

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.030	-0.052	-0.043	-0.029
Std Deviation (1 reading)	0.293	0.218	0.294	0.356
Std Error (10 readings)	0.093	0.069	0.093	0.113
St Error (100 readings)	0.029	0.022	0.029	0.036
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.042	-0.051	-0.028	-0.019
St Deviation (1 reading)	0.324	0.294	0.316	0.370
St Error (10 readings)	0.102	0.093	0.100	0.117
St Error (100 readings)	0.032	0.029	0.032	0.037
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.013	-0.017	-0.014	-0.045
Std Deviation (1 reading)	0.188	0.185	0.221	0.237
Std Error (10 readings)	0.059	0.058	0.070	0.075
Std Error (100 readings)	0.019	0.018	0.022	0.024
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.024	-0.039	-0.012	-0.059
Std Deviation (1 reading)	0.202	0.175	0.203	0.246
Std Error (10 readings)	0.064	0.055	0.064	0.078
Std Error (100 readings)	0.020	0.017	0.020	0.025

Table 2a Lindenberg 1999 – 2008. Mean rate of change in temperature between launches at 01:00 and 07:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.020	0.045	0.022	0.003
Std Deviation (1 reading)	0.295	0.207	0.329	0.379
Std Error (10 readings)	0.093	0.066	0.104	0.120
St Error (100 readings)	0.030	0.021	0.033	0.038
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.037	0.017	0.011	0.004
St Deviation (1 reading)	0.325	0.300	0.312	0.368
St Error (10 readings)	0.103	0.095	0.099	0.116
St Error (100 readings)	0.033	0.030	0.031	0.037
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.006	0.016	-0.005	0.030
Std Deviation (1 reading)	0.184	0.182	0.221	0.241
Std Error (10 readings)	0.058	0.058	0.070	0.076
Std Error (100 readings)	0.018	0.018	0.022	0.024
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.025	0.074	-0.003	0.035
Std Deviation (1 reading)	0.207	0.179	0.213	0.275
Std Error (10 readings)	0.065	0.057	0.067	0.087
Std Error (100 readings)	0.021	0.018	0.021	0.027

Table 2b Lindenberg 1999 – 2008. Mean rate of change in temperature between launches at 07:00 and 13:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.036	0.040	0.010	0.013
Std Deviation (1 reading)	0.265	0.219	0.304	0.372
Std Error (10 readings)	0.084	0.069	0.096	0.118
St Error (100 readings)	0.026	0.022	0.030	0.037
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.011	0.027	0.023	0.000
St Deviation (1 reading)	0.305	0.280	0.337	0.368
St Error (10 readings)	0.097	0.088	0.107	0.116
St Error (100 readings)	0.031	0.028	0.034	0.037
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.006	-0.005	0.004	-0.003
Std Deviation (1 reading)	0.182	0.191	0.215	0.235
Std Error (10 readings)	0.058	0.060	0.068	0.074
Std Error (100 readings)	0.018	0.019	0.021	0.023
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.031	-0.033	0.032	0.024
Std Deviation (1 reading)	0.199	0.175	0.202	0.270
Std Error (10 readings)	0.063	0.055	0.064	0.085
Std Error (100 readings)	0.020	0.017	0.020	0.027

Table 2c Lindenberg 1999 – 2008. Mean rate of change in temperature between launches at 13:00 and 19:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.001	-0.024	-0.006	0.001
Std Deviation (1 reading)	0.264	0.201	0.293	0.375
Std Error (10 readings)	0.084	0.064	0.093	0.119
St Error (100 readings)	0.026	0.020	0.029	0.037
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.001	0.002	-0.014	0.009
St Deviation (1 reading)	0.303	0.274	0.309	0.363
St Error (10 readings)	0.096	0.087	0.098	0.115
St Error (100 readings)	0.030	0.027	0.031	0.036
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.012	0.005	0.011	0.018
Std Deviation (1 reading)	0.173	0.190	0.214	0.241
Std Error (10 readings)	0.055	0.060	0.068	0.076
Std Error (100 readings)	0.017	0.019	0.021	0.024
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.021	-0.002	-0.036	0.009
Std Deviation (1 reading)	0.188	0.178	0.200	0.243
Std Error (10 readings)	0.060	0.056	0.063	0.077
Std Error (100 readings)	0.019	0.018	0.020	0.024

Table 2d Lindenberg 1999 – 2008. Mean rate of change in temperature between launches at 19:00 and 01:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.050	-0.060	-0.030	0.004
Std Deviation (1 reading)	0.215	0.216	0.261	0.362
Std Error (10 readings)	0.068	0.068	0.083	0.114
St Error (100 readings)	0.022	0.022	0.026	0.036
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.017	-0.046	-0.068	-0.018
St Deviation (1 reading)	0.287	0.274	0.286	0.359
St Error (10 readings)	0.091	0.087	0.090	0.113
St Error (100 readings)	0.029	0.027	0.029	0.036
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.014	-0.022	-0.034	-0.009
Std Deviation (1 reading)	0.178	0.201	0.208	0.231
Std Error (10 readings)	0.056	0.064	0.066	0.073
Std Error (100 readings)	0.018	0.020	0.021	0.023
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.009	-0.009	-0.009	-0.048
Std Deviation (1 reading)	0.187	0.176	0.202	0.239
Std Error (10 readings)	0.059	0.056	0.064	0.076
Std Error (100 readings)	0.019	0.018	0.020	0.024

Table 2e Lindenberg 2009 – 2012. Mean rate of change in temperature between launches at 01:00 and 07:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.046	0.032	0.013	0.046
Std Deviation (1 reading)	0.253	0.219	0.270	0.253
Std Error (10 readings)	0.080	0.069	0.086	0.080
St Error (100 readings)	0.025	0.022	0.027	0.025
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.014	-0.007	0.041	-0.008
Std Deviation (1 reading)	0.269	0.249	0.285	0.350
Std Error (10 readings)	0.085	0.079	0.090	0.111
St Error (100 readings)	0.027	0.025	0.028	0.035
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.027	-0.010	0.027	0.027
Std Deviation (1 reading)	0.169	0.199	0.199	0.169
Std Error (10 readings)	0.054	0.063	0.063	0.054
Std Error (100 readings)	0.017	0.020	0.020	0.017
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.032	0.033	0.011	0.076
Std Deviation (1 reading)	0.184	0.167	0.186	0.255
Std Error (10 readings)	0.058	0.053	0.059	0.081
Std Error (100 readings)	0.018	0.017	0.019	0.026

Table 2f Lindenberg 2009 – 2012. Mean rate of change in temperature between launches at 07:00 and 13:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.047	-0.038	0.017	0.004
Std Deviation (1 reading)	0.271	0.237	0.294	0.303
Std Error (10 readings)	0.086	0.075	0.093	0.096
St Error (100 readings)	0.027	0.024	0.029	0.030
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.010	0.073	-0.017	-0.011
St Deviation (1 reading)	0.286	0.268	0.295	0.293
St Error (10 readings)	0.091	0.085	0.093	0.093
St Error (100 readings)	0.029	0.027	0.030	0.029
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.020	0.035	0.011	-0.038
Std Deviation (1 reading)	0.167	0.190	0.192	0.210
Std Error (10 readings)	0.053	0.060	0.061	0.066
Std Error (100 readings)	0.017	0.019	0.019	0.021
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.020	0.023	0.009	-0.024
Std Deviation (1 reading)	0.183	0.176	0.209	0.243
Std Error (10 readings)	0.058	0.056	0.066	0.077
Std Error (100 readings)	0.018	0.018	0.021	0.024

Table 2g Lindenberg 2009 – 2012. Mean rate of change in temperature between launches at 13:00 and 19:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.034	-0.038	-0.033	-0.014
Std Deviation (1 reading)	0.231	0.247	0.269	0.406
Std Error (10 readings)	0.073	0.078	0.085	0.128
St Error (100 readings)	0.023	0.025	0.027	0.041
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.004	-0.055	-0.006	0.060
St Deviation (1 reading)	0.272	0.285	0.273	0.378
St Error (10 readings)	0.086	0.090	0.086	0.119
St Error (100 readings)	0.027	0.028	0.027	0.038
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.027	-0.028	0.005	-0.009
Std Deviation (1 reading)	0.168	0.193	0.202	0.226
Std Error (10 readings)	0.053	0.061	0.064	0.071
Std Error (100 readings)	0.017	0.019	0.020	0.023
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.023	-0.062	-0.032	0.001
Std Deviation (1 reading)	0.176	0.185	0.200	0.248
Std Error (10 readings)	0.056	0.059	0.063	0.078
Std Error (100 readings)	0.018	0.019	0.020	0.025

Table 2h Lindenberg 2009 – 2012. Mean rate of change in temperature between launches at 19:00 and 01:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.060	-0.088	-0.019	-0.003
Std Deviation (1 reading)	0.294	0.180	0.289	0.386
Std Error (10 readings)	0.093	0.057	0.091	0.122
St Error (100 readings)	0.029	0.018	0.029	0.039
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.070	-0.068	-0.048	-0.068
St Deviation (1 reading)	0.305	0.161	0.253	0.353
St Error (10 readings)	0.096	0.051	0.080	0.112
St Error (100 readings)	0.030	0.016	0.025	0.035
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.003	0.019	-0.004	-0.014
Std Deviation (1 reading)	0.281	0.254	0.269	0.310
Std Error (10 readings)	0.089	0.080	0.085	0.098
Std Error (100 readings)	0.028	0.025	0.027	0.031
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.003	0.038	0.022	-0.020
Std Deviation (1 reading)	0.309	0.279	0.247	0.270
Std Error (10 readings)	0.098	0.088	0.078	0.085
Std Error (100 readings)	0.031	0.028	0.025	0.027

Table 2i Southern Great Plains 2006 – 2012. Mean rate of change in temperature between launches at 00:00 and 06:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.038	0.060	0.012	0.025
Std Deviation (1 reading)	0.279	0.173	0.255	0.405
Std Error (10 readings)	0.088	0.055	0.081	0.128
St Error (100 readings)	0.028	0.017	0.025	0.041
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.024	0.008	-0.005	0.015
St Deviation (1 reading)	0.266	0.167	0.232	0.344
St Error (10 readings)	0.084	0.053	0.073	0.109
St Error (100 readings)	0.027	0.017	0.023	0.034
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.003	0.008	0.011	0.027
Std Deviation (1 reading)	0.290	0.247	0.255	0.280
Std Error (10 readings)	0.092	0.078	0.080	0.089
Std Error (100 readings)	0.029	0.025	0.025	0.028
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.034	0.032	-0.004	0.028
Std Deviation (1 reading)	0.274	0.265	0.247	0.275
Std Error (10 readings)	0.087	0.084	0.078	0.087
Std Error (100 readings)	0.027	0.026	0.025	0.027

Table 2j Southern Great Plains 2006 – 2012. Mean rate of change in temperature between launches at 06:00 and 12:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.081	0.093	0.036	0.052
Std Deviation (1 reading)	0.316	0.326	0.285	0.425
Std Error (10 readings)	0.100	0.103	0.090	0.134
St Error (100 readings)	0.032	0.033	0.028	0.043
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.044	0.073	0.033	0.010
St Deviation (1 reading)	0.297	0.319	0.254	0.369
St Error (10 readings)	0.094	0.101	0.080	0.117
St Error (100 readings)	0.030	0.032	0.025	0.037
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.046	0.001	-0.024	-0.038
Std Deviation (1 reading)	0.261	0.326	0.257	0.290
Std Error (10 readings)	0.082	0.103	0.081	0.092
Std Error (100 readings)	0.026	0.033	0.026	0.029
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.025	-0.047	-0.019	-0.015
Std Deviation (1 reading)	0.260	0.284	0.245	0.281
Std Error (10 readings)	0.082	0.090	0.077	0.089
Std Error (100 readings)	0.026	0.028	0.024	0.028

Table 2k Southern Great Plains 2006 – 2012. Mean rate of change in temperature between launches at 12:00 and 18:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.

Altitude = 5km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.025	-0.058	-0.049	-0.047
Std Deviation (1 reading)	0.288	0.340	0.286	0.420
Std Error (10 readings)	0.091	0.108	0.090	0.133
St Error (100 readings)	0.029	0.034	0.029	0.042
Altitude = 10km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.001	-0.004	-0.005	0.009
St Deviation (1 reading)	0.302	0.326	0.259	0.396
St Error (10 readings)	0.095	0.103	0.082	0.125
St Error (100 readings)	0.030	0.033	0.026	0.040
Altitude = 15km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	0.020	-0.041	0.020	0.020
Std Deviation (1 reading)	0.286	0.332	0.253	0.310
Std Error (10 readings)	0.090	0.105	0.080	0.098
Std Error (100 readings)	0.029	0.033	0.025	0.031
Altitude = 20km	Spring	Summer	Autumn	Winter
Mean rate of change, K / hour	-0.006	-0.029	-0.003	0.005
Std Deviation (1 reading)	0.272	0.309	0.245	0.270
Std Error (10 readings)	0.086	0.098	0.078	0.085
Std Error (100 readings)	0.027	0.031	0.025	0.027

Table 21 Southern Great Plains 2006 – 2012. Mean rate of change in temperature between launches at 18:00 and 00:00 hours, along with standard deviation of a single measurement and standard error with increased number of measurements for 4 seasons.