TABLE 9.—*Average annual clockwise (CW.) or counterclockwise (CCW.) turning of winds from surface direction at Drexel, Nebr.*

Surface direction.	Altitude above M. S. L. (meters).													
	500		750		1,000		2,000		3,000		4,000		5,000	
	CW.	CCW.	CW.	CCW.	CW.	CCW.	CW.	CCW.	CW.	CCW.	CW.	CCW.	CW.	CCW.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
N	1	3	5	9	14	26	10	61	2	84	2	98	0	100
NNE	5	6	24	20	32	38	42	52	24	72	0	100	0	100
NE	5	1	21	10	38	16	52	34	35	50	30	70	.....	....
ENE	2	0	19	13	43	13	62	18	83	17	100	0	.....	....
E	14	0	32	8	41	11	88	8	100	0	100	0	100	0
ESE	16	0	50	2	78	0	100	0	100	0	100	0	100	0
SE	25	0	56	2	70	2	89	4	90	3	100	0	100	0
SSE	10	0	44	4	64	4	81	7	97	0	96	0	89	0
S	7	1	33	4	56	2	85	4	95	2	96	2	100	0
SSW	12	0	41	4	60	7	77	4	84	3	88	5	100	0
SW	12	0	33	2	50	5	74	9	82	6	83	17	100	0
WSW	17	0	41	2	62	2	77	8	71	11	78	18	100	0
W	11	0	39	3	56	6	70	16	54	22	52	14	100	0
WNW	4	0	32	8	39	13	49	30	42	47	24	49	0	100
NW	4	1	18	7	20	7	15	18	12	47	7	68	0	50
NNW	3	0	6	14	7	24	9	58	3	69	5	79	0	100
Means	8	1	28	7	51	12	56	23	58	26	60	30	56	38

TABLE 10.—*Average annual frequency of a west component in winds at various levels at Drexel, Nebr.*

Surface direction.	Altitude above M. S. L. (meters).							
	396	500	750	1,000	2,000	3,000	4,000	5,000
	%	%	%	%	%	%	%	%
N	50	52	50	55	76	90	95	100
NNE	0	2	10	17	45	75	100	100
NE	0	0	0	0	24	46	50	.....
ENE	0	0	0	3	29	67	100	.....
E	0	0	0	0	22	50	100	100
ESE	0	0	6	6	57	73	83	100
SE	0	0	9	24	62	73	92	100
SSE	0	6	25	41	75	94	91	80
S	50	53	64	76	90	96	97	100
SSW	100	100	99	96	97	98	95	100
SW	100	100	100	100	99	99	95	100
WSW	100	100	100	100	100	97	94	100
W	100	100	100	100	98	100	100	100
WNW	100	100	100	100	100	100	100	100
NW	100	100	99	99	100	100	100	100
NNW	100	99	97	97	96	100	100	100
Means	60	61	64	68	83	92	95	98

NOTE.—Winds recorded exactly "north" or "south" have been considered as having had a westerly component in 50% of the cases.

TABLE 11.—*Average annual frequency of north and south components in winds at various levels at Drexel, Nebr.*

Surface direction.	Altitude above M. S. L. (meters).															
	396		500		750		1,000		2,000		3,000		4,000		5,000	
	N.	S.	N.	S.	N.	S.	N.	S.	N.	S.	N.	S.	N.	S.	N.	S.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
N	100	0	100	0	100	0	100	0	99	1	98	2	95	5	100	0
NNE	100	6	100	0	100	0	95	5	85	15	80	20	100	0	100	0
NE	100	0	100	0	97	3	88	12	68	32	71	29	75	25	....	....
ENE	100	0	97	3	85	15	65	35	33	67	8	92	0	100	....	....
E	50	50	39	61	39	61	32	68	11	89	0	100	0	100	0	100
ESE	0	100	0	100	0	100	0	100	0	100	0	100	0	100	0	100
SE	0	100	0	100	0	100	0	100	2	98	8	92	23	77	0	100
SSE	0	100	0	100	0	100	0	100	0	100	8	92	9	91	20	80
S	0	100	0	100	0	100	0	100	4	96	9	91	26	74	67	33
SSW	0	100	0	100	0	100	1	99	9	91	24	76	47	53	67	33
SW	0	100	0	100	5	95	8	92	31	69	48	52	48	52	67	33
WSW	0	100	4	96	18	82	32	68	65	35	67	33	71	29	100	0
W	50	50	59	41	76	24	85	15	84	16	88	12	85	15	100	0
WNW	100	0	100	0	98	2	98	2	87	13	84	16	72	28	50	50
NW	100	0	100	0	100	0	99	1	99	1	93	7	75	25	100	0
NNW	100	0	100	0	100	0	100	0	97	3	93	7	75	25	67	33
Means	48	52	49	51	49	51	49	51	49	51	52	48	55	45	62	38

NOTE.—Winds recorded exactly "east" or "west" have been considered as having had a northerly component in 50 per cent of the cases, and a southerly component in the remaining 50 per cent.

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WINDS AND TEMPERATURE-GRADIENTS IN THE STRATOSPHERE.

By G. M. B. DOBSON.

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From the results of temperature observations by *ballons-sondes*, it can be shown that the horizontal pressure-gradient, and therefore the wind velocity, should decrease rapidly on passing from the troposphere to the stratosphere. Previously there had been little confirmation of this by actual observations. Seventy ascents recorded by the international commission gave data for temperature, wind velocity, and wind direction to great heights. These showed that, almost without exception, winds of moderate or great velocity in the troposphere fall off very rapidly on entering the stratosphere, while the wind direction remained constant. On days with small pressure-gradients this effect was not usually found—a result which was to be expected, since the slope of the tropopause would then not necessarily be toward the low pressure. Horizontal pressure and temperature-gradients calculated for the observed winds on typical days with moderate or large pressure-gradients show that the pressure-gradient is suddenly reduced, and the temperature-gradient suddenly reversed, on entering the stratosphere. The temperature-gradients calculated from the observed wind velocities are in good agreement with those deduced by Mr. W. H. Dines from temperature and pressure observations.