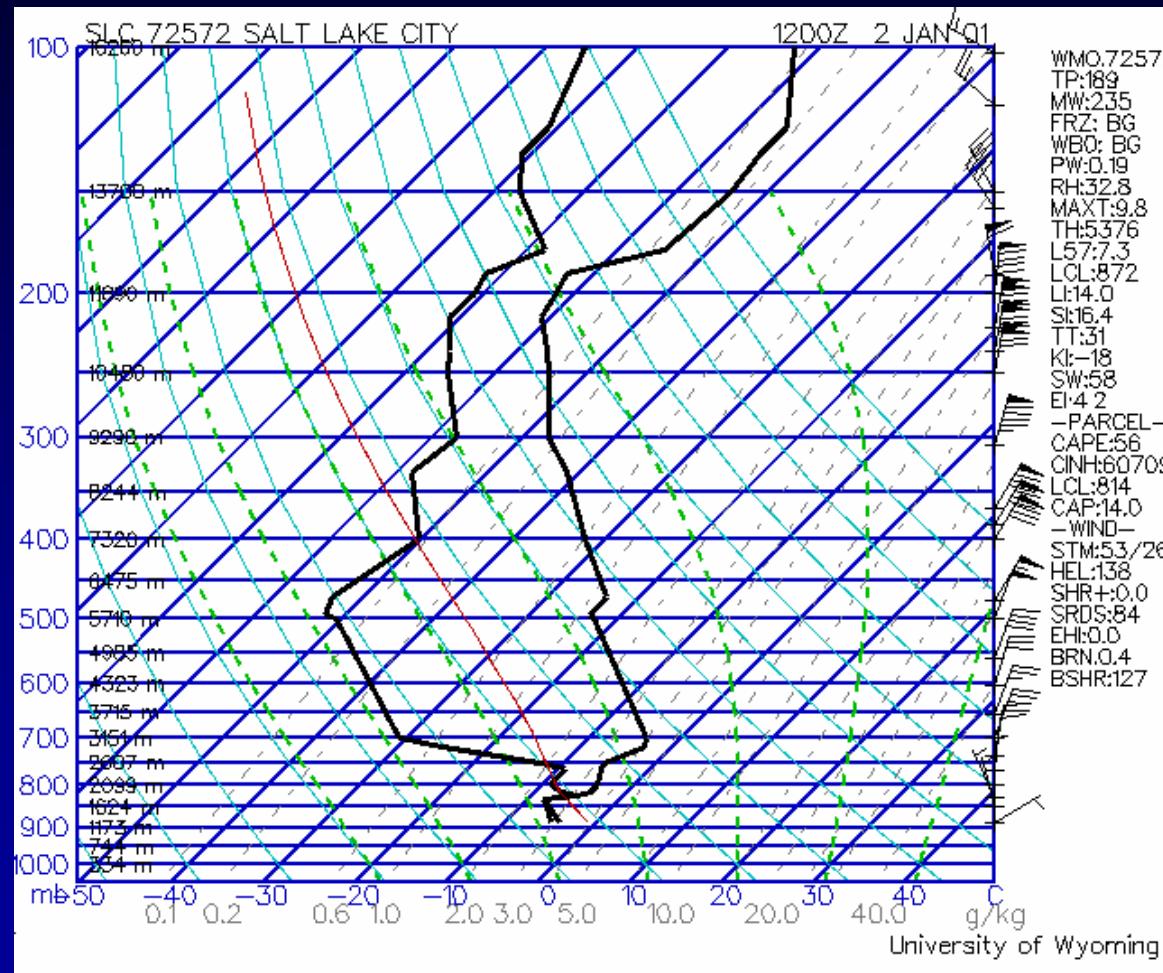


From Mt. Ogden

Dan Judd Photo

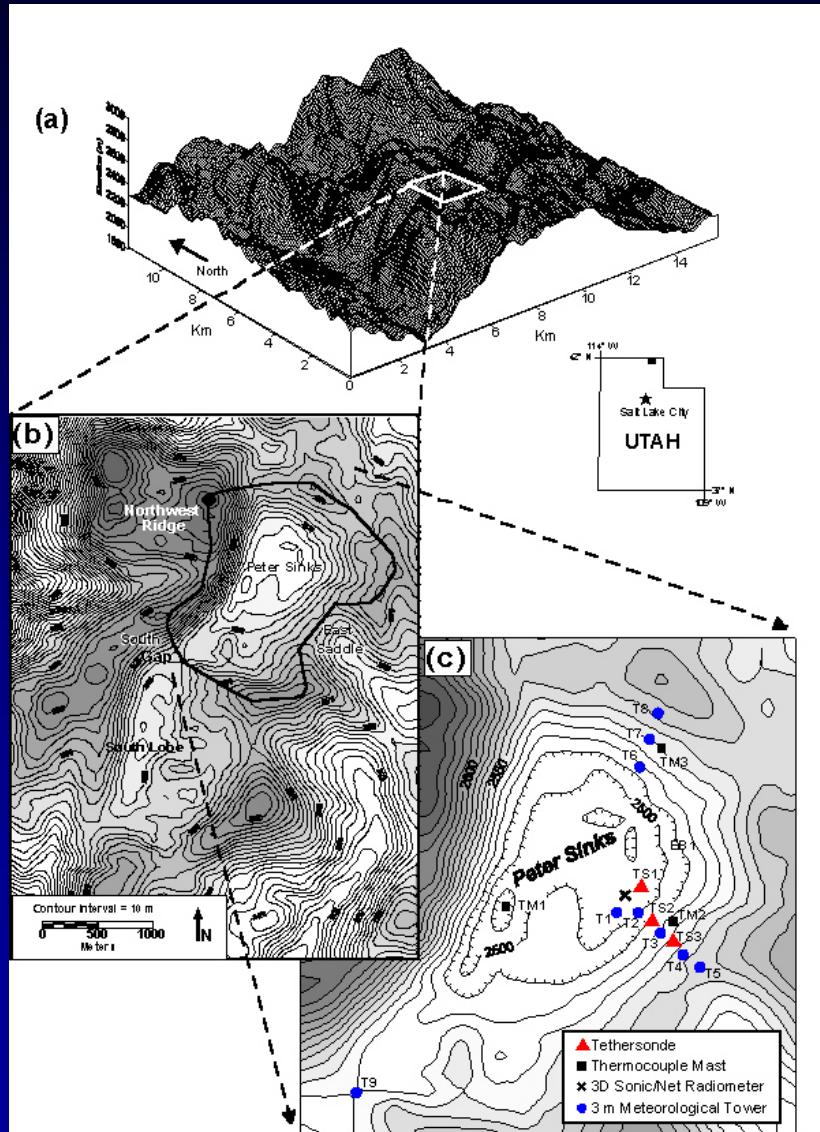


# SLC rawinsonde animation



# Peter Sinks Cold Pool Buildup

# Peter Sinks Experiment



## Participants:

University of Utah  
PNNL  
Judd Communications  
Campbell Scientific Inc.  
Army DPG

$$T_{\min} = -56^{\circ}\text{C}$$

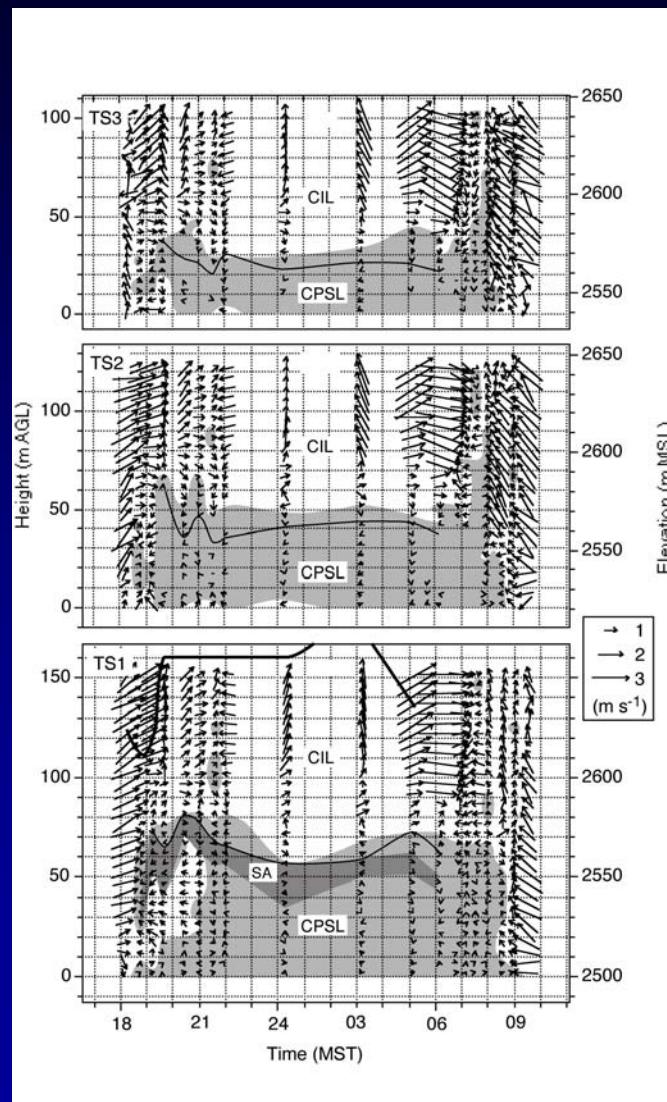
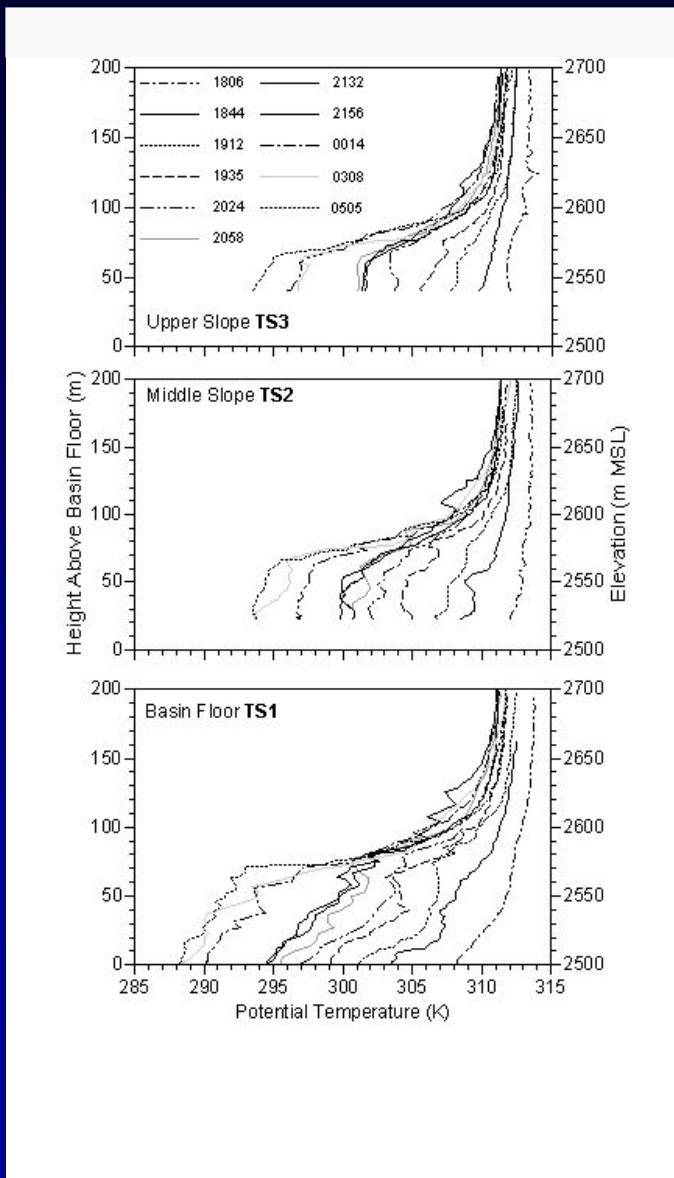
1/30/02 -61°F  
Middle Sink



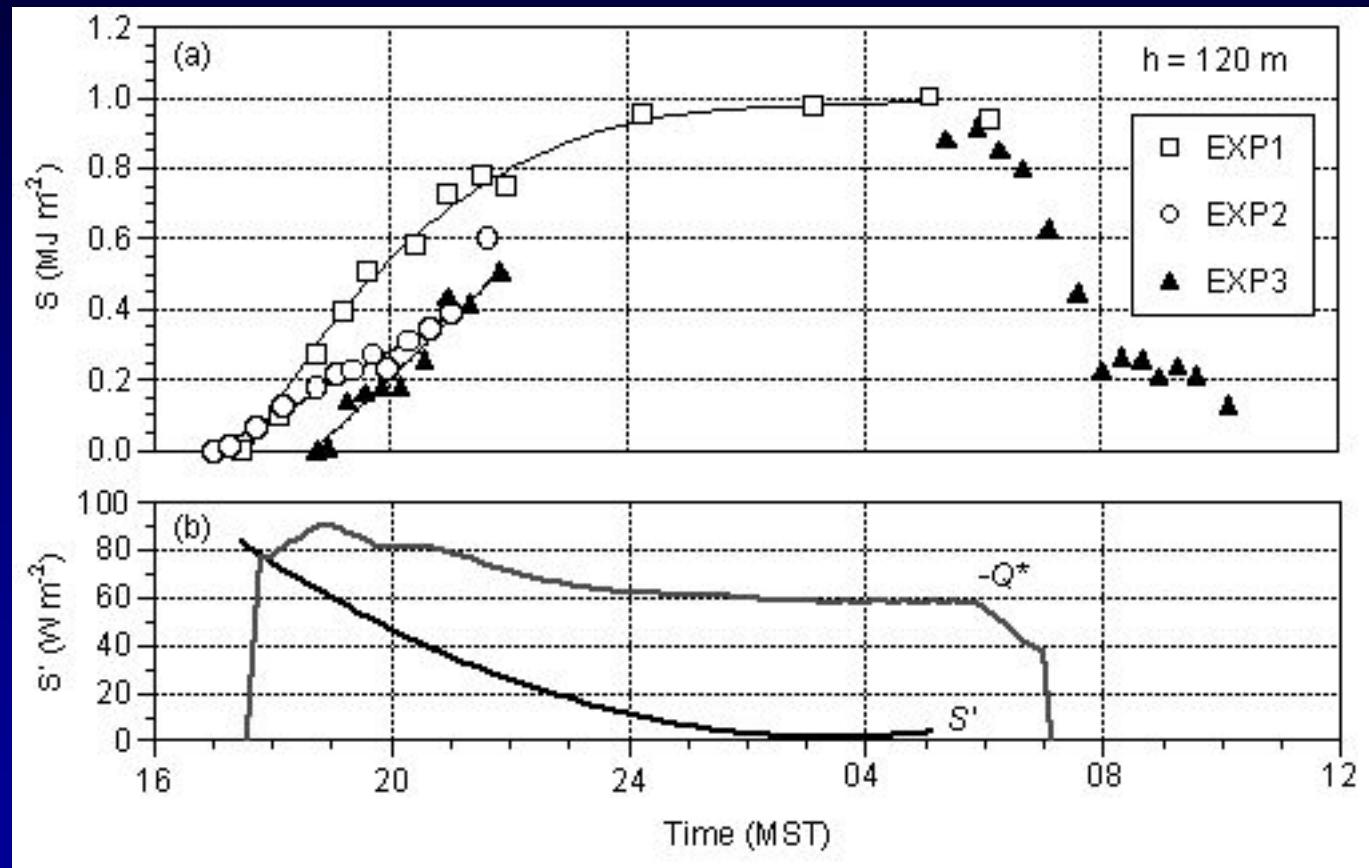
Clements et al., 2002: Cold pool structure and evolution in a mountain basin : Peter Sinks, Utah. Submitted to *Journal of Applied Meteorology*.

# Peter Sinks Experiment

Shading  $\leq 0.4 \text{ m/s}$

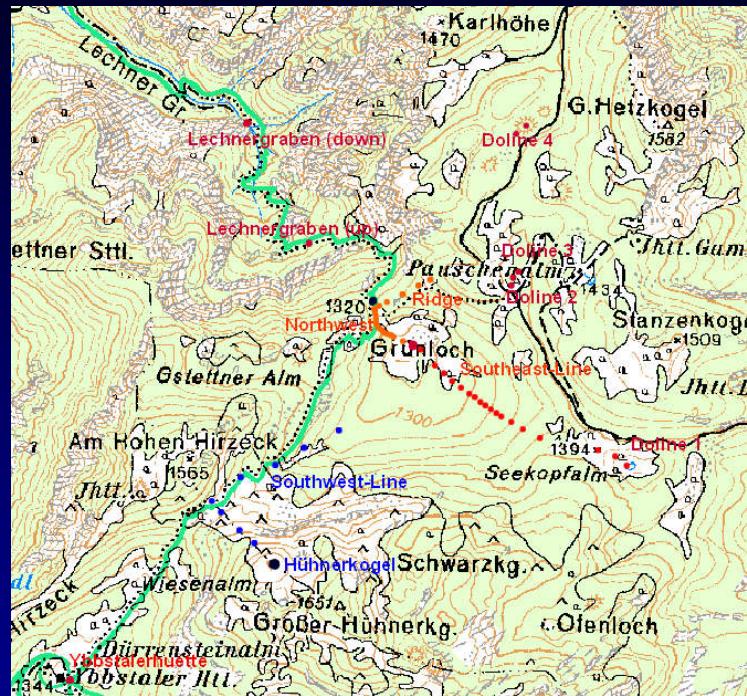


# Rate of heat loss from basin atmosphere



Cold Pool  
Buildup/Breakup  
in Sinkholes of the  
Eastern Alps

# Gstettner-Alm Experiment 2001-2002

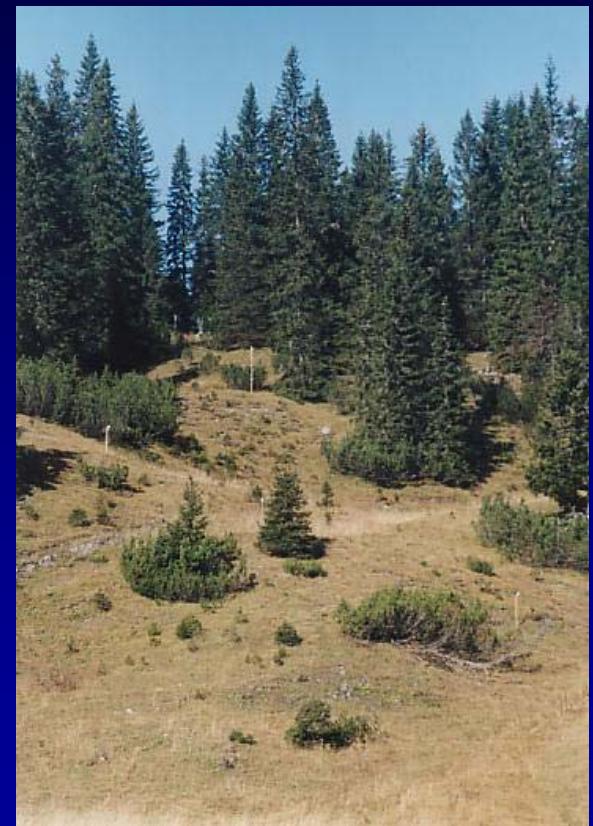


Eisenbach photo

The Gruenloch

Participants:

University of Vienna  
Agric. Univ. Austria  
ZAMG  
PNNL

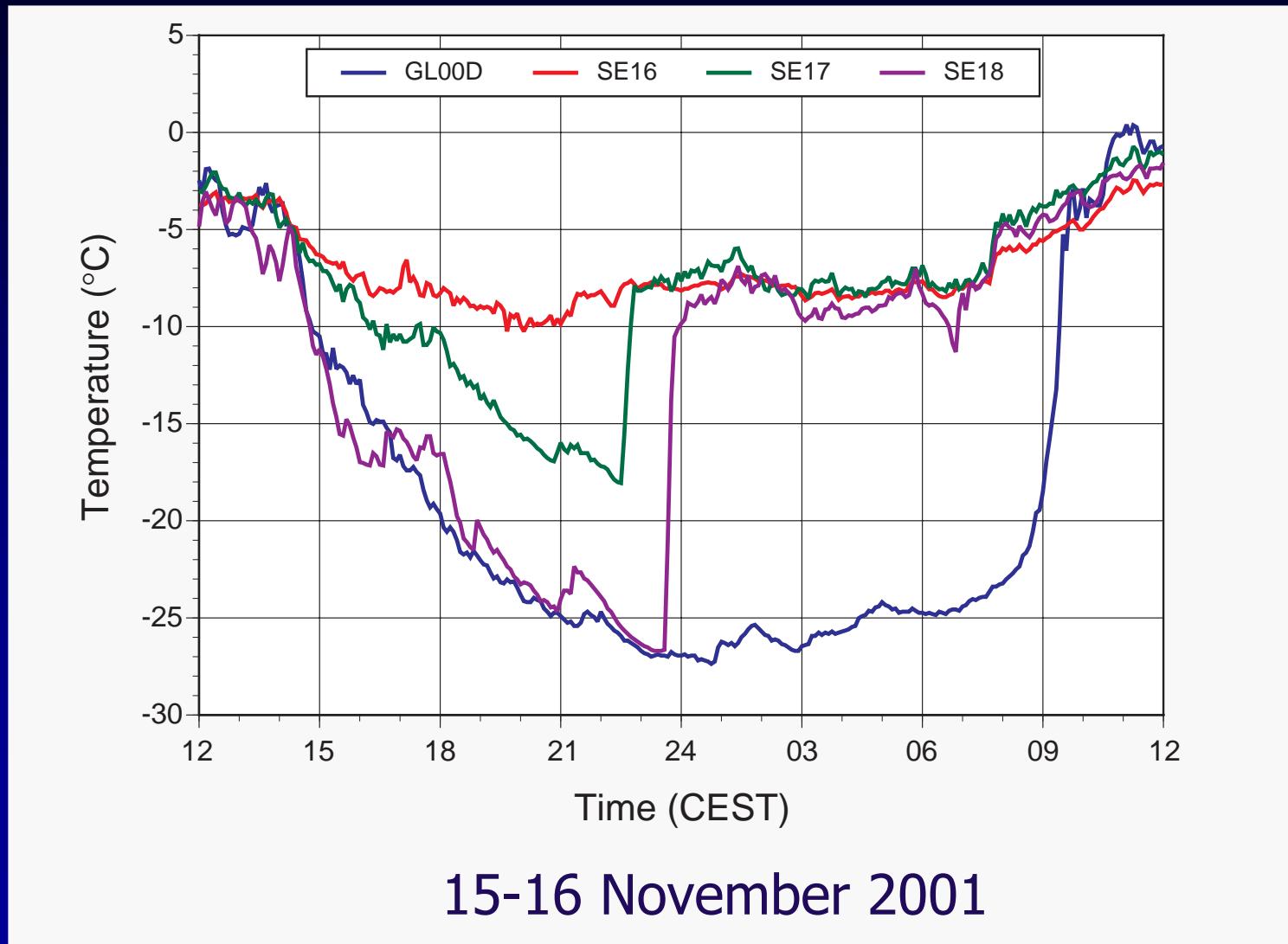


Pospichal photo

Haiden obs this winter: -8°C, -38°C

Pospichal photo

# Seekopfalm turbulent erosion episode



Snow on ground