

Mountain Weather

Mazama Ski Mountaineering 2010

Dick Iverson

Newton Ck Canyon
Mt. Hood



**Happy ski mountaineers
are weather junkies**

Newton Ck Canyon
Mt. Hood

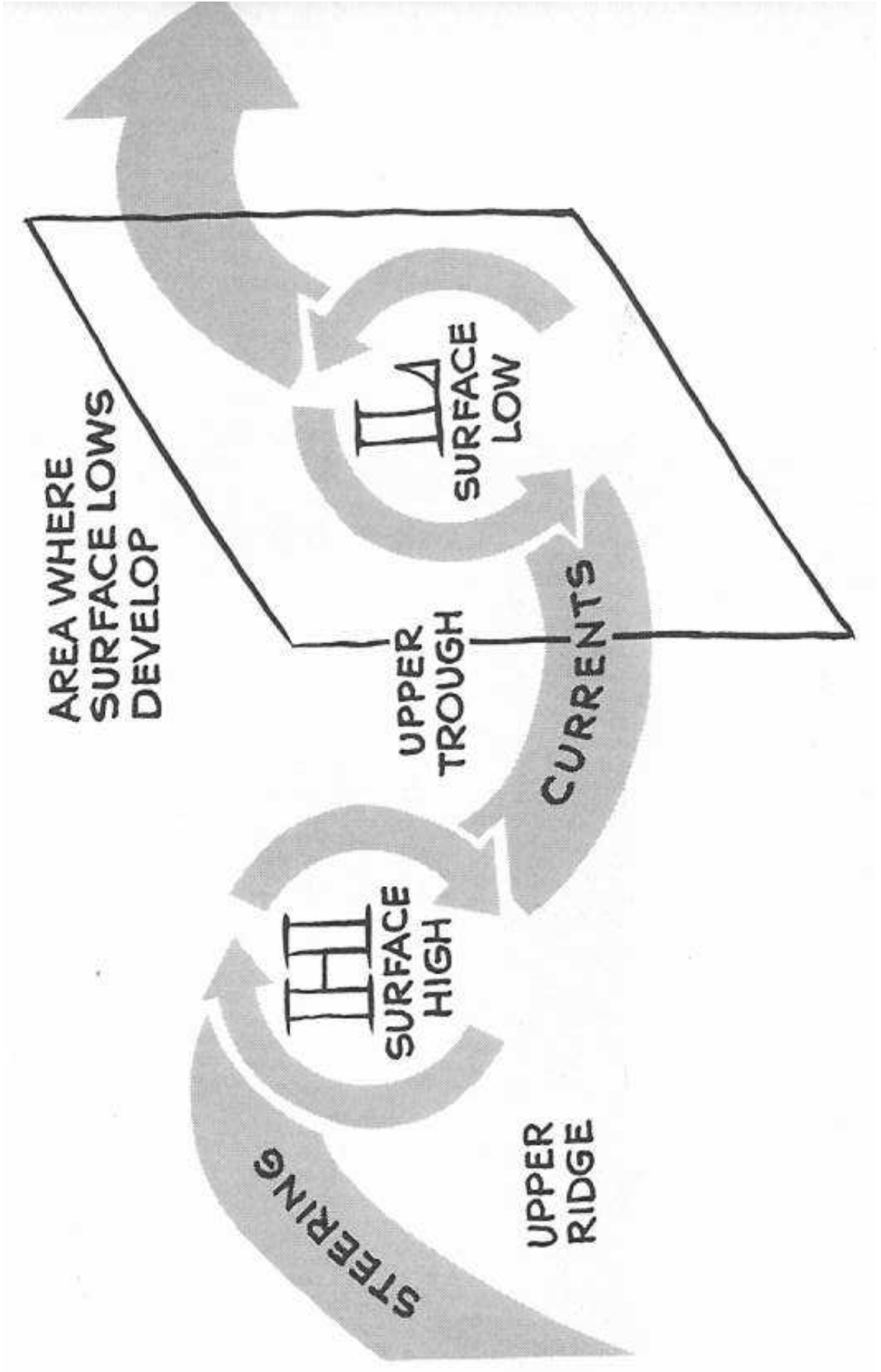


What is weather?

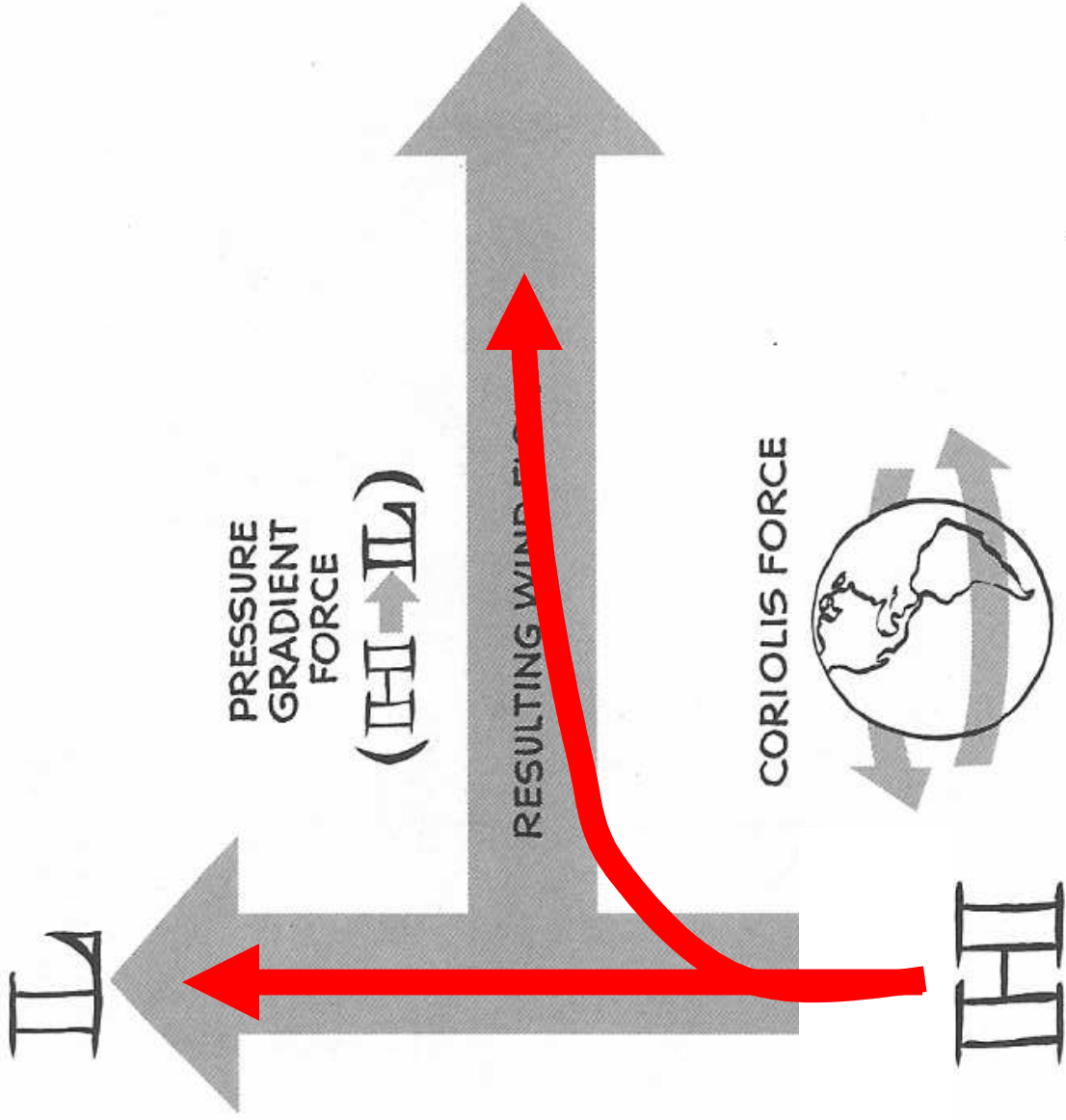
**Short-term response of atmosphere
to distribution of temperature,
pressure and water vapor**

Climate is the long-term average of weather

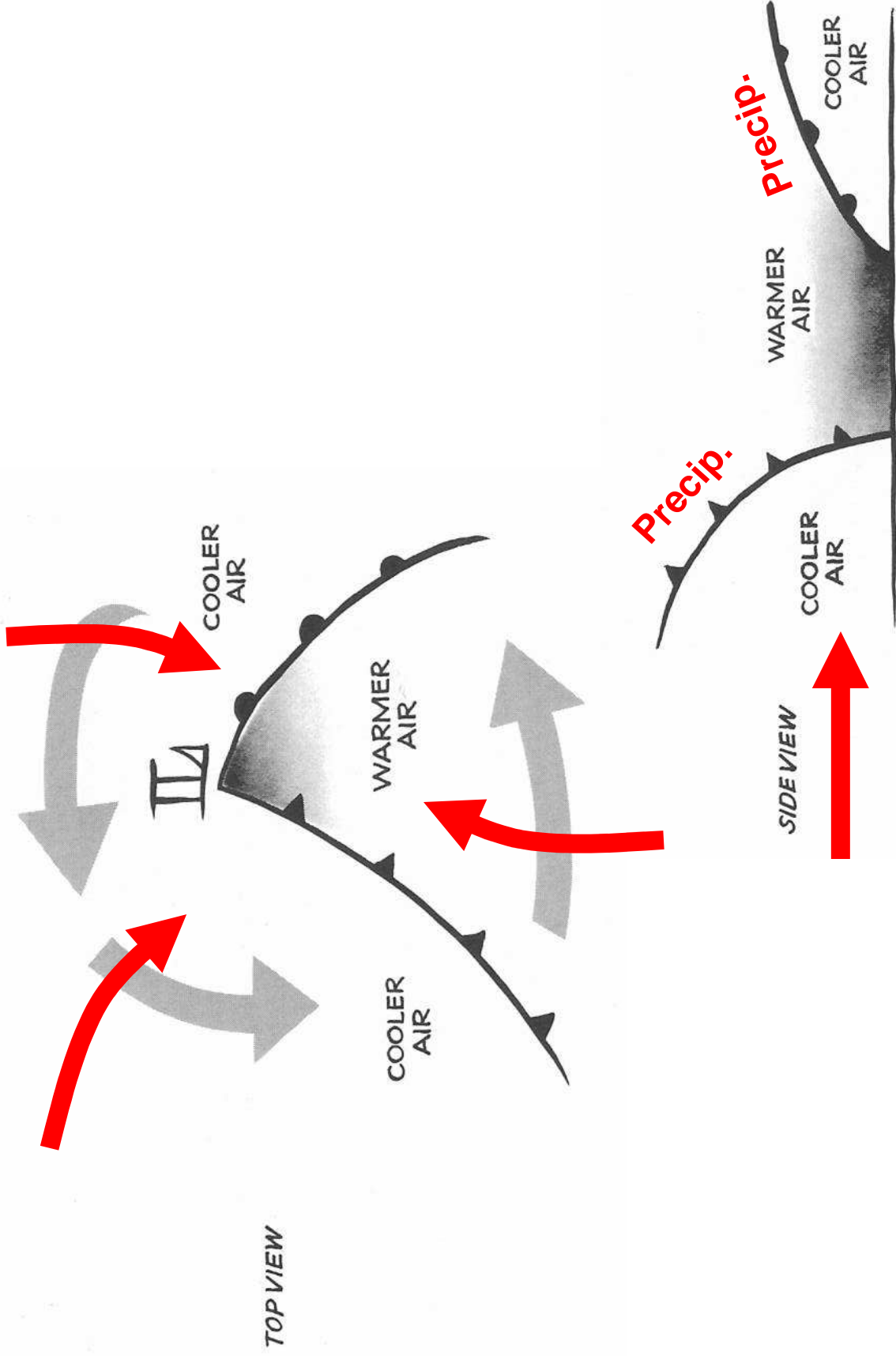
Map of high-altitude jet-stream winds that move large-scale air masses about and steer low-pressure centers



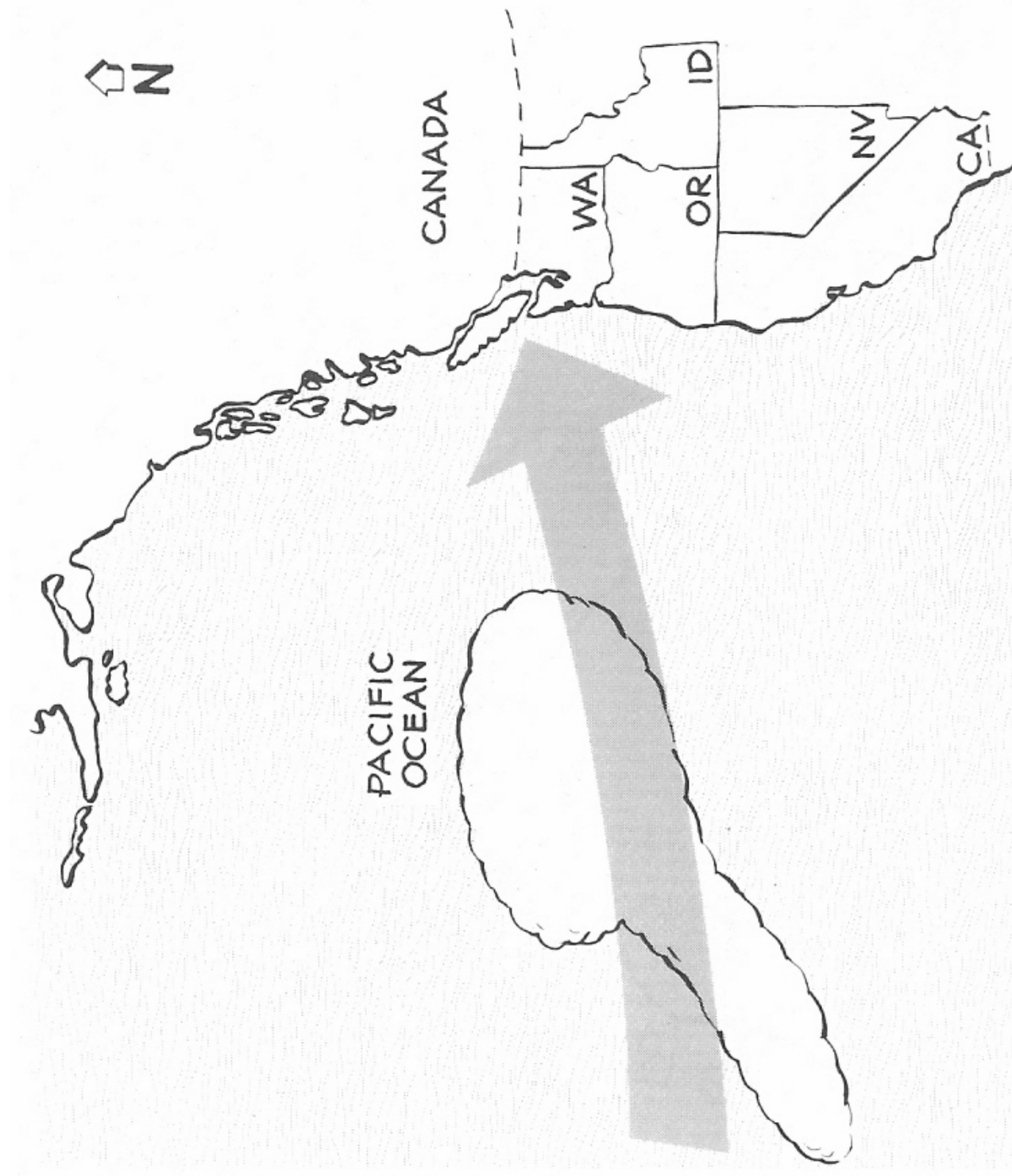
Wind blows from high pressure to low, but large-scale winds are deflected to the right (in northern hemisphere)



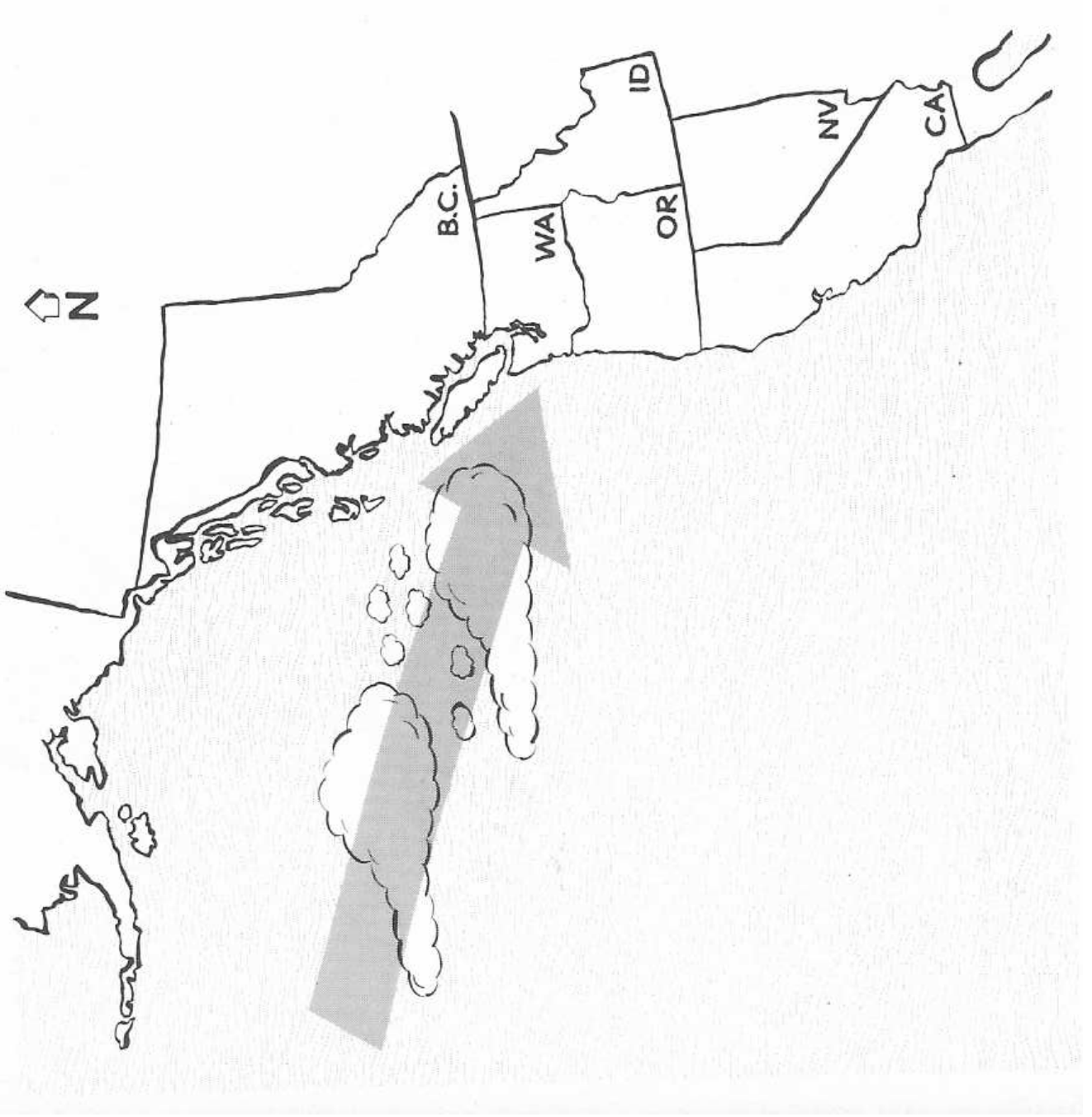
Air convergence and circulation about a surface low-pressure center



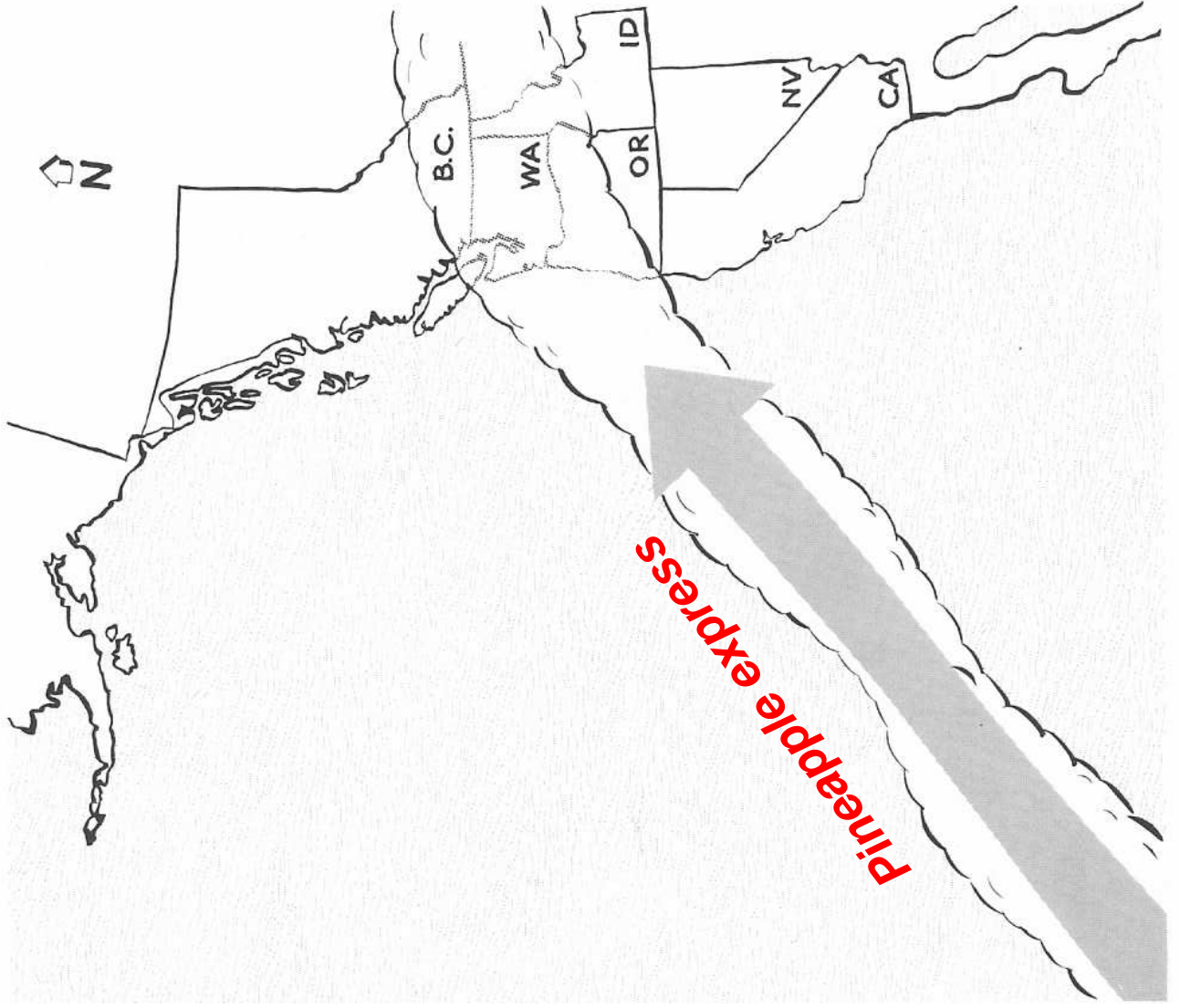
West-southwest storm track



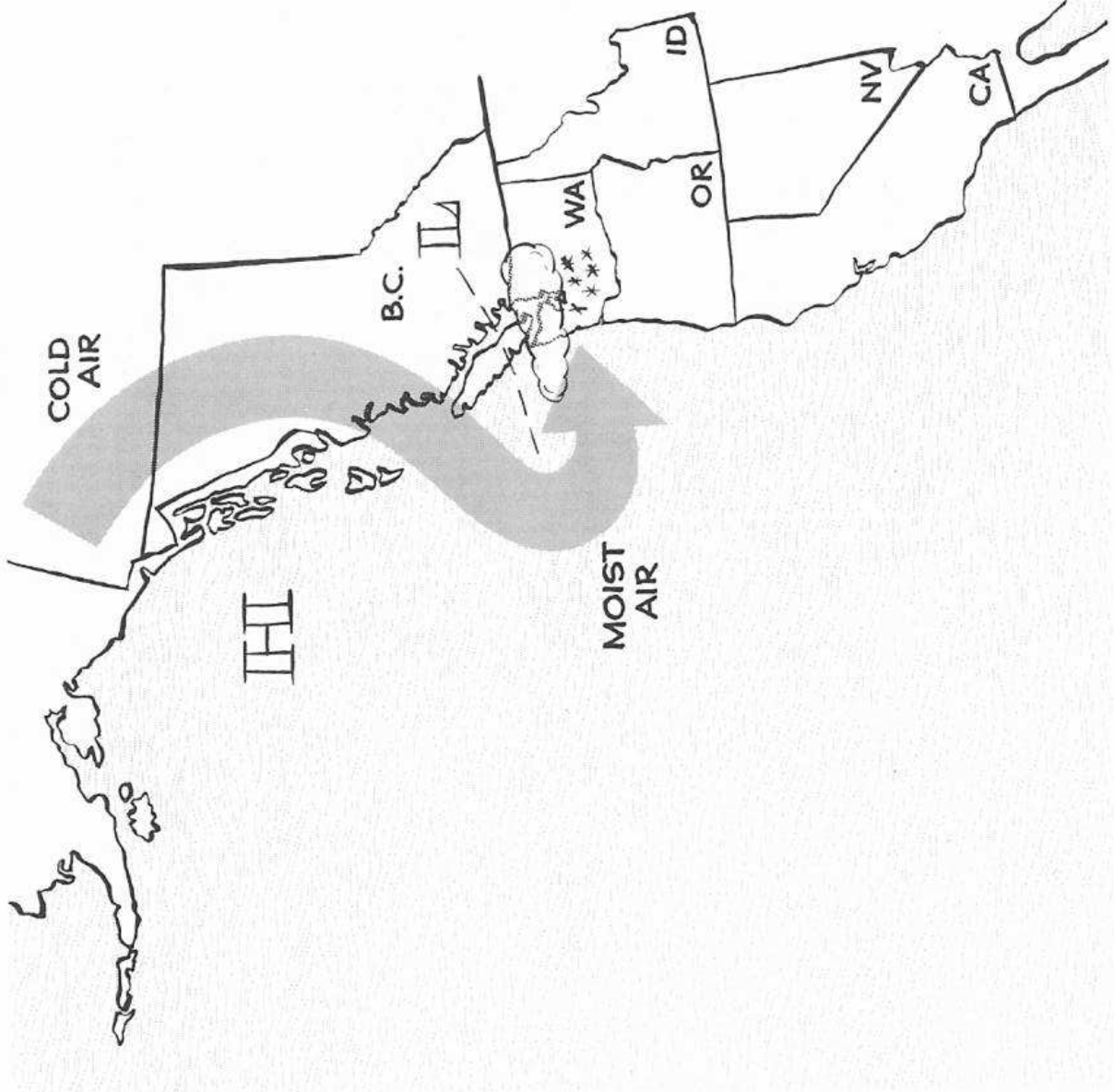
West-northwest storm track



South-southwest storm track



Polar express

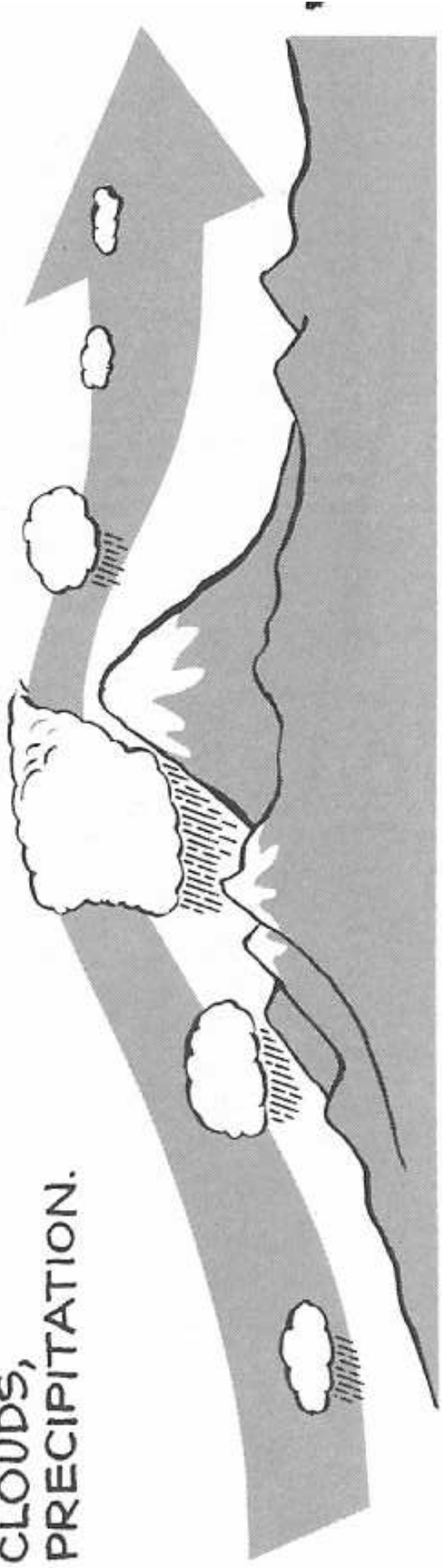


Orographic effect

Moist adiabatic lapse rate: 1 degree F per 300 ft. elevation

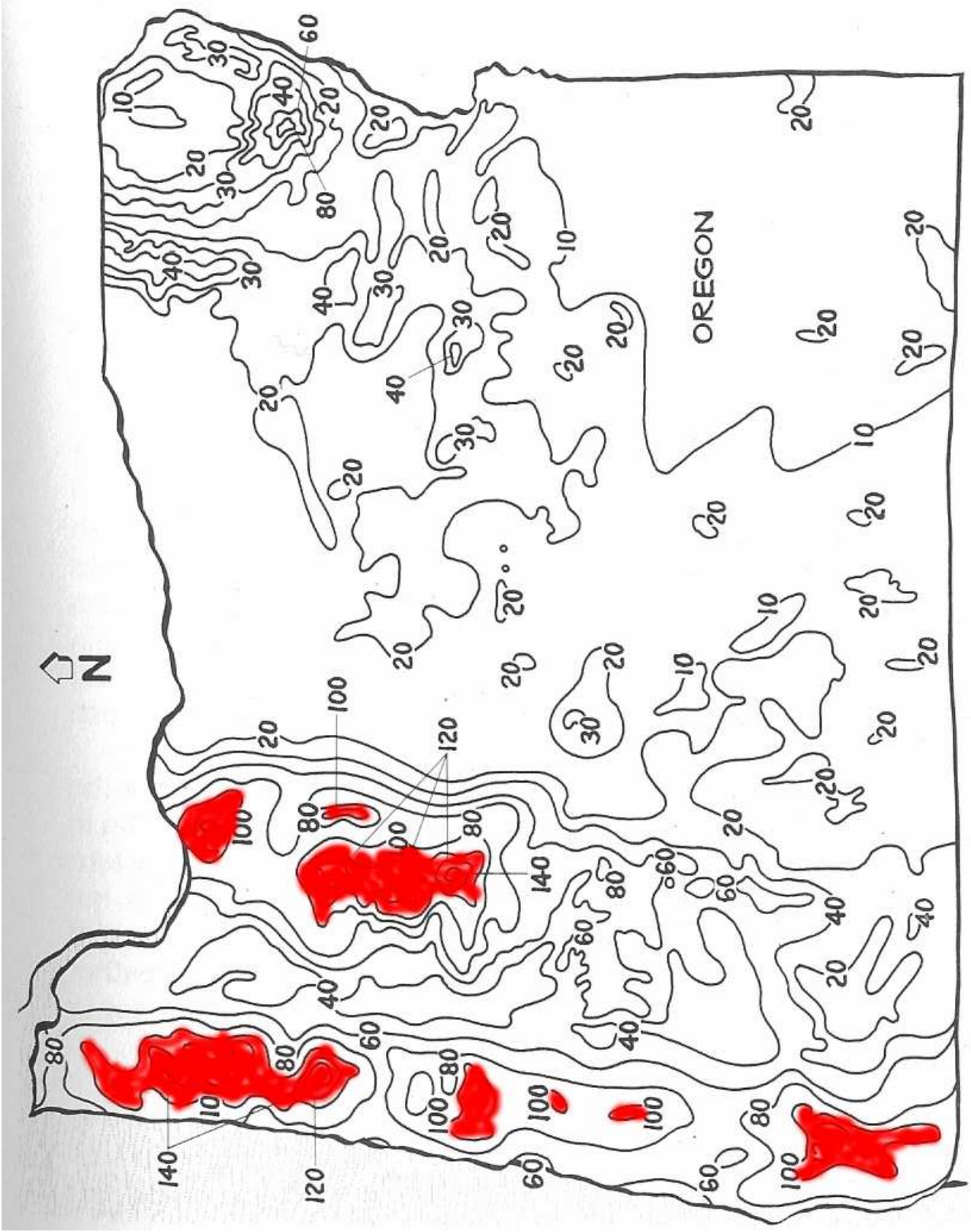
AIR RISES, COOLS,
MORE MOISTURE
CONDENSES INTO
CLOUDS,
PRECIPITATION.

AIR SINKS, WARMS,
CLOUDS EVAPORATE.

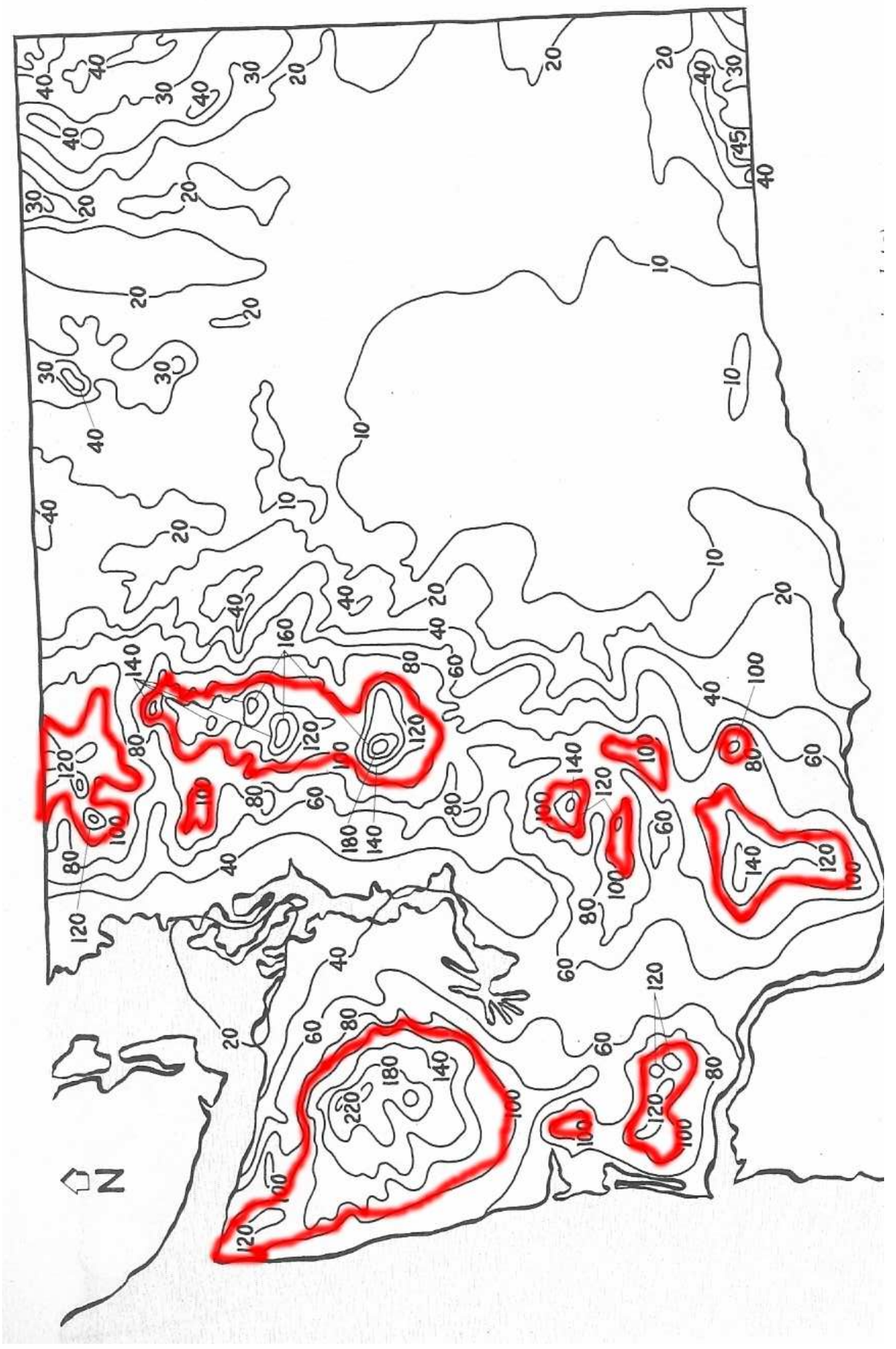


Influence of mountains on precipitation.

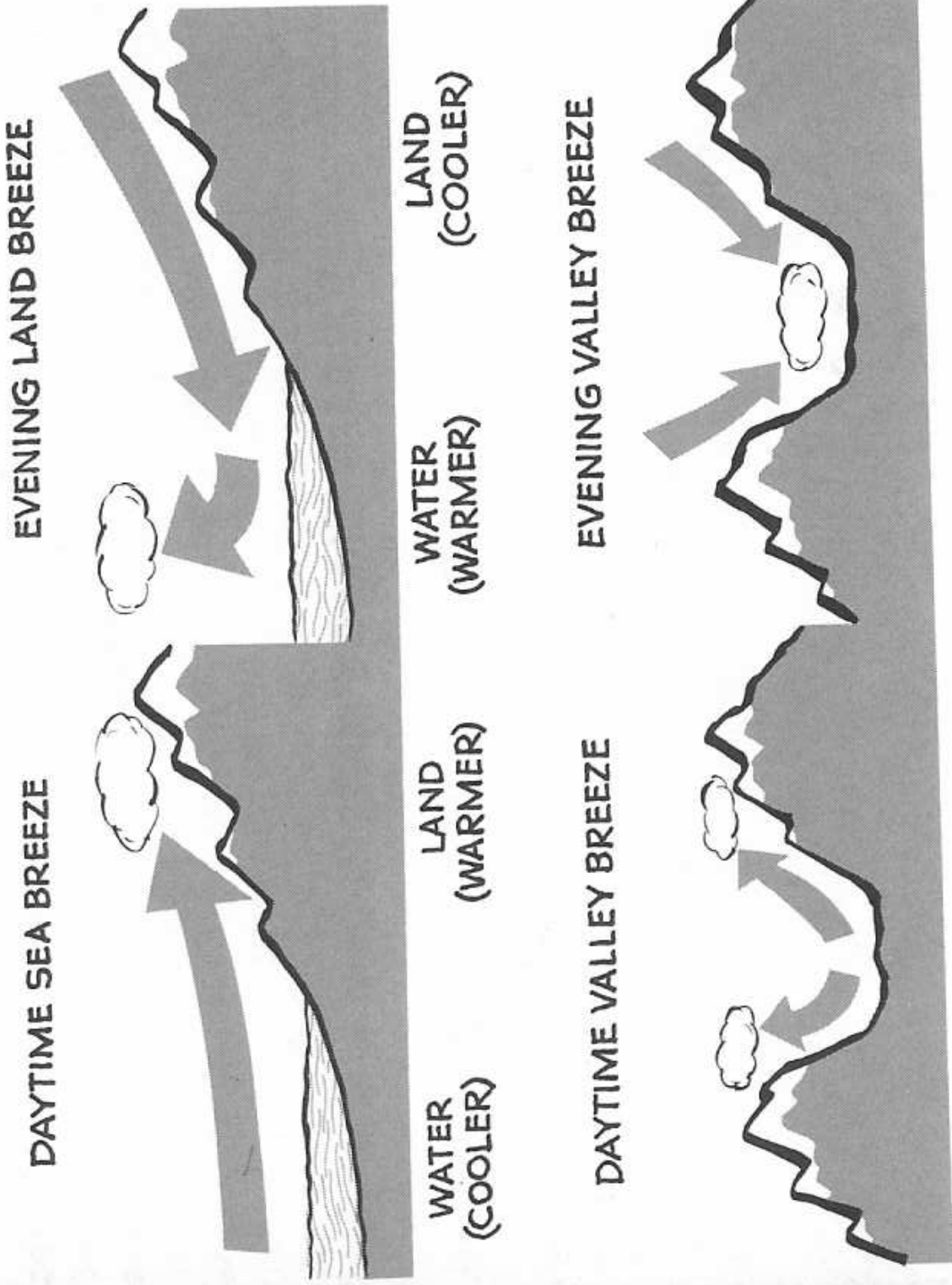
Oregon mean annual precipitation (inches)



Washington mean annual precipitation (inches)



Local thermal winds



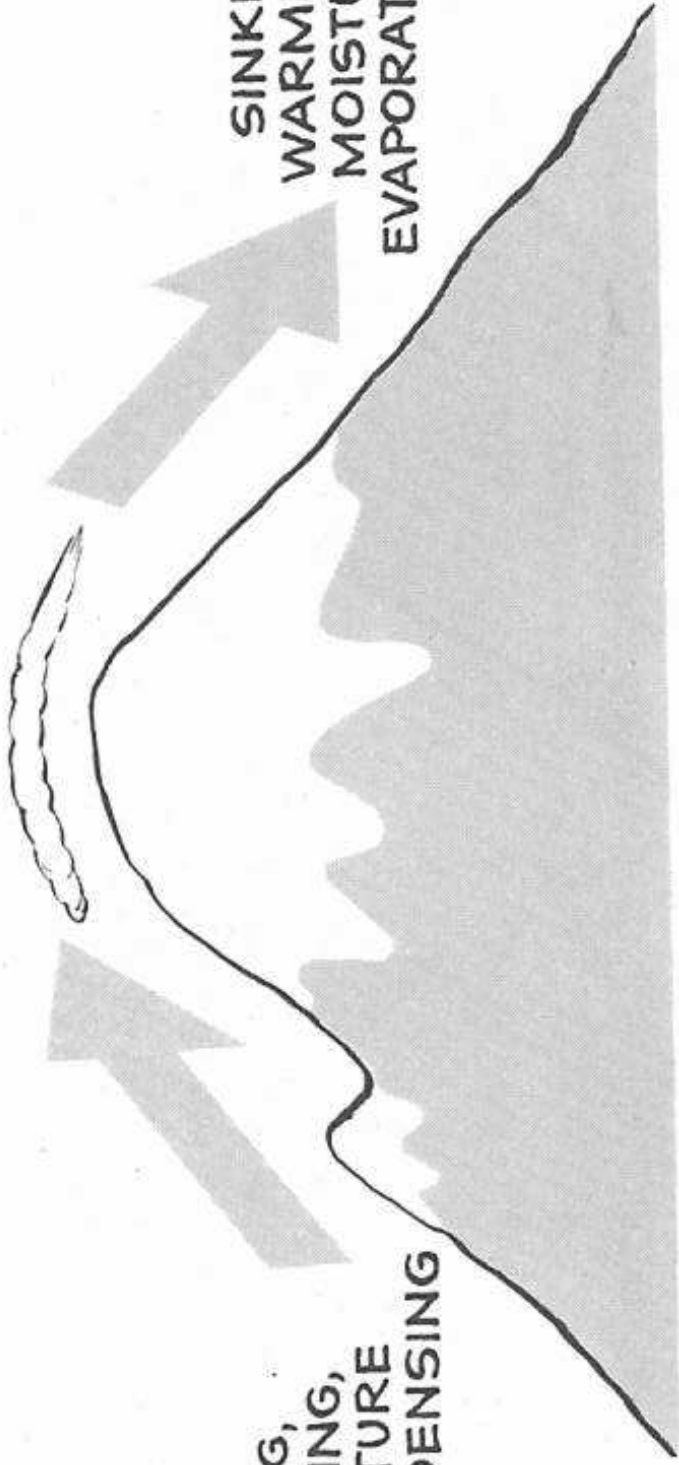
Orographic cloud formation

CLOUD FORMING

CLOUD DISSIPATING

AIR RISING, COOLING, MOISTURE CONDENSING

AIR SINKING, WARMING, MOISTURE EVAPORATING



Weather forecasting in the mountains

- **Use of altimeter as barometer**
(80 ft. elevation gain in 3 hours – impending storm!)
- **Use of electronic gadgets**
- **Interpreting clouds**



**High
Clouds**

above 20,000 feet
(6,000 meters)

cirro-stratus

cirrus

cirro-cumulus

alto-stratus

6,500 to 20,000 feet
(2,000 to 6,000 meters)

alto-cumulus

strato-cumulus

stratus

below 6,500 feet
(2,000 meters)

nimbo-stratus

cumulus

fog

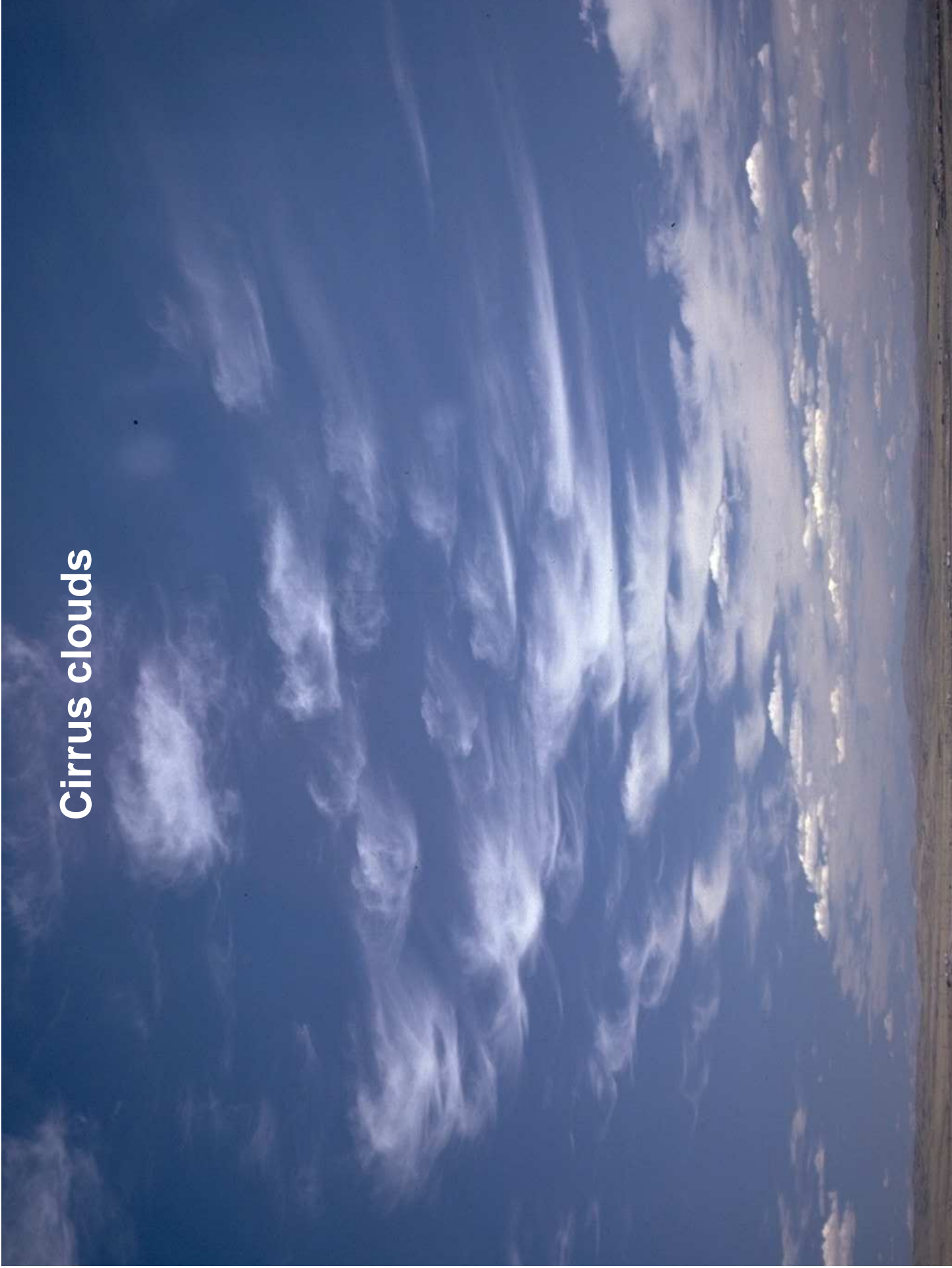
(Made
mostly of
ice
crystals)

**Middle
Clouds**

**Low
Clouds**

cumulo-nimbus

Cirrus clouds



Lenticular clouds, Mt. Rainier



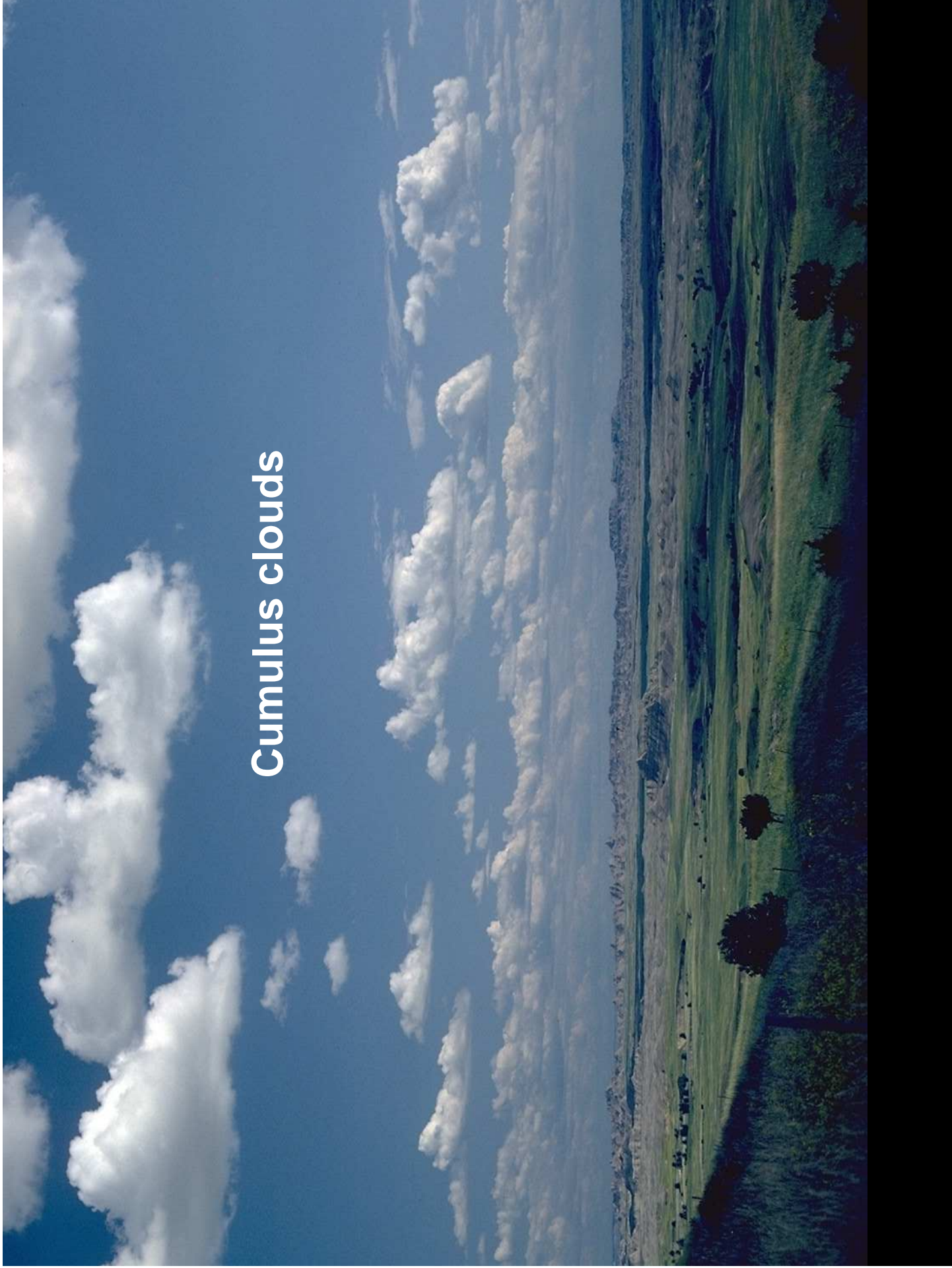
Even cooler lenticulars, Mt. Rainier





Stratus cloud deck

Cumulus clouds



Cumulonimbus clouds (thunderhead)



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Mountain Weather Information Sources

Book: **Northwest Mountain Weather** by Jeff Renner, The Mountaineers, 1992

Online Book: **Practical Mountain Weather** by John Papineau

http://pafc.arh.noaa.gov/classroom/practical_mountain.php

NOAA weather radio

Web sites:

www.mazamas.org (useful links)

www.nws.noaa.gov (U.S. national weather service)

www.weatheroffice.gc.ca (Canadian weather service)

www.nwac.us (northwest avalanche center)

www.avalanche.ca (Canadian avalanche center)

www.avalanche.org (Westwide avalanche network)

www.csac.org (Cyberspace avalanche center)

Daily Weather Log. Station location and elevation: _____

Date	Temperature at 4 AM	Temperature at 4 PM	Wind speed & direction	Precip. type & amount	Comments

<http://www.nwac.us/>

Northwest Weather and Avalanche Center



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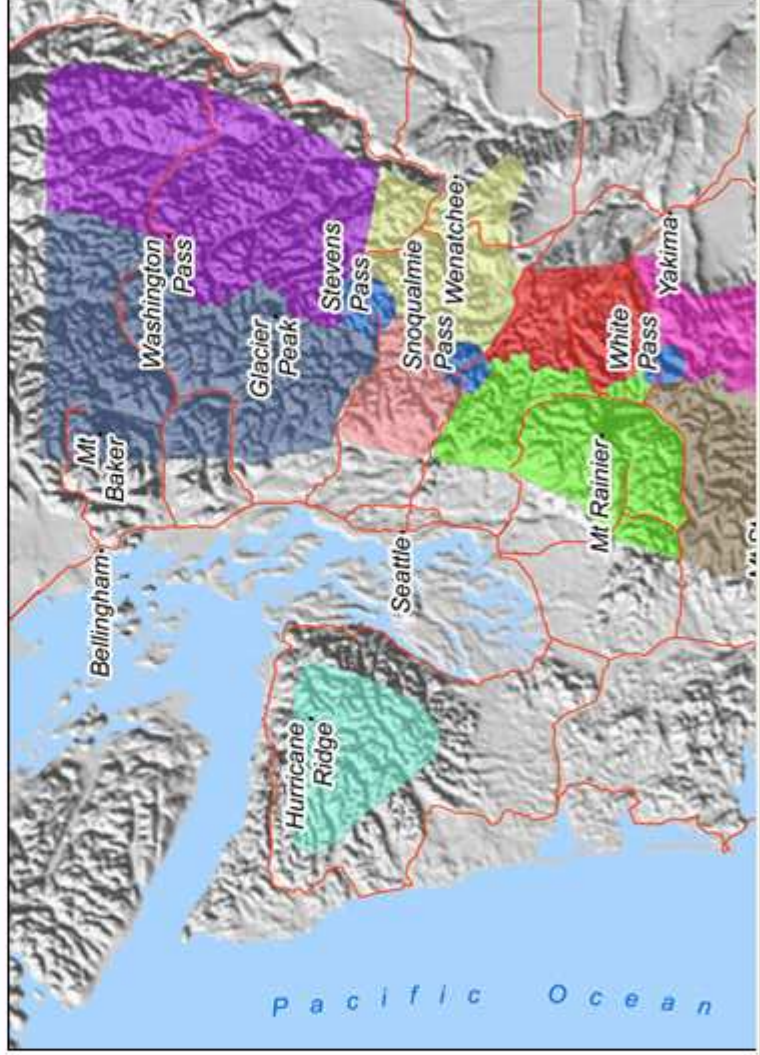


MT·BAKER

www.mtbaker.us

Announcements

Dec. 2009 Friends of NWAC newsletter



NOW 10-Day Alpental
NOW 10-Day Snoqualmie
Pass
NOW 10-Day Crystal Ski
Area
NOW 10-Day Crystal Grn.
Valley
NOW 10-Day Chinook Pass
NOW 10-Day Sunrise
NOW 10-Day Paradise
NOW 10-Day Camp Muir
NOW 10-Day White Pass
NOW 10-Day Mt. St. Helens
NOW 10-Day Ski Bowl-
Gov't Camp
NOW 10-Day Timberline
Base
NOW 10-Day Timberline
Upper
NOW 10-Day Mt. Hood
Meadows

Abbreviated list of NWAC weather stations

Weather Data for Timberline Base - Last 10 days

1-12-2010

Northwest Weather and Avalanche Center
 Timberline Lodge, Oregon

MM/DD	Hour	Temp F	RH & Min	Wind Avg	Wind Max	Wind Dir	Hour Prec.	Total Prec.	24 Hr Snow	Total Snow	
6000' 6000' 6000' 6000' 6000' 6000' 6000' 6000' 6000' 6000'											
1 12	1400	32	100	-0	4	11	324	.05	.34	0	71
1 12	1300	33	100	-0	3	8	290	.04	.29	0	71
1 12	1200	34	100	-0	2	12	303	0	.25	0	71
1 12	1100	33	100	-0	0	6	314	0	.25	0	71
1 12	1000	33	100	-0	1	10	357	0	.25	1	71
1 12	900	32	100	-0	2	8	338	0	.25	0	71
1 12	800	32	100	-0	3	11	323	.01	.25	1	71
1 12	700	32	100	-0	4	10	339	.01	.24	0	70
1 12	600	32	100	-0	2	14	352	.12	.23	0	70
1 12	500	33	100	-0	0	8	356	.05	.11	0	71

1 12	400	34	100	-0	0	4	252	.05	.06	25	71
1 12	300	35	98	-0	4	16	203	.01	.01	26	71
1 12	200	38	73	-0	1	12	165	0	0	26	71
1 12	100	38	71	-0	1	7	320	0	0	26	71
1 12	0	39	64	-0	2	15	255	0	0	26	71
1 11	2300	39	64	-0	1	6	151	0	0	25	71
1 11	2200	39	65	-0	1	7	171	0	0	25	71
1 11	2100	39	66	-0	4	14	169	0	0	25	70
1 11	2000	40	64	0	4	13	173	0	0	0	70
1 11	1900	40	62	0	5	12	153	0	0	25	69
1 11	1800	41	59	-0	3	12	146	0	0	0	69
1 11	1700	41	61	-0	5	13	130	0	0	0	70

1-13-2009
Northwest Weather and Avalanche Center
Timberline Lodge, Oregon

Wind sensors not heating and may rime
Precip gage partially heating, under-recording

MM/DD	Hour	Temp F	RH %	Wind Min	Wind Avg	Wind Max	Wind Dir	Hour Prec.	Total Prec.	24 Hr Snow	Total Snow
		6000'	6000"	6000'	6000'	6000'	6000'	6000'	6000'	6000'	6000'
1 12	1500	48	22	7	14	26	27	0	0	1	102
1 12	1600	48	21	5	13	24	24	0	0	1	102
1 12	1700	46	23	5	14	22	16	0	0	1	102
1 12	1800	44	19	3	14	24	20	0	0	1	102
1 12	1900	45	22	3	15	23	23	0	0	1	102
1 12	2000	44	22	3	15	25	26	0	0	1	102
1 12	2100	46	19	3	17	34	26	0	0	1	102
1 12	2200	45	20	8	17	28	25	0	0	1	102
1 12	2300	45	19	6	19	31	32	0	0	1	102
1 13	0	45	15	7	20	31	39	0	0	1	102
1 13	100	46	14	7	18	30	35	0	0	1	102
1 13	200	47	14	5	16	25	33	0	0	1	102
1 13	300	46	16	6	17	26	37	0	0	0	102
1 13	400	46	13	3	17	27	35	0	0	1	102
1 13	500	47	13	8	18	27	39	0	0	1	102
1 13	600	46	13	3	16	23	42	0	0	1	102
1 13	700	47	12	5	15	24	36	0	0	1	102
1 13	800	48	12	4	16	25	40	0	0	1	101
1 13	900	49	12	6	15	25	39	0	0	1	101
1 13	1000	50	10	3	12	21	36	0	0	1	101
1 13	1100	49	12	2	12	19	29	0	0	0	101
1 13	1200	50	10	3	13	21	32	0	0	1	101
1 13	1300	52	10	2	14	23	24	0	0	1	101
1 13	1400	51	12	1	13	21	16	0	0	1	101

1-9-2009
Northwest Weather and Avalanche Center
Timberline Lodge, Oregon

Wind sensors not heating and may rime
Precip gage partially heating, under-recording
24 snowdepth repaired 1/4

MM/DD	Hour	Temp	RH	Wind	Wind	Wind	Wind	Wind	Dir	Hour	Total	24 Hr	Total
	PST	F	%	Min	Avg	Max	6000'	6000'	6000'	Prec.	Prec.	Snow	Snow
		6000'	6000"	6000'	6000'	6000'	6000'	6000'	6000'	6000'	6000'	6000'	6000'
1 8	500	28	100	6	12	20	342	.1	.1	.1	.1	6	104
1 8	600	28	100	4	10	19	338	.05	.15	.05	.15	8	105
1 8	700	28	100	5	12	23	336	.05	.2	.05	.2	9	107
1 8	800	28	100	7	15	25	333	.01	.21	.01	.21	9	108
1 8	900	26	100	7	15	28	339	.01	.22	.01	.22	9	108
1 8	1000	26	100	5	11	21	340	.01	.23	.01	.23	9	108
1 8	1100	27	100	4	11	18	340	.04	.27	.04	.27	10	108
1 8	1200	26	100	4	11	24	334	.02	.29	.02	.29	11	109
1 8	1300	25	100	7	12	23	335	0	.29	0	.29	11	110
1 8	1400	26	100	4	12	21	329	.02	.31	.02	.31	12	110
1 8	1500	26	100	6	12	23	336	.03	.34	.03	.34	12	110
1 8	1600	25	100	6	14	26	345	.06	.4	.06	.4	13	111
1 8	1700	23	100	4	13	24	350	.02	.42	.02	.42	14	112
1 8	1800	22	100	7	15	25	354	.02	.44	.02	.44	14	112
1 8	1900	20	100	10	16	25	356	.01	.45	.01	.45	15	112
1 8	2000	18	99	10	16	27	0	.02	.47	.02	.47	15	113
1 8	2100	17	99	8	16	26	2	.01	.48	.01	.48	15	113
1 8	2200	18	99	7	14	23	9	.01	.49	.01	.49	15	113
1 8	2300	17	99	7	13	20	5	.01	.5	.01	.5	15	113
1 9	0	16	98	5	13	20	10	0	.5	0	.5	15	113
1 9	100	15	98	3	10	16	7	0	.5	0	.5	15	114
1 9	200	16	98	5	12	19	3	0	.5	0	.5	14	113
1 9	300	16	98	2	8	17	2	0	.5	0	.5	1	113
1 9	400	20	100	-0	7	18	32	0	.5	0	.5	1	113