TYPES AND CYCLES OF SUMMER WEATHER

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In this research, the three summer months, June, July and August of 1938, 1939 and 1940 were investigated in an attempt to pick out some definite weather types which could be used in any summer month of any year. The attempt was made to pick out the types without reference to any past types found in winter months. This was done by going through the daily synoptic charts and trying to find a periodicity in the movement of frontal systems or pressure centers. The days were counted from the time frontogenesis began in the Western part of the Continent until the resulting wave left the Atlantic Coast.

Only the most definite pictures were taken and finally called types, as there were numerous periods where no definite sequence or movement of the systems could be observed. These generally were in transition stages from one type to another. The enclosed tables which give a picture of the daily synoptic charts as to location, shape and movement of the systems were devised before attempting to pick out any of the types. This was done to see if there was any sequence in the movement of the centers or any relation between the type of weather prevalent on the Continent and the shape, position and intensity of the anticyclones and frontal systems in the Pacific and in Canada.

There were finally four different types picked out. These have been called, for the sake of convenience, B-w, R, 9-day, and 16-day types. The reason for giving them different names was that all had different length periods; i.e., 6, 3, 9 and 16 days respectively. Other than that, their general characteristics and appearance were practically the same. It is believed that the difference in length of period is largely due to the shape and location and intensity of

of the Pacific Anti-cyclone. For example, it was observed that when the Pacific anti-cyclone was large and fairly intense with an East-West orientation, fronts on the Continent were more persistent and also had an East-West orientation. On the other hand when the Pacific Anticyclone was fairly broken down and displaced far to the West, fronts passed rapidly across the Continent and off the Atlantic Coast. Also the location of low centers and frontal systems in the Pacific and their intensity seems to have an important part in the period of these types.

For cycles or types of the same period, it was noted that the synoptic charts apparently had the same conformation, that is, except for small variations, the day by day appearance of the weather maps was identical. For cycles that were alike a general picture of the sequence of weather events was drawn up. This picture was called a type. A type is represented by several small maps to show the average progression of weather events during the period of the cycle.

Explanation of the Tables

After repeatedly looking through the file of large maps in the Meteorology Department of the California Institute of Technology in the search for types and cycles, it became apparent that certain dominant features were characteristic of the summer maps. If these certain dominant features were tabulated it was thought that the weather situation for as long a period as a month could be comprehended at a glance. Also the influence of these dominant features upon the persistence and change of types could be studied more easily and carefully without the necessity of handling large and bulky maps.

With this end in view a worksheet was constructed for each month to be used in a statistical study of the characteristics of each type. This table shows the exact day of the month each type began and ended, and the number of days in each cycle. It is thought that such a table as this worksheet might aid in future research to discover the indications for a change in type or the reasons for a long or short period.

In order that this statistical tabulation of data on the worksheet convey an impression to the mind of the reader of the characteristics of the weather map, some explanation of the headings in the table and the entries thereafter is necessary:

Date:

4:30 a.m. maps were the daily reference, but in the case where this map was missing, the fraction "½" indicates the use of the evening map.

Type:

The type of weather persisting a fter the beginning of any cycle is indicated.

Day of Cycle:

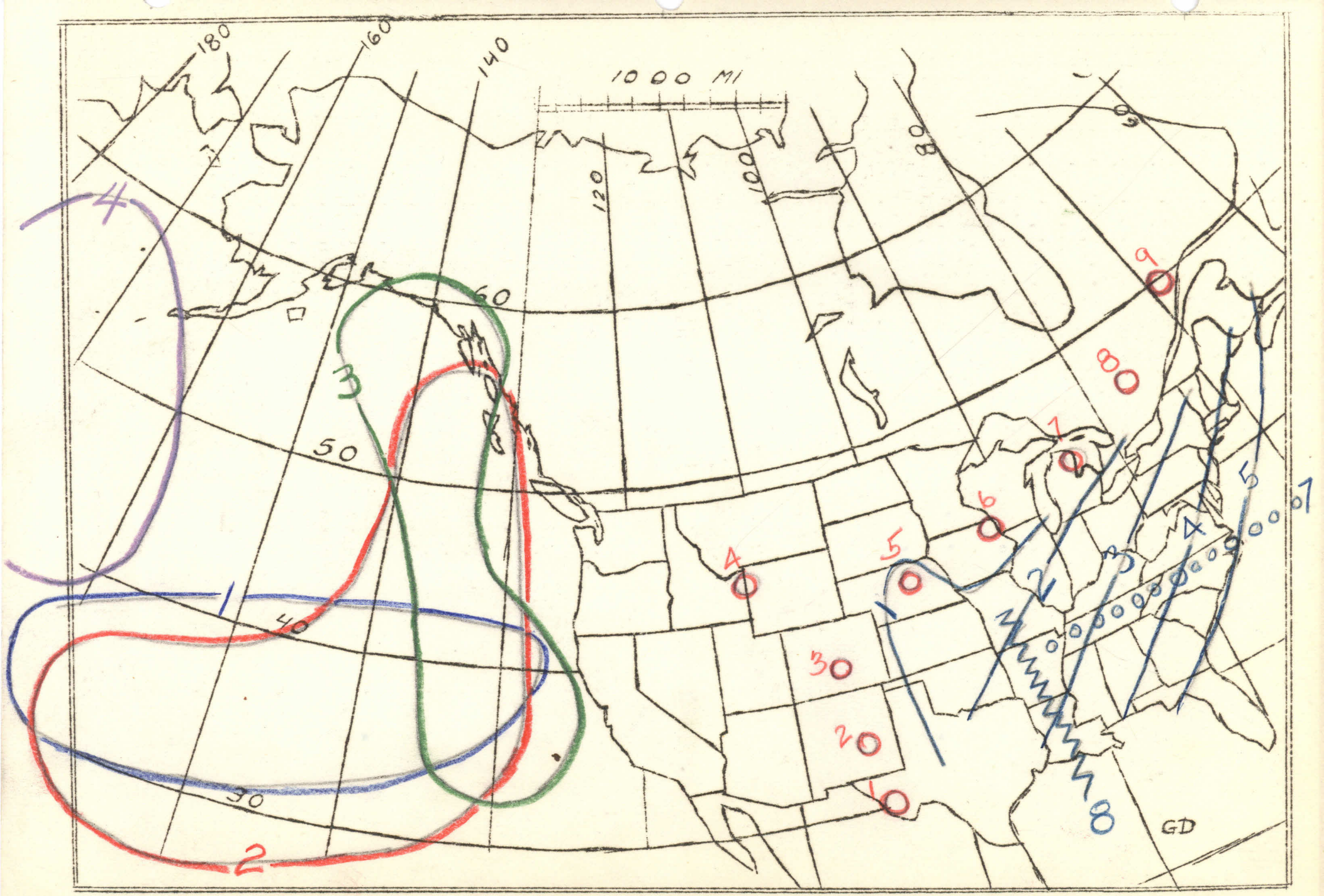
The criterion for the length of cycle is the number of days between the inception of the wave and its passage off the Atlantic coast of the United States. Invariably the place of frontogenesis and first appearance of the wave was in the west central part of the United States. An average position of the start of these summer waves would be the location of the states of Colorado and Kansas. It will be noted that there is sometimes a double entry such as "1/8" under a certain date. This means that before the wave of the previous cycle had passed off the Atlantic Coast, the new wave of the following cycle had already formed.

Aleutian Low:

If the Aleutian low was centered at latitude 60 degrees, it was entered as normal; if above 60 degrees, high; if at 50 degrees, low; and if at 40 degrees, extremely low (a check mark with the subscript "x" in the row with the heading "low").

Tg:

The invasion of Tropical Gulf air into the interior of the United States and its contact there with Polar Pacific air that had come over the mountains from the west, or with Polar Continental air that had rushed down from the north, was responsible for the start of the wave and the beginning of the cycle. "Starts" means that the circulation was favorable for the commencement of a flow of Tropical Gulf air over Texas. It may have already invaded the coastal region of Texas. "Deep" refers to the inflow of Tropical Gulf air having reached as far as northern Texas, Oklahoma and Kansas. "Boundary" signifies that the wave which now extends over most of the Central and Eastern States in



Key Map to Tabulation on Work Sheet

1938 JUNE

(best example: June 1–3; best example: June 10–13)

	1	2	3	4	5½	6	7	8	9	10	11	12½	13	14	15	16	17	18	19½	20	21	22	23	24	25	26	27	28	29	30
TYPE	R			R			R			R				BW							BW							BW		
DAY OF CYCLE	1	2	3	1	2	3	1	2	3	1	2	3	4	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3
ALEUTIAN LOW – HIGH																														
ALEUTIAN LOW – NORMAL		L	L	L	L	L	L	L	L	L	L	L	L		L	L	L	L			L	L	L	L	L		L	L		
ALEUTIAN LOW – LOW	L																												L	L
ALEUTIAN LOW – NONE														L					L	L										
TG – STARTS				L		L			L																		L			
TG – DEEP										L		L	L	L															L	L
TG – BOUNDARY	L	L	L				L				L				L	L	L	L	L	L	L	L	L	L	L					
TG – NONE					L			L																				L		
WAVE OCL.		L	L	L	L	L	L	L	L		L	L	L				L					L	L	L			L		L	
WAVE POS.	2	3	5	2,5	5	1	3	5	5	1	3	4	5	1	2	3	3	4	4	7	5	1,5	2	2	2		4	5	5,1	5,1
LOW POS.	X	7	9	7,9	9	7,9	8	8	9	X	8	9	9	5	9	6,9	3,7	5,8	X	9	9	9	9	9	5		8	X	8,4	8,4
LOW CANADA – Above 60°		WE		W					E	E	C	E	E	E	W		W	W	W	WC	E	E	E	E	E				E	
LOW CANADA – BORDER	E	WE	CE	E	CE	CE	C	E					E	C	E	WE				E		E								W
HIGH CANADA – Above 60°	C		C	E			W	W	W		W	W											W	W	W			C	C	E
HIGH CANADA – BORDER						W	W									C	CE	C	E		E			W	W		C	C	C	
FRONT CAN. EAST ROCKIES								F	F						F	F	F	F	F										F	F
PAC. HIGH BULGE – LOW														L	O		L	L	L											
PAC. HIGH BULGE – HIGH	L	O	L	O	L	O				L	O									L	L	O								
PC OUTBREAK						L	L	L																			L	L		
PAC. HIGH POSITION	2	2	2	2	2	1	1	2	2	1	1	2	1	1	1	2	1	1	1	2	3	3	3	2	3		2	2	2	2
AIR MASS N.	P_p	"	"	"	"	"	P_c	"	"	"	"	"	"	"	"	"	"	"	X	P_c	"	P_p	"	P_c	"		"	"	"	P_p
AIR MASS S.	T_G	"	T_A	"	"	R_{pp}	T_G	"	T_A	T_G	"	"	T_A	T_G	"	"	"	"	X	T_G	"	"	"	"	"		"	T_A	"	T_G

1938 JULY

not representative — not representative

		1	2	3	4½	5	6	7	8	9	10½	11	12	13	14	15	16	17½	18	19	20	21	22	23	24½	25	26	27	28	29	30	31½
DATE																																
TYPE						BW							BW						BW						BW							
DAY OF CYCLE		4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7,1	2	3	4	5	6	7,1	2	3	4	5	6	7	8
ALEUTIAN LOW	HIGH				L	L	L			L	L	L		L	L			L														L
	NORMAL	L	L						L	L	L	L	L	L			L			L					L	L						
	LOW							L								L		L					L	L								
	NONE																		L		L	L					L	L	L	L	L	
TG	STARTS															L	L															
	DEEP	L				L	L						L																			L
	BOUNDARY		L					L	L	L		L		L	L			L	L	L	L	L	L	L			L		L	L	L	
	NONE				L						L														L	L		L				
WAVE OCL.			L		L	L								L		L	L				L	L			L	L				L	L	X
WAVE POS.		1	3		5,1	5,1	5,1	2	2	3	6	6	1,5	2,5	3	4	5	3	3	4	3	3	3	4	5,3	1 2,5	6,5	2,5	3	3	4	1,3
LOW POS.		3	8		3,8	3,8	5,8	5	7	8	9	4,9	4,8	6,8	7	8	3,9	8	X	6	9	9	X	4	5	9	X	9	6	8	8	9
LOW CANADA	Above 60°	W	C					W	W	W				E	C	C		C	C	E	E	E	E	C	E	E	C	WC	C	C	C	CE
	BORDER				WE	WE	WE	W	WC	WE	E	WE	C		E	E	CE	E		C										WE		
HIGH CANADA	Above 60°	E			E	E	E	E	C	C			C	C			W															
	BORDER	E			E	E	E	E					E	C			W									W	C	C	E			C
FRONT CAN. EAST ROCKIES		F	F		F	F	F	F	F	F	F	F	F	F		F		F												F		
PAC. HIGH BULGE	LOW					L	O	O		O																						
	HIGH											L	L	L	O	L		L	L		L	O	L	L	L	O						L
PC OUTBREAK																																
PAC. HIGH POSITION		2	3		1	1	1	2	1	1	1	1	1	2	2	2	1	2	2	1	2	1,4	2	3	1,4,3	2,4	1	1,4	1	2	2,4	1
AIR MASS N.		Pc	"		X	Pc	Pp	"	"	"	X	Pp	"	"	"	"	"	X	Pp	Pc	"	"	Pp	"	X	Pp	"	"	"	"	"	"	Pc
AIR MASS S.		TG	"		X	TA	TG	"	"	"	X	TG	"	"	"	"	"	X	TG	"	"	"	"	"	X	TG	"	"	"	"	"	"	TG

1938 AUGUST

good example

DATE	1	2	3	4	5	6	7½	8	9	10	11	12	13	14½	15	16	17	18	19	20	21½	22	23	24	25	26	27	28½	29	30	31
TYPE		BW						BW				BW						R				R									
DAY OF CYCLE	9	1	2	3	4	5	6	7,1	2	3	4	5,1	6,2	3	4	5	6	7,1	2	3	4	1	2	3	4						
ALEUTIAN HIGH	L									L	L	L	L			L	L	L	L		L	L	L	L	L	L	L	L	L	L	L
ALEUTIAN NORMAL	L								L						L																
ALEUTIAN LOW														L										LX	LX	LX	L		LX	L
ALEUTIAN NONE		L	L	L	L	L	L	L												L										
TG STARTS			L											L				L				L	L	L		X				
TG DEEP					L	L				L					L	L			L									L	L	L	
TG BOUNDARY	L	L		L			L	L	L		L						L			L	L										
TG NONE												L	L												L		L			L	
WAVE OCL.	L	L	L	L	L	L	L	L		L	L	L	L		L			L	L	L	L	L		L		L		L		L	L
WAVE POS.	3	3,1	1	2	4	3	1	3	1	2	3	5	5,1	2	2	2	3	5,8	1	1	3	1,5	2	3	5,3	2,5	2,3,5	5	2,7,5	1	1
LOW POS.	7	8,5	6	8	9	9	9	9	5	6	7	8	9,5	7	9,2	5	7	5,8	5	6	8H	5,9	5	5,8	8,3	9	3,9	8	5	5	3,6
HIGH LOW CANADA Above 60°	WC	W	W	C		C		E	C	E	WE	C	W	E		W	WC	E			C			C	C	CE	E	C	WE	E	E
HIGH LOW CANADA BORDER		E	E	C	CE	E	E	E		C	E	E	WE	C	WE			W	WE	CE		CE	E		C	E	E	E	WE		C
HIGH CANADA Above 60°																			E	E							W				W
HIGH CANADA BORDER							C	W	WC		W				C	E	E	E				W	W	C			W	W	C	C	
FRONT EAST CAN. ROCKIES	F	F	F									F	F		L		F	F									F		F		
PAC. HIGH BULGE LOW		L	L	O										L	L	L	O	L	L	O											
PAC. HIGH BULGE HIGH						L	L	L	L	O											L	L	O						L	O	
PC OUT BREAK PAC. HIGH POSITION	1	1	1	1	2	2	2	2	2	2	1H	1H	1H	2	2	2	1H	1H	1H	3H	2	2	1H	4	4	4	1	2	2	X	2
AIR MASS N.	Po	Pp	"	"	"	"	Pc	"	Po	Pp	"	"	"	X	Pp	Pc	"	"	Pp	Pc	"	"	"	"	"	P	P	X	X	Pp	Pp	"
AIR MASS S.	TG	"	"	"	"	"	TA	"	TG	"	"	TA	"	X	TA	TG	"	TA	TG	"	"	TA	Po	"	TA	TG	X	X	TG	TG	"

good example — good example

1939 JUNE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
DATE					5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
TYPE					9									9										9						
DAY OF CYCLE					1	2	3½	4	5	6	7	8	9	10/1	2	3	4	5	6	7	8	9	10	1	2½	3	4	5	6	7
ALEUTIAN HIGH																														
ALEUTIAN NORMAL					L	L	L	L	L																			L	L	L
ALEUTIAN LOW								L			L			L	L	L					L	L	L	L	L	L	L	L		
ALEUTIAN NONE												L		L			L													
TG STARTS					Lx							L	L				L				L			L						
TG DEEP						L									L	L		L							L	L				
TG BOUNDARY							L	L	L	L									L	L		L	L				L	L	L	L
TG NONE											L																			
WAVE OCL.							L	L		L	L	L				L				L		L	L	L	L			L	L	L
WAVE POS.					1	1	2	3	4	3	3	4	4	N	1	1	1	1	3	3	1	2	5	1	1	1	2	3	?	3
LOW POS.					4	4,9	N		8	6	7,9	8	2	3	6,9	5	3	5	6	9,2	5	6	7	4	5	5	?	9	?	7
HIGH LOW CANADA Above 60°												E	W	E	E				E		E		C					E		C
HIGH LOW CANADA BORDER					E	E	C	C	E		C		E					E	E	W	C	E	E	W		WC E		W	E		
HIGH CANADA Above 60°												W	W	W	W	C	C		C		?	?		E	E	C			W	W
HIGH CANADA BORDER					W	C	C	C	C	C	C		E	W	W	C	C	E	E	?			E			E			W	W
FRONT CAN. EAST ROCKIES																						L				L				
PAC. HIGH BULGE LOW							L					L							L	L					L	L	O			
PAC. HIGH BULGE HIGH																				L	L									
PC OUTBREAK					L	L								L	L													L	L	L
PAC HIGH POSITION					1	1	2	1	3	3	3	3	1	1	1	1	1	1,4	2	2	2	3	2	2	1	1	1	1	1	1
AIR MASS N.																														
AIR MASS S.																														

good example | poor ex. | best example | good ex.

1939 JULY																														
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
TYPE			9									R				9										BW					BW	
DAY OF CYCLE		8,1	2	3½	4	5	6	7	8	9	10	1	2	3	4	1	2	3	4	5	6	7	8	9	10,1	2	3	4	5	6	7,1	2
ALEUTIAN LOW	HIGH			L																			L	L	L							
	NORMAL	L	L				L												L	L		L					L		L	L		L
	LOW																				L											
	NONE																															
TG	STARTS	L										L	L	L	L											L						
	DEEP		L	L	L											L	L	L	L						L							
	BOUNDARY					L	L	L	L	L	L									L	L	L	L	L			L	L	L	L	L	L
	NONE																															
WAVE OCL.			L			L		L	L	L	L			L	L							L	L	L				L	L	L	L	L
WAVE POS.		1	1	3	1	1	2	3	3	4	5	5	1	1	4	1	1	1	1	4	4	4	4	4	4,1	5,1	1	2	3	3	4	2
LOW POS.		4	4	3	3	2		6	9,7	8	9	9,4	4	6	8	4	4	4	6	X	7	8	8	8	8,4	9	X	X	9	9	7	
HIGH LOW	Above 60° Canada					E		C	E			C	C								C	C	E	E	C	E	C	E	E	E	E	
	BORDER Canada	EW	C		E				E	EC	E	EW	EW	C	E	EW	EW	EW	EW	W	W	C	E	E	E	W	C			W	C	?
	Above 60° Canada															C	C	C	C			W								C	W	C
	BORDER Canada							E		W	WC		C	W	W	C	C		C	C	E	E				C	E	W	C	C	E	C
FRONT CAN.	EAST ROCKIES											L														L			L	L		
PAC. HIGH BULGE	LOW						L	L	L	O			L				L	L	O		L	L	O								L	
	HIGH																									L	L	L	O			
Pc OUTBREAK													L	L	L	L	L	L														
PAC. HIGH POSITION		2	1	1,2	1,4	1,4	1	1,4	1	1,4	1,4	1,2	2	1	2	1,4	1	1	1	1	2	2	2	2	1,4	2	2	2	1	1	1	1
AIR MASS N.																																
AIR MASS S.																																

1939 AUGUST — good ex. — good ex. — a. (See other side)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
DATE																																
TYPE						BW					?							BW					R				?					
DAY OF CYCLE		3	4	5	6	7,1	2	3	4	5	6,1	2	3	4	5	6	7	8,1	2	3	4	5	6,1	2	3	4	1					
ALEUTIAN LOW	HIGH							L	L	L	L									L		L				L	L	L				L
	NORMAL	L	L	L	L	L	L						L	L	L		L	L	L		L		L	L					L	L	L	
	LOW										L	L				L				L												
	NONE																								L							
TG	STARTS													L	L			L	L													
	DEEP	L						L	L		L	L				L	L															
	BOUNDARY		L	L						L			L														TM					
	NONE				L	L	L													L	L	L	L	L	L	L		L	L	L	L	L
WAVE OCL.		L		L	L	L	L			L	L		L	L	L			L		L	L	L			L		L	L	L		L	
WAVE POS.		1	2	3	4	5	5	1	2	3	5	1	1	1,4	4	5,1	3,1	4	5	7	3	3	5,1	5,2	5,2	6	5	5,1	5,1	6,5	5	5
LOW POS.		5	6	7	8	9	3,9	3	5	7	9,5	6	5	8	8	3	8,5			9	7	6	7	6,9	9	8	9	4,9	7	X	X	3
HIGH LOW CANADA	Above 60°	W	W	C	E	E						WE		WE	WE			WE	WE	W	WE		C	W	C	C	WE	W	C	W	W	WE
	BORDER	E		C	E	E	WE		C		E		WC	WE	C	C	C			E		W		WE	C	E	E	WE		W	W	
	Above 60°	C		E		C	C	C					W		C				C	C		C				W		C		C	C	W
	BORDER	C	E	W		C	C	WE	E	W	C	C		C				WE	C	C	E					E	C	C		C	C	WE
FRONT EAST CAN ROCKIES					L	F						F	F	F	F	F		F	F		F		F	F	F	F		F	F	F		F
PAC HIGH BULGE	LOW	L		O																									O			
	HIGH		L				L	L	L	O					L		L	O	L	L	O	L							L			L
Pc OUTBREAK																																L
PAC HIGH POSITION		1	1	1	1	1	2	2	2	1	1	1	1	1	1	2	1	2	2	2	2	2	1	1	1	1	1	2	1	1	1	2
AIR MASS N.		P_P	"	"	"	"	"	"	"	"	P_c	"	"	"	"	"	"	P_o	"	X	X	P_P	"	"	"	X	P_P	X	P_o	X	X	P_c	
AIR MASS S.		T_G	"	"	"	T_A	"	T_G	"	"	T_A	T_G	"	"	"	"	"	T_A	"	X	X	T_A	T_M	"	"	X	T_A	X	T_M	X	X	T_M		

a) Aleutian lows come straight in and at a rather low latitude to reduce Pacific High to low latitude---these waves shooting in straight eastward cause series of confused waves to cross the United States---the orientation of the Pacific High is North West--South East.....Three day period for waves to reach coast.

1940 JUNE

poor example — poor ex. — poor ex.

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
TYPE	16															BW					BW					BW				BW
DAY OF CYCLE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16 1	2	3	4	5	1	2	3	4	5	1	2	3	4	5 1
ALEUTIAN LOW HIGH																														
ALEUTIAN LOW NORMAL	L	L	L				L	L	L	L			L	L	L				L				L	L						
ALEUTIAN LOW LOW			L	L	L	L				Lx	Lx	L				Lx	Lx	L		L	L	L								L
ALEUTIAN LOW NONE																									L	L	L	L	L	
TG STARTS	L	L														L		L		L										
TG DEEP			L			L								L			L					L				L			
TG BOUNDARY				L	L		L	L	L	L	L	L	L		L				L				L	L	L			L		
TG NONE																					L					L			L	L
WAVE OCL.		L	L		L	L	L	L			L	L		L	L	L	L	L	L	L	L		L	L	L	L	L	L	L	L
WAVE POS.	1,5	1	2	2	2	6	2	2	3,1	3	3	3	3	1	3	5	2	2	3	6	5,1	1	2	3	5	5,2	1	2	4	2,5
LOW POS.	5,7	6H	8	5,8	3,7	4,9	6,7	6,8	1,5	6	7	8	8	5H	8	9	7H	8H	9	9	5,9	5	6	6	8	5,8	5	6	8	9
HIGH LOW CANADA CANADA Above 60°				W						W					W		W				W			W			W			
HIGH LOW CANADA CANADA BORDER		CE	E		W	WE			W	WC	W	C	WE	CE	E	WE	WC	E	E	WE	E	W		C		WC	WE	E	E	E
HIGH LOW CANADA CANADA Above 60°	C	W		E			W		W			W				C	W	W								W				
HIGH LOW CANADA CANADA BORDER			C	E			E	C		E			C			C		W	W	C	C	E								W
FRONT CAN. EAST ROCKIES	L		F	F		F	F	F		F	F		F	F	F		F			F	F	F			F	F				
PAC. HIGH BULGE LOW							L	L	0				L													L	L	0		
PAC. HIGH BULGE HIGH			L	L	L	0								L	0	L	L	0				L	0	0						
Pc OUTBREAK																				L	L								L	
PAC. HIGH POSITION	1	1	2	3	2	1	1	2	1	3	X	1	1	2	2	3	X	1	1	2	2	2	2	1	1H	2	1H	1H	3	1
AIR MASS N.	Pp	Pc	Pc	Pp	"	"	Pc	"	X	Pp	"	Po	Pc	Pp	"	"	"	Pc	"	"	"	"	Pp	Pc	"	"	"	Pp	"	"	"
AIR MASS S.	TG	Ppo	Po	TG	"	"	"	"	X	TG	"	"	"	"	"	"	"	"	"	"	"	"	"	"	TA	"	"	TG	"	"	"

1940 JULY

Note(a) — Notes on other side — Note(a) — Note(b)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
DATE																																
TYPE						?					R_P			R_P				?							?							
DAY OF CYCLE		2	3	4	5	1	2	3	4	5	$^6_1$	2	3	$^4_1$	2	3	4	$^5_1$	2	3	4	5	6	7	1	2	3	4	5	6	7	8
ALEUTIAN LOW	HIGH						L				L	L						L				L	L	L						L		
	NORMAL				L	L		L	L	L			L			L	L		L	L	L					L	L	L				
	LOW	L	L	Lx	Lx	Lx				Lx	Lx	Lx	Lx	L	L																	L
	NONE																								L			L		L		
TG	STARTS	L														L																
	DEEP								L		L							L	L	L									L	L		
	BOUNDARY		L	L			L			L		L	L	L			L				L	L	L	L	L	L	L	L			L	L
	NONE				L	L		L							L																	
WAVE OCL.				X		L									L	L	L	L	L				L		L	L	L			L	L	L
WAVE POS.		3	5	3,5	5	5	5,1	5,1	2_H	6	1	2	3	5	1_H	2_H	6	6	6	1	2_H	2	3	1	1	2	2	2	1,7	1	2	7
LOW POS.		8,3	9,2	8,2	8	9	4	3	8_H	9	4		2,8	1,8	6_H	7_H	8	4,9	5	5	5,7	2,8	5	5	5	7,8,3	8	8,3	5	6	8,3	8
HIGH LOW CANADA	Above 60°		W		W	C			E		W					W		C			W			W	E		C		W		W	W
	BORDER	E	E		W		C	C		E	E	E		C	C	E	C	E				W	C		C	E	E			C	E	E
	Above 60°			W	C			W	W	W	C			W	W		W	W	W	C	C				W			W				
	BORDER	W	C	E	C							C	C	E	E	W			E		E	E		C		W	C	C	WE	C	C
FRONT EAST CAN. ROCKIES							F				F			F			F	F	F	F	F	F	F	F	F				F	F	
PAC. HIGH BULGE	LOW																															
	HIGH						L	O								O																
P_C OUTBREAK		L	L								L	L	L		L	L	L	L									L	L	L			L
PAC. HIGH POSITION		X	X	3	3	3	2	1	1	X	X	1	1	1	2	2	2	2	1	1	1	X	X	X	1_H	2	1	1	1	1	1_H	1_H
AIR MASS N.		P_C	"	"	"	"	"	"	P_P	P_C	"	"	"	"	"	"	"	"	"	"	P_P	"	"	X	X	P_P	P_C	"	"	"	"	"	"
AIR MASS S.		P_{PO}	T_G	"	T_A	"	"	T_G	"	"	"	"	"	T_A	P_O	"	T_G	T_A	"	T_G	"	"	X	X	X	"	"	"	"	"	"	"	"

a) The subscript p of Rp signifies that this type although similar to the R type is not identical in that a Pc outbreak is involved in creating the wave instead of the normal way by a bulge of Pp air coming ~~xex~~ over the Rocky Mountains.

b) Notice breakdown of Pacific High with lows forming there and waves extending SE-NW off California Coast---note at same time that lows form over Hudson Bay area and that two wave systems extend from east to west over northern U. S. ---compare similar period August 26-31, 1938.

poor example — poor ex. — poor ex. — See note (a) for July 1940

1940 AUGUST

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
DATE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
TYPE		BW							BW							BW						R_P			9							
DAY OF CYCLE		9,1	2	3	4	5	6	7	1	2	3	4	5	6	7	8,1	2	3	4	5	6	1	2	3	4,1	2	3	4	5	6	7	8
ALEUTIAN LOW	HIGH	L				L	L																			L	L				L	
	NORMAL		L	L	L			L	L	L	L	L	L	L	L	L	L	L	L	L	L	L		L	L			L	L	L		L
	LOW																						L				L					
	NONE																															
TG	STARTS								L	L						L										L						
	DEEP	L	L	L	L								L					L														
	BOUNDARY					L	L							L	L		L		L	L	L						L	L	L	L	L	
	NONE							L			L	L										L	L	L	L							L
WAVE OCL.		L		L	L	L	L	L	L	L							L	L	L		L	L	L	L	L			L		L	L
WAVE POS.		5,1	5,1	5,1	5,1	2	3	5	5	X	X	X	2	6	6	1	1	2	2	4	1_H	2_H	2	3	4,1	1	2	3	7,8	2,5	3	3
LOW POS.		9	4	5	6	7,8	8	9,1	9	1	2	3	X	4,9	$4_{H,8}$	5	5	8_H	7,9	8	5_H	6_H	7	8	9,5	5	6	5	6	6_H	7_H	7
HIGH CANADA LOW	Above 60°	C	C	WC	C		W	W	E	W	W	C	C	W	W	W				W					W				C			
	BORDER	E					E	WE						WE	W	W	C	E	E	E	CE	CE		E	E	E	WE	WE		C	C	E
	Above 60°					W																C										
	BORDER	E	E	E		CE		C	C	C	E	WE		C	CE	E	WE	W	W	C			WE	C	C	C	C	C	E	E	WE	C
FRONT CAN.	EAST ROCKIES	F				F	F	F	F	F			F	F	F				F						F	F	F	F	F			
PAC. HIGH BULGE	LOW		L	O							L	O															O		L	O		
	HIGH				L	L	O									L	L	O	O													
P_C OUTBREAK																				L		L	L	L								
PAC. HIGH POSITION		1_H	2	2	2	2	2	2	1	1,4	1	1_H	1	1	2	2	2	2	2	1	3	1	1	1	2	2	X	1	2	2	X	X
AIR MASS N.		P_C	"	P_P	"	"	"	"	"	"	X	X	P_P	"	"	"	P_C	"	"	"	"	"	"	"	"	X	P_P	P_C	"	"	X	P_P	"
AIR MASS S.		T_G	"	"	"	"	"	T_A	"	T_G	X	X	T_G	"	"	"	"	"	"	"	"	"	T_A	P_O	"	X	P_O	T_G	"	"	X	T_G	"

B-w Type

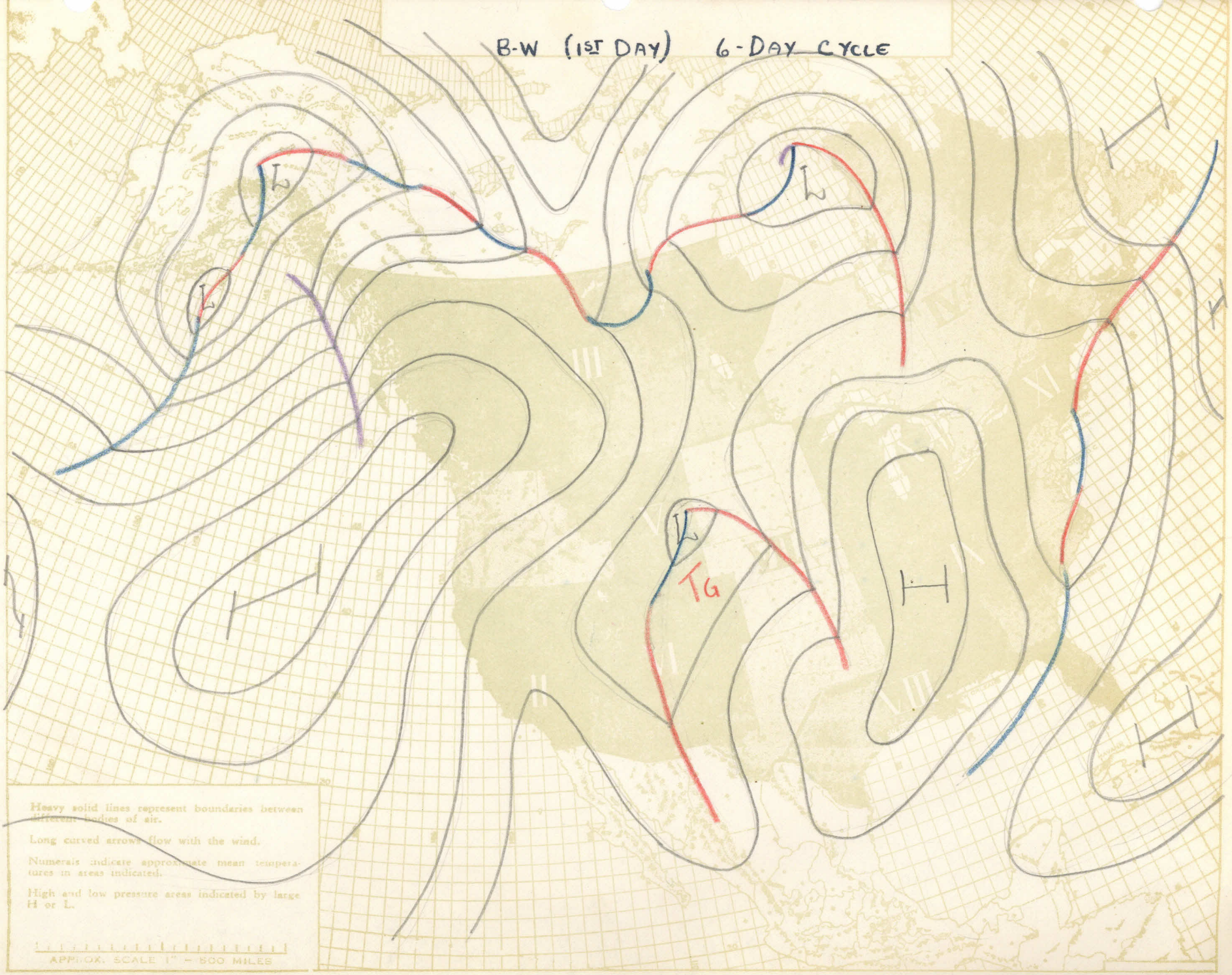
This type is so called B-w because of the shape of the Pacific Anticyclone and also in that it follows the general appearance of the accepted B-type.

The Pacific anticyclone is generally a wedge shape, orientated in a Northwest-Southeast direction with the NE part extending into the continent at British Columbia. It has a six day sequence or it takes six days for a front which is formed between Tg and Pp, east of the Rockies, to move across the continent and leave the Atlantic Coast. The movement of this wave is apparently aided by an anticyclone which breaks off from the Pacific anticyclone in the Pacific Northwest and pushes the wave across the continent. This anticyclone generally breaks off on about the second or third day of the cycle.

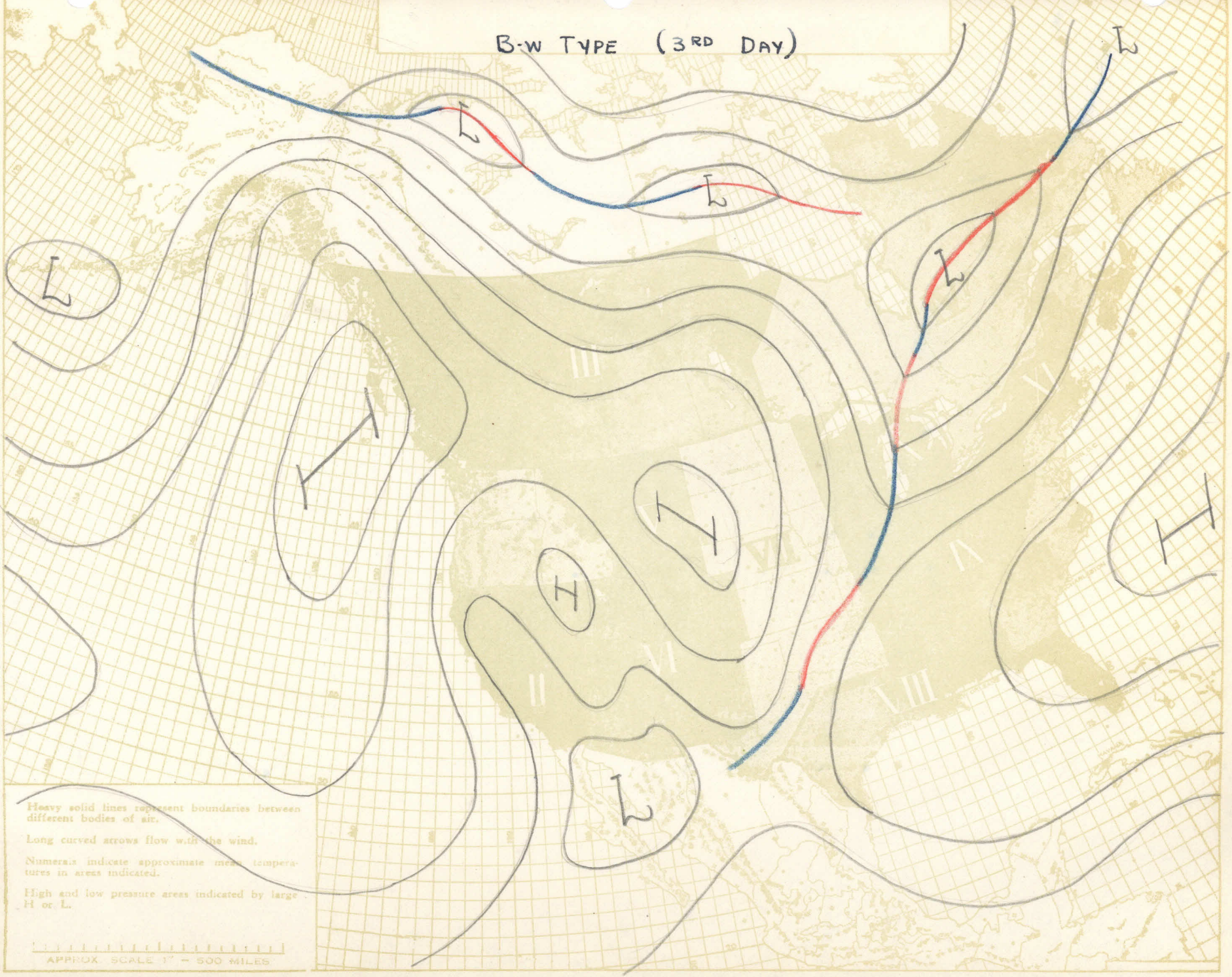
In this type, occlusions are also passing through the Gulf of Alaska rather rapidly and passing over the continent far to the North through Canada. Fronts in the United States are generally Tg--Pp fronts and pass through the central part of the United States.

This type is fairly dry, the greatest amounts of precipitation occuring in the Northwest where the occlusions first hit the continent. The front through the United States does not cause much precipitation. There is no precipitation at all through California and the Great Basin.

This type was by far the most distinct and most prevalent through out the three years studied in this research. It occurred mostly in 1938 but was also in evidence through 1939 and 1940. It occurred ten times consecutively in the three summer months of 1938; four times in 1939 and four times in 1940. The sequence was disrupted only when the


B-W (1ST DAY) 6-DAY CYCLE
L
L
L
H
H
H
H
TG
Heavy solid lines represent boundaries between different bodies of air.
Long curved arrows flow with the wind.
Numerals indicate approximate mean temperatures in areas indicated.
High and low pressure areas indicated by large H or L.
APPROX. SCALE 1" = 500 MILES

B-W Type (3rd Day)



Heavy solid lines represent boundaries between different bodies of air.

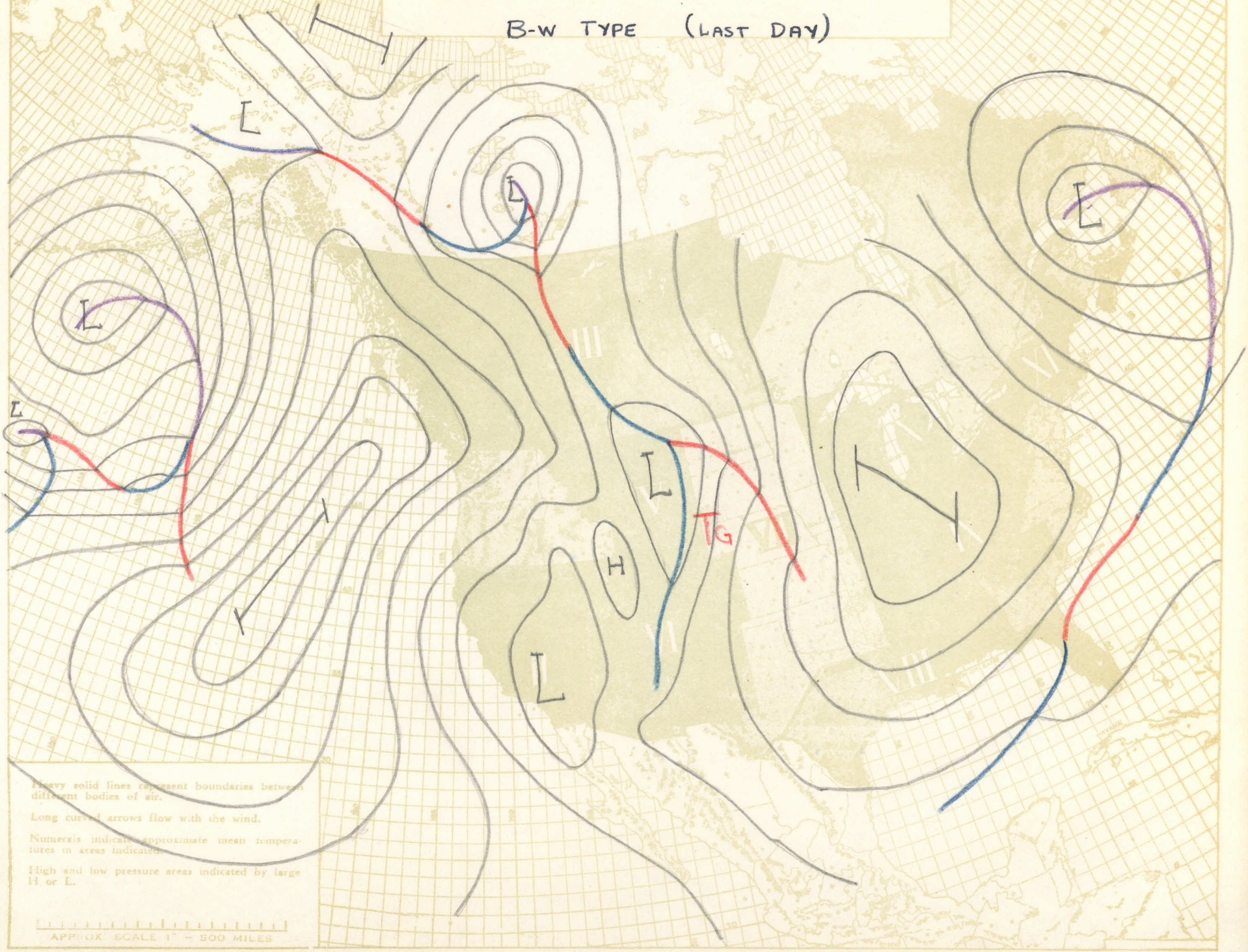
Long curved arrows flow with the wind.

Numerals indicate approximate mean temperatures in areas indicated.

High and low pressure areas indicated by large H or L.

APPROX. SCALE 1" = 500 MILES

B-W TYPE (LAST DAY)



Heavy solid lines represent boundaries between different bodies of air.

Long curved arrows flow with the wind.

Numerals indicate approximate mean temperatures in areas indicated.

High and low pressure areas indicated by large H or L.

APPROX. SCALE 1" = 500 MILES

R - Type (3 Days)

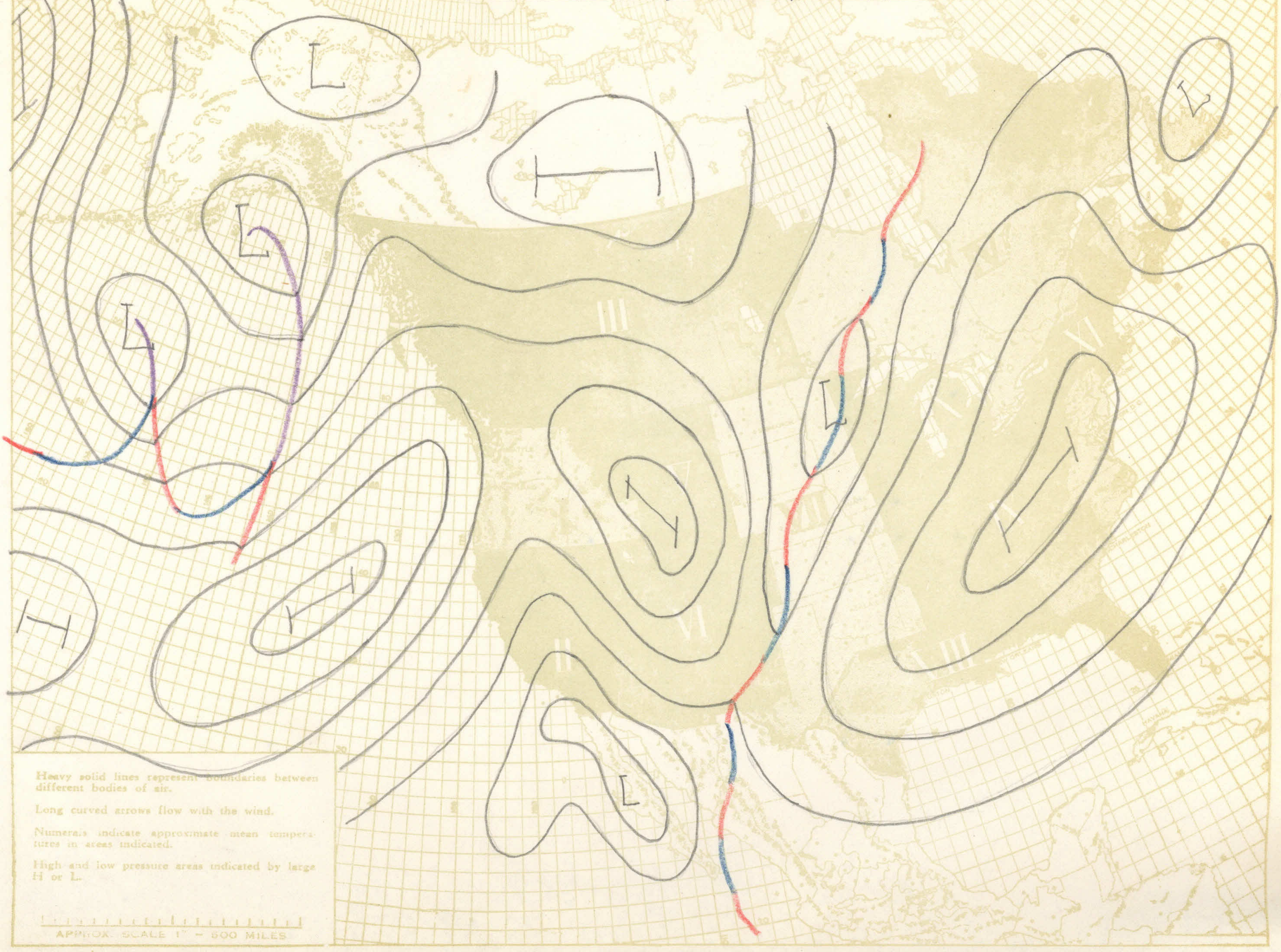
This type has been named R as a matter of convenience although it is quite similar to the B-w, the chief difference being that it has a three - day cycle or takes three days for the front formed East of the Rockies to clear the Atlantic Coast.

In appearance and action it is the same as the B-w. The Pacific anticyclone is oriented Northeast-Southwest along the Pacific Coast and there is a break-off of this high in British Columbia generally on the first day of the cycle and this broken off anticyclone travels rapidly across the continent pushing the Tg - Pp front ahead of it.

In this type there are occlusions entering the continent through the Gulf of Alaska but in contrast to the B-w type, do not form a low pressure trough through Canada; there is an anticyclone in Canada in the same place that there was low pressure in the B-w type.

This type was rather infrequent in occurrence, but generally seemed to occur before or at the end of a series of B-w types. Also the anticyclone that broke off of the Pacific high is more intense than in the B-w type. This type occurred six times during 1938 and twice in 1939. It did not occur in 1940.

R-TYPE (1ST DAY) 3-DAY CYCLE



Heavy solid lines represent boundaries between different bodies of air.

Long curved arrows flow with the wind.

Numerals indicate approximate mean temperatures in areas indicated.

High and low pressure areas indicated by large H or L.

APPROX. SCALE 1" = 500 MILES

9 - Day Type

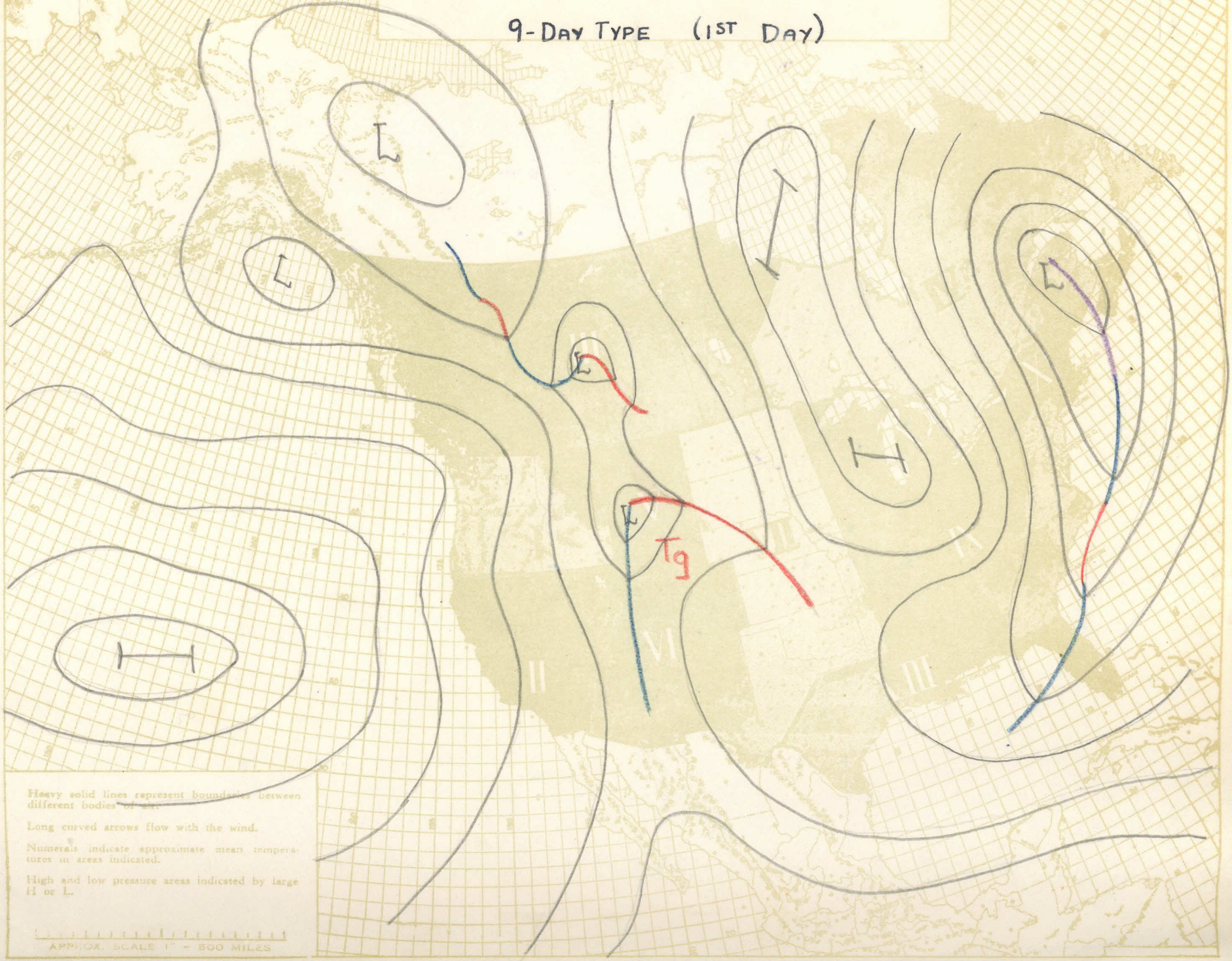
This nine day type is also similar in appearance to the B-w type but has a longer cycle. The Pacific anticyclone covers a more extensive area and does not have the usual Northeast-Southwest orientation, but does have the characteristic bulge in the Pacific anticyclone in the Northwest and this bulge breaks off on the second or third day and also on about the seventh or eighth day of the cycle. The first broken off anticyclone moves rapidly across the continent just above the Tg - Pp front which has formed in the Central part of the U. S. and lies in an E -W direction. The second anticyclone which breaks off on the seventh day forms a front East of the Canadian Rockies, between itself and the first anticyclone. This second anticyclone begins to move across the continent and cleans both waves off the Atlantic Coast.

The chief characteristics to be recognized in this type is the large anticyclone in the Pacific and the fact that there are no active Aleution Lows or fronts passing through the Gulf of Alaska. The only fronts passing through enter Alaska from the Straits of Siberia.

This type was also infrequent in occruuence, being found only in 1939, where it occurred five times consecutively. It was preceded by an odd type similar to an E and was followed by a B-w type.

This type caused a greater amount of Precipitation in the central part of the United States than the other two types already discussed.

9-Day Type (1st Day)



Heavy solid lines represent boundaries between different bodies of air.

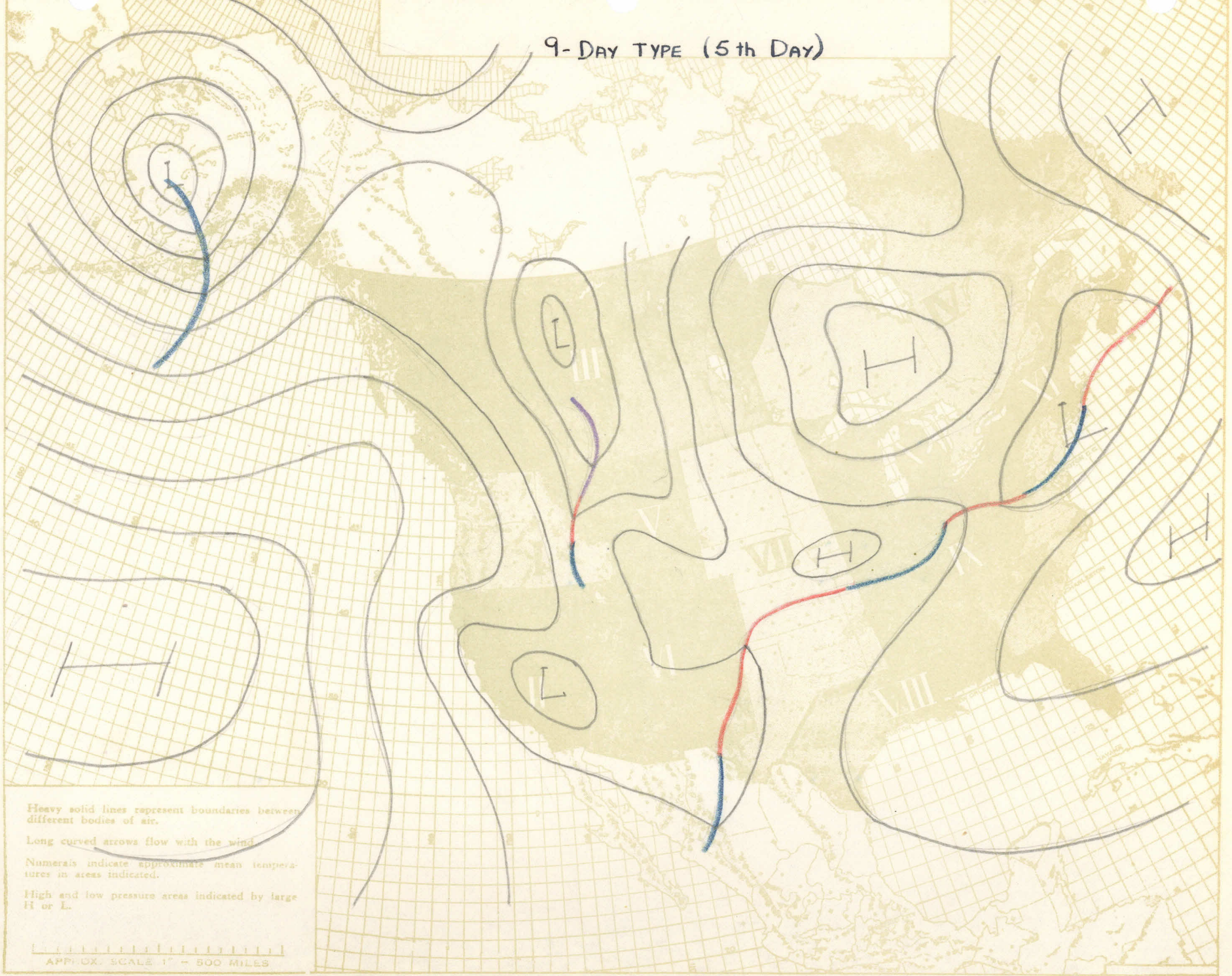
Long curved arrows flow with the wind.

Numerals indicate approximate mean temperatures in areas indicated.

High and low pressure areas indicated by large H or L.

APPROX. SCALE 1" = 500 MILES

9-Day Type (5th Day)



Heavy solid lines represent boundaries between different bodies of air.

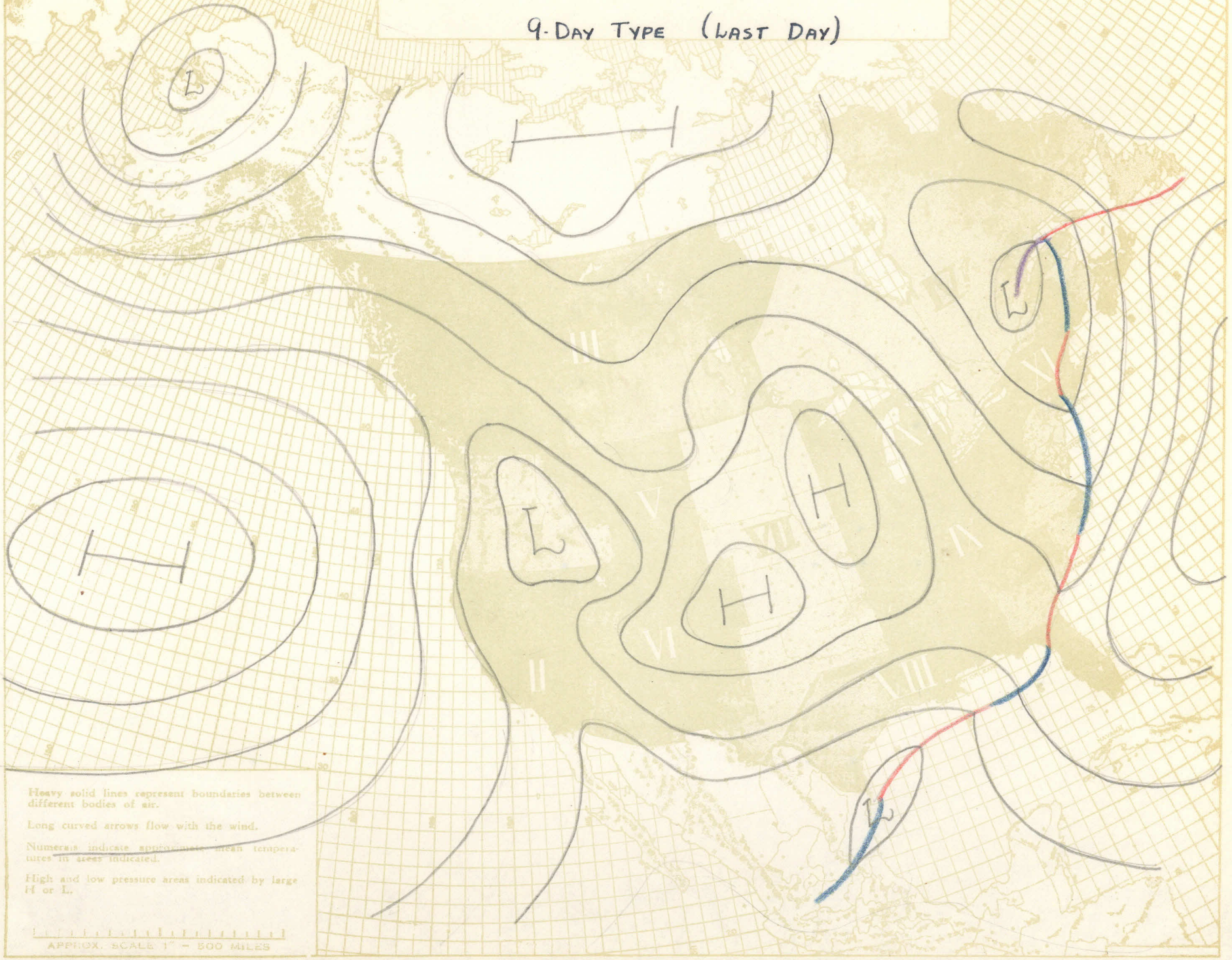
Long curved arrows flow with the wind.

Numerals indicate approximate mean temperatures in areas indicated.

High and low pressure areas indicated by large H or L.

APPROX. SCALE 1" = 500 MILES

9-Day Type (Last Day)



16 - Day Type

This type was picked out because it persisted over a sixteen day period; however, it may or may not be a definite type as it was found only once in the three years studied.

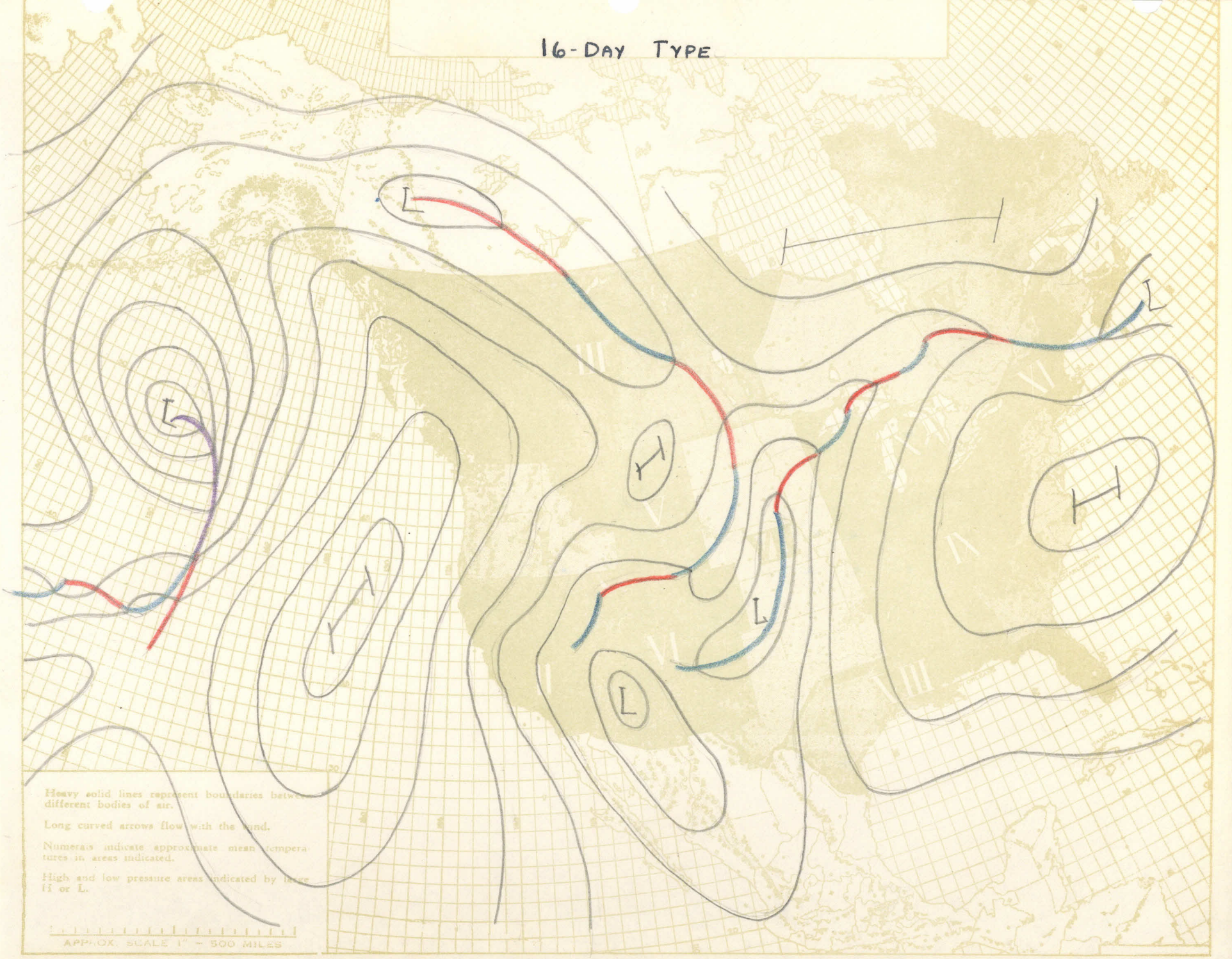
Its distinguishing characteristic was the lows in the Pacific. These were at much lower latitudes and the Aleutian low was of much lower pressure than usual. The Pacific anticyclone is displaced farther to the south and does not cover as an extensive area as in the other types.

There is a large Canadian High, generally in the western part of Canada or over Alaska. Frontal systems arriving at the Pacific Coast from Northern California to Washington cause large amounts of precipitation in those areas. Active fronts are formed East of the Rockies in the United States between Pp and Tg air. Waves travel along this front through the central part of the United States from west to east. A long front extends from about Wyoming through the Great Lakes area and to New England. Greatest amounts of precipitation occur in the Rockies in Idaho, Montana and Wyoming, and in the North Central States.

As the cycle pregresses the waves on the front in the United States are pushed Southeastward by Pp air which has broken off of the Pacific anticyclone, leaving the Atlantic Coast on the sisteenth day. The end or cleaning up of this type was aided by a Pc outbreak which entered the United States through the Great Lakes area.

Other features of the picture of this type are very nearly the same as the other types, the Bermuda high being centered just East of the Florida Coast. In comparison to the accepted types this follows more closely to the E-type than any others observed. It did not occur in any of the other years and only during the first half of June in 1940.

16-Day Type


L
L
L
L
L
H
H
H
Heavy solid lines represent boundaries between different bodies of air.
Long curved arrows flow with the wind.
Numerals indicate approximate mean temperatures in areas indicated.
High and low pressure areas indicated by letters H or L.
APPROX. SCALE 1" = 500 MILES

CONCLUSIONS DRAWN FROM TABLE OF TABULATION

For 9 Day Type:

The Pacific High bulge and invasion of Pp air on the continent takes place at a lower latitude than it does for the 6-day B-w type, that is, south of the Columbian Gorge.

The Aleutian Low is normal or at a lower than normal latitude or there is no low present.

No front is present east of the Canadian Rocky Mountains.

On the third or fourth day a boundary of Tg air is along the Appalachian Mountains.

For B-w Type:

The Pacific High bulge breaks off on the 2nd or 3rd day, causing Pp air to cross the mountains in the vicinity of the Columbian Gorge. This air that is detached joins in the circulation of the Continent.

The Aleutian Low is in the normal position or a t a higher latitude.

Centers of low pressure exist in Canada at latitude 60 degrees or above.

General:

A Pc outbreak will terminate any succession of types or B-w or 9-day and the following type will be R or Rp.

For the shorter cycles of weather (R or Rp) the interacting air masses are generally Pc and Tg or Ta; for the longer cycles, Pp and Tg or Ta.

General:

If, during the summer months, lows form in the Pacific off the California Coast the weather situation on the continent becomes confused and cannot very well be typed.

At the beginning of any cycle the Pacific Anticyclone is usually in the (1) position and by the end of the cycle has developed to the (2) or even (3) position.

No front is present east of the Canadia n Rocky Mountains during the long 9-day Type. This front is present during the R and B-w Types usually at the end of one cycle and the beginning of another

TYPE	NUMBER OF TIMES OCCURRED	AVERAGE LENGTH CYCLE (DAYS)	MAXIMUM NUMBER OF SUCCESSIVE CYCLES
R or Rp	11	4	4
B-w	21	6½	10
9-Day	6	9½	4
16-Day	1	16	0