Comparison of MLT winds measured by all-sky meteor radar and the D1 LF method – Collm, 51.3°N, 13°E

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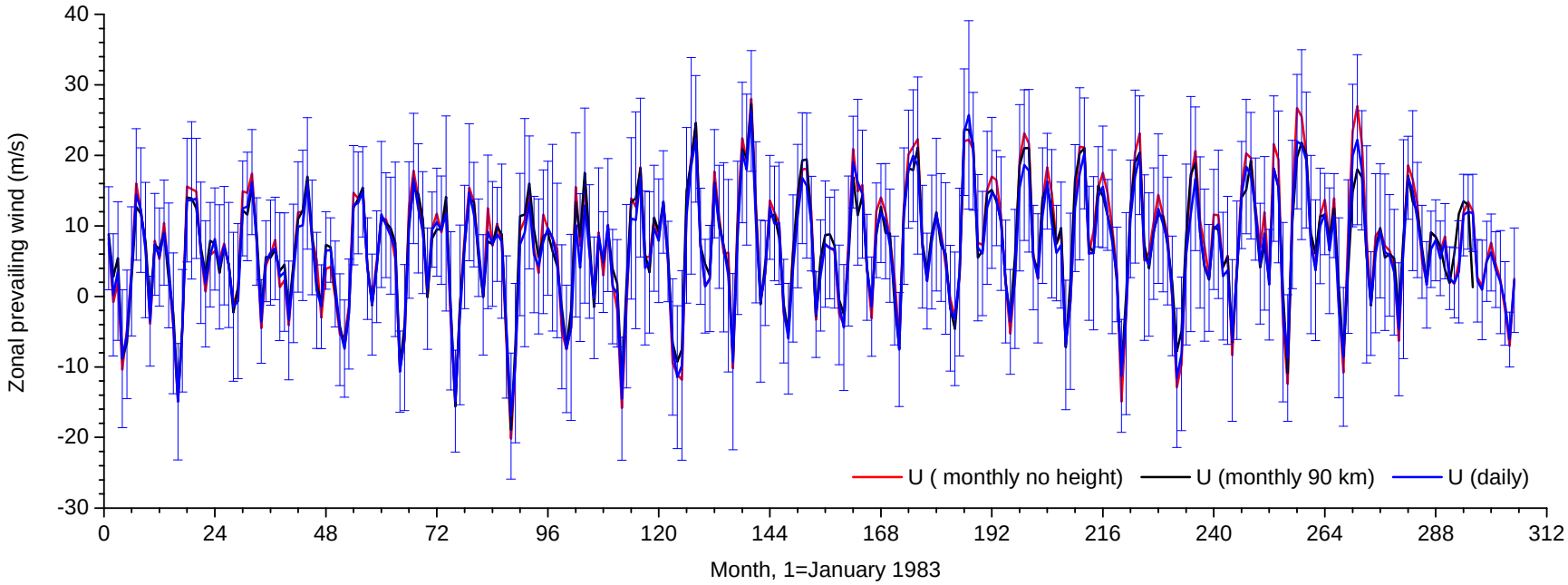
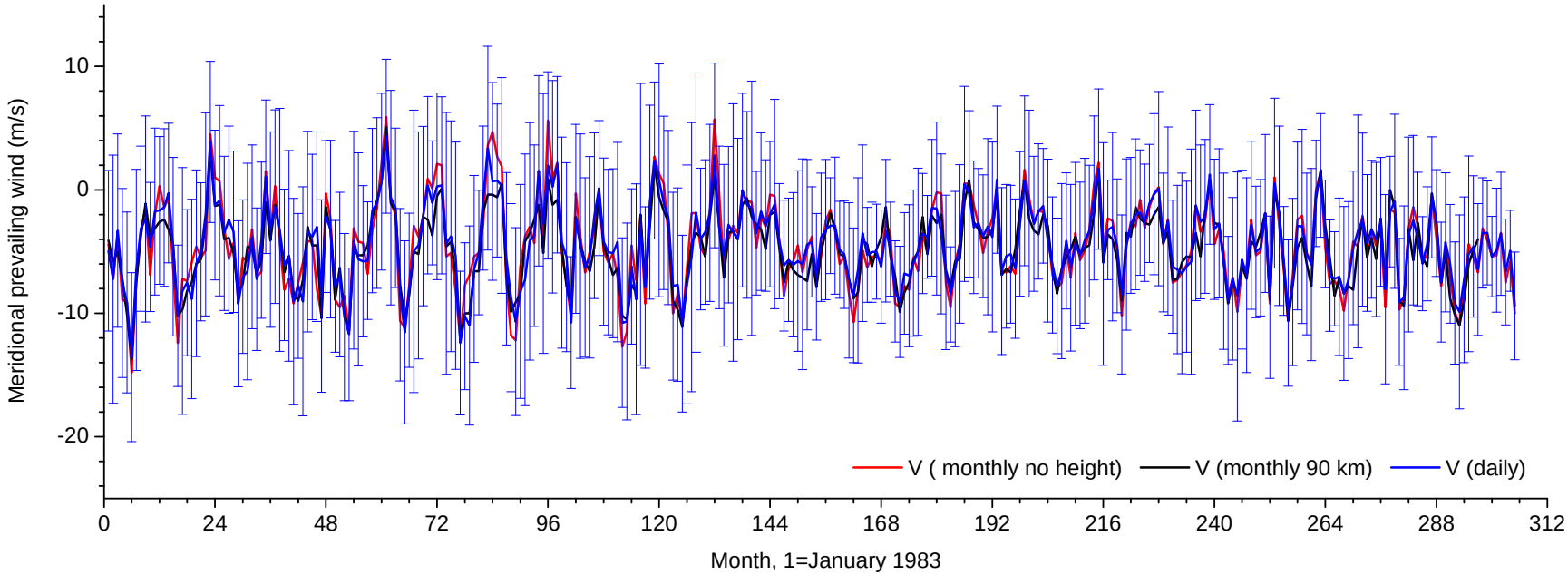
Collm LF

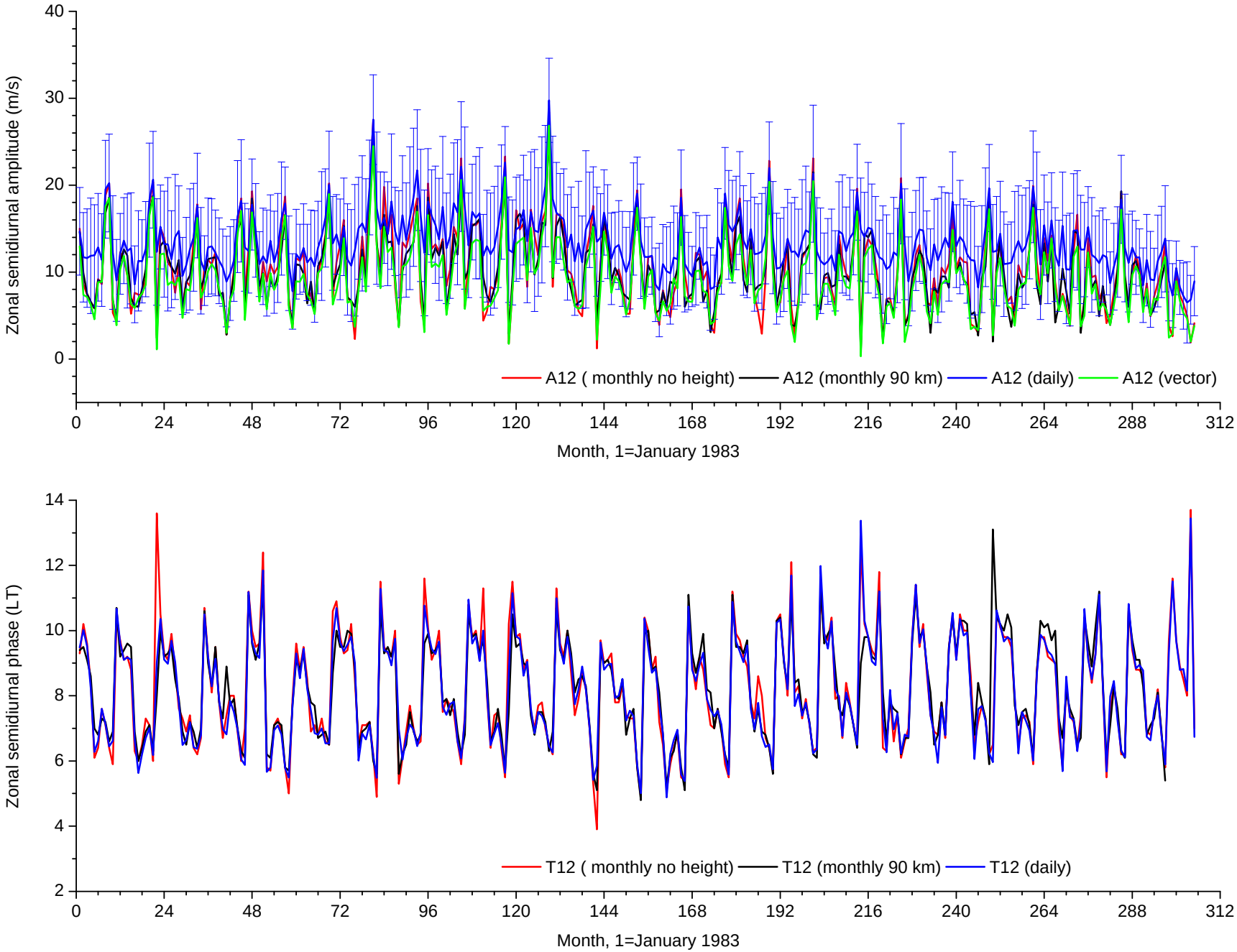
Analyses base on regression with mean winds and circular polarised SDT.

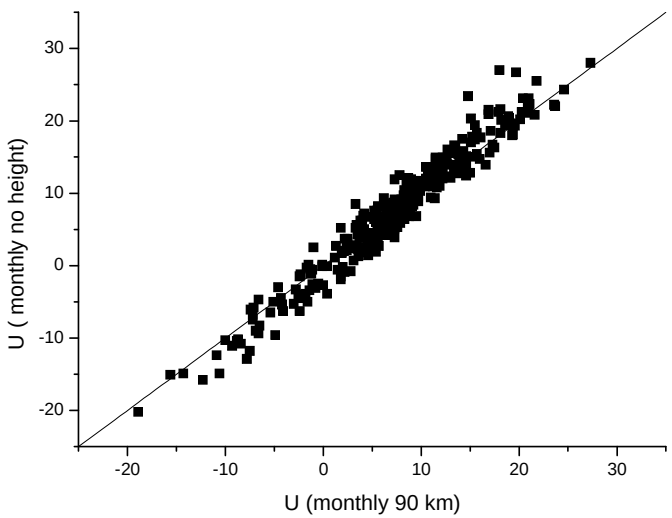
Three different data sets have been analysed:

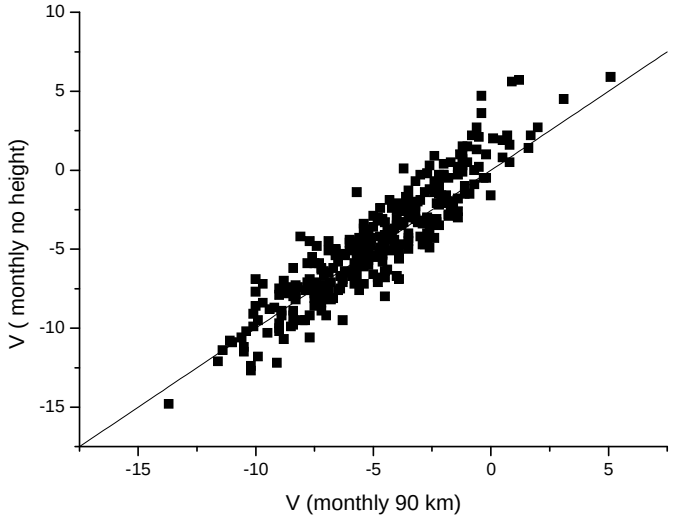
1. „Monthly no height“: from monthly median half-hourly winds without height information used
2. „Monthly 90 km“ from one month of half-hourly data applying regression of 2nd order height-dependent coefficients
3. „Daily“: Monthly means from daily winds calculated from half-hourly means of one day each. Monthly tides are calculated from vector and energetic averaging.

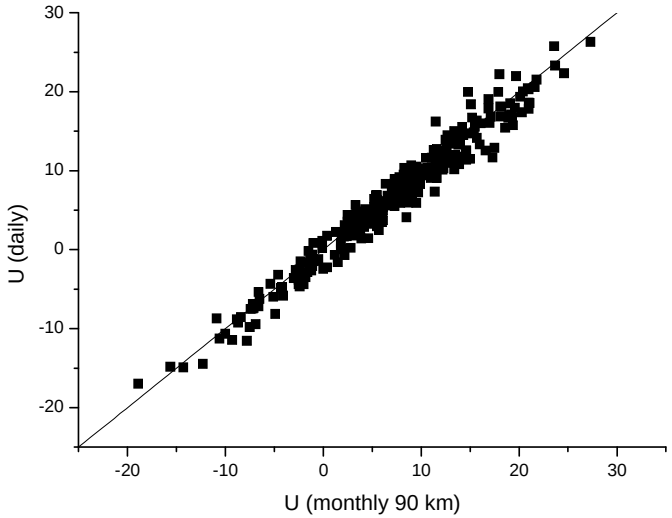

Zonal prevailing wind (m/s)
40
30
20
10
0
-10
-20
-30
0
24
48
72
96
120
144
168
192
216
240
264
288
312
Month, 1=January 1983
U (monthly no height)
U (monthly 90 km)
U (daily)

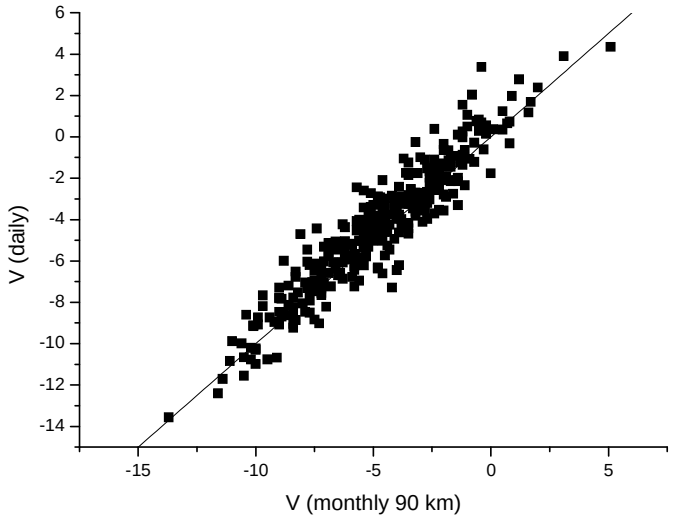

Meridional prevailing wind (m/s)
10
0
-10
-20
0
24
48
72
96
120
144
168
192
216
240
264
288
312
Month, 1=January 1983
V (monthly no height)
V (monthly 90 km)
V (daily)

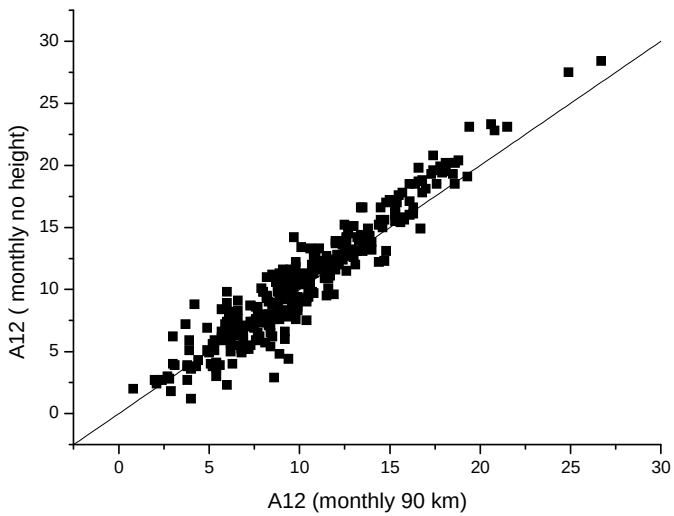

Zonal semidiumal amplitude (m/s)
40
30
20
10
0
A12 (monthly no height)
A12 (monthly 90 km)
A12 (daily)
A12 (vector)
0
24
48
72
96
120
144
168
192
216
240
264
288
312
Month, 1=January 1983
Zonal semidiumal phase (LT)
14
12
10
8
6
4
2
T12 (monthly no height)
T12 (monthly 90 km)
T12 (daily)
0
24
48
72
96
120
144
168
192
216
240
264
288
312
Month, 1=January 1983

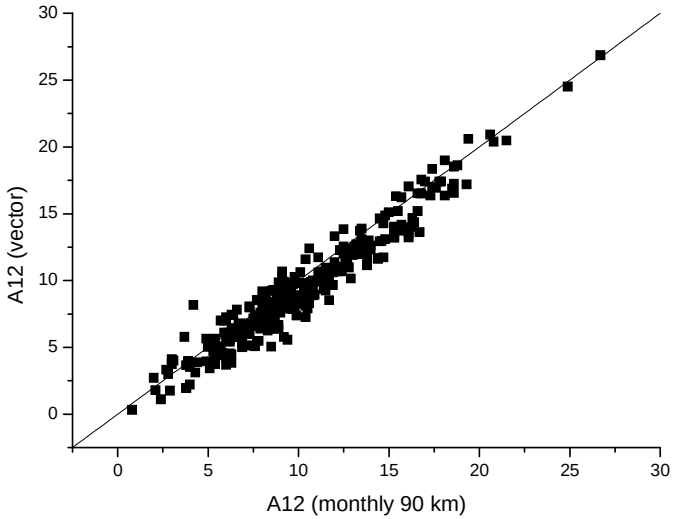

U (monthly no height)
U (monthly 90 km)
30
20
10
0
-10
-20
-20
-10
0
10
20
30

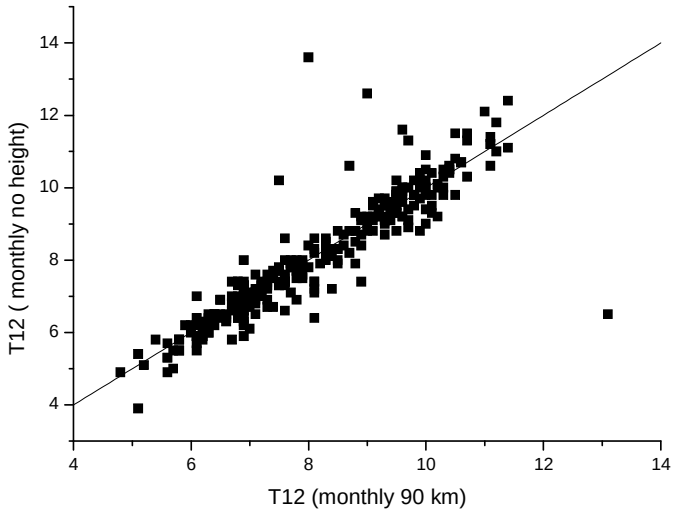

V (monthly no height)
V (monthly 90 km)
10
5
0
-5
-10
-15
-15
-10
-5
0
5

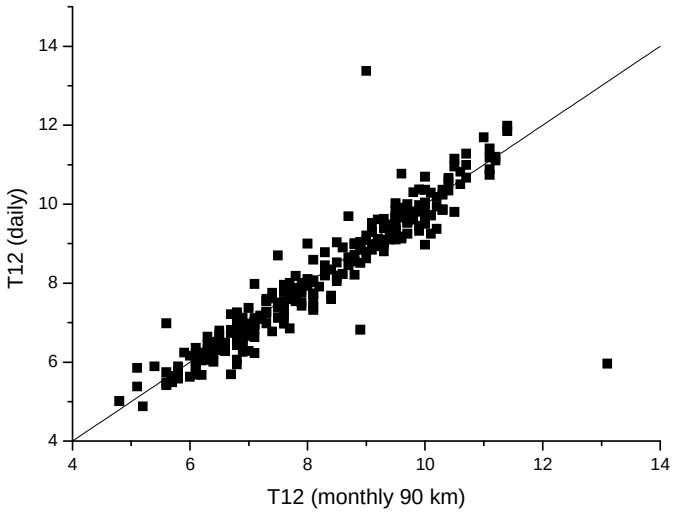

U (daily)
U (monthly 90 km)
30
20
10
0
-10
-20
-20
-10
0
10
20
30


V (daily)
V (monthly 90 km)
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-15
-10
-5
0
5


A12 (monthly no height)
A12 (monthly 90 km)
0
5
10
15
20
25
30


A12 (vector)
A12 (monthly 90 km)
0
5
10
15
20
25
30


T12 (monthly no height)
T12 (monthly 90 km)
4
6
8
10
12
14


T12 (daily)
T12 (monthly 90 km)
4
6
8
10
12
14

Conclusions on Collm LF

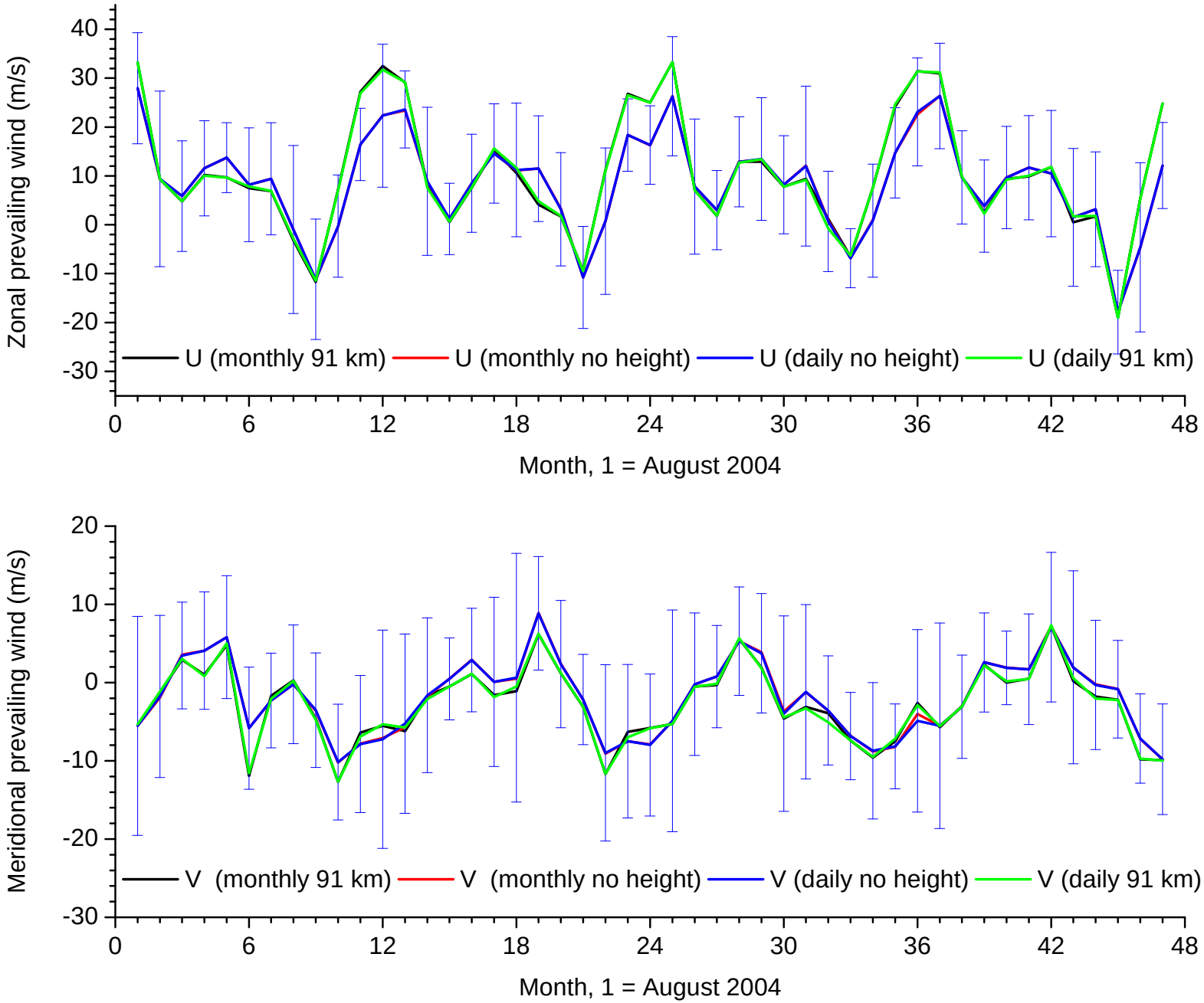
1. Differences between monthly values at 90 km and those calculated without height dependence are small, interannual variability can be reproduced
2. There is a tendency that large positive zonal winds are overestimated when heights are not considered, this is partly due to nighttime heights larger than 90 km especially during solar minimum. Ther may be an effect on detction of long-term trends.
3. Calculating monthly means from daily averages provide very similar results than analysing the entire month in one regression.

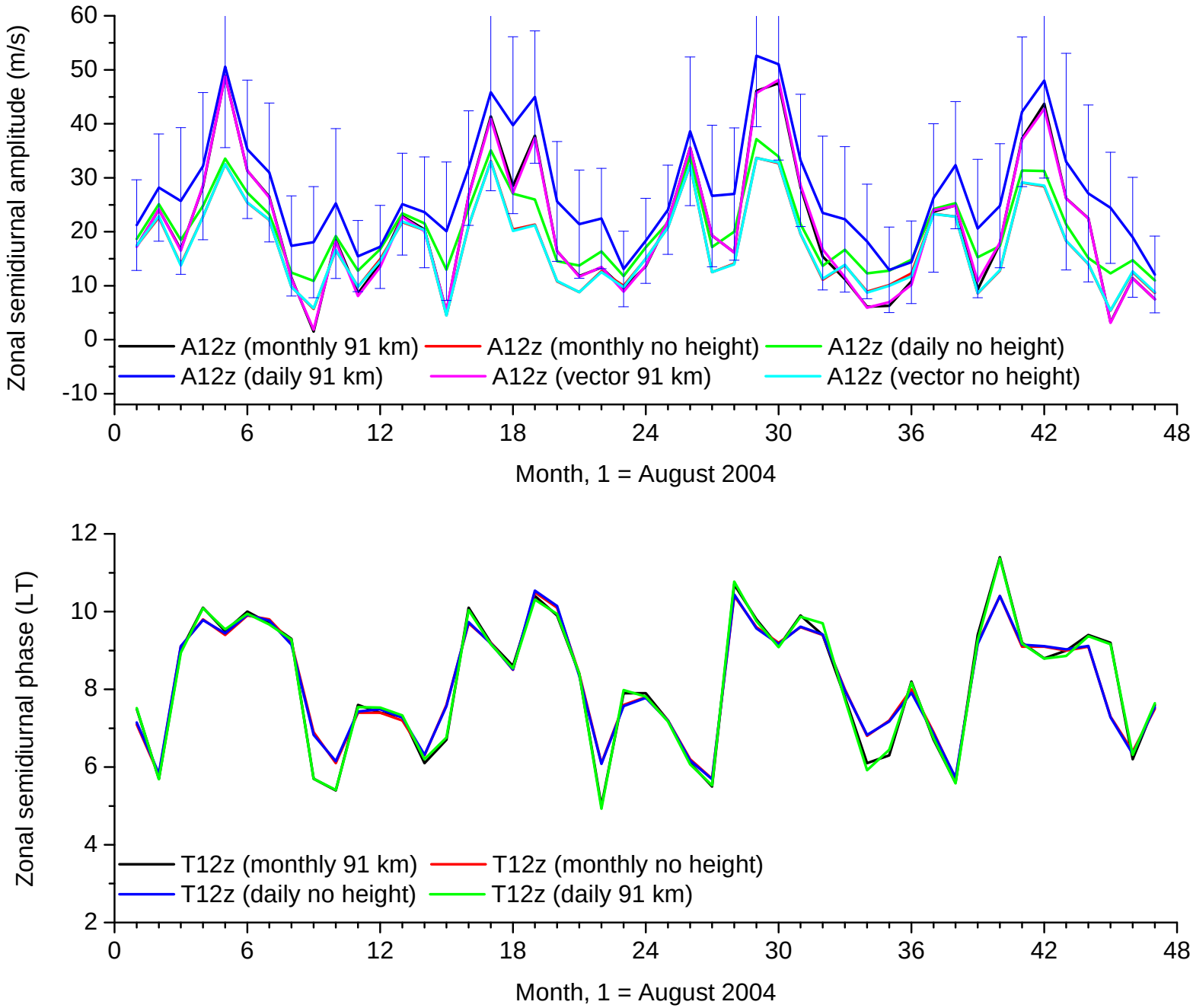
Collm SKiYMET Meteor Radar

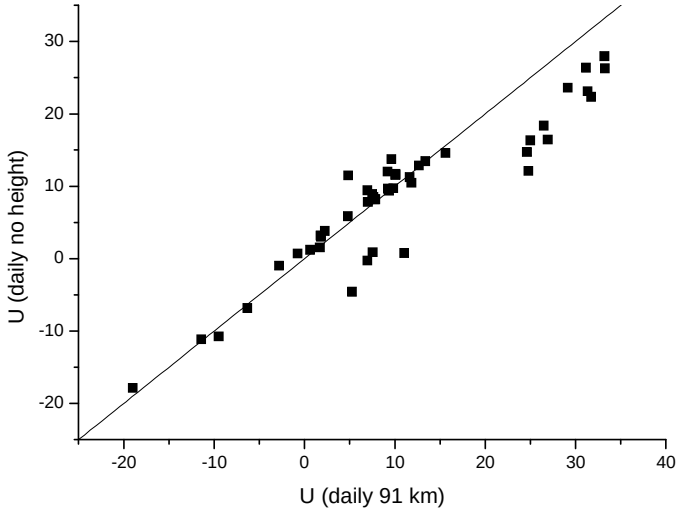
Analysis is peformed using regression with mean winds, TDT, SDT, DT.

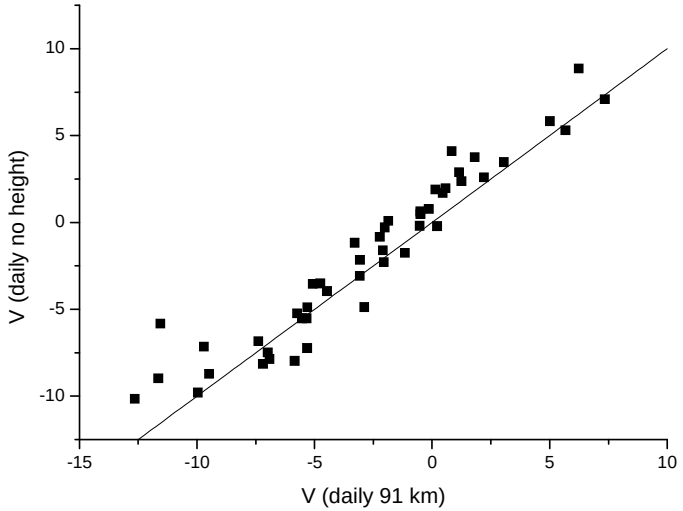
Four different datasets have been analysed:

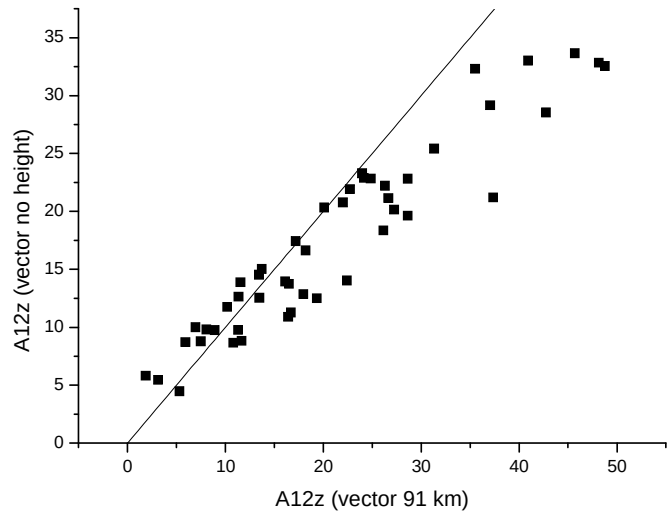
1. „Monthly no height“: from one month of hourly data including all meteors from 80-100 km
2. „Monthly 91 km“ from one month of hourly data including meteors from 89.5 – 92.5 km.
3. „Daily no height“: Monthly means from daily winds calculated from hourly means of one day each, including all data from 80-100 km. Monthly tides are calculated from vector and energetic averaging.
4. „Daily 91 km“: Monthly means from daily winds calculated from hourly means of one day each, including meteors from 89.5-92.5 km. Monthly tides are calculated from vector and energetic averaging.

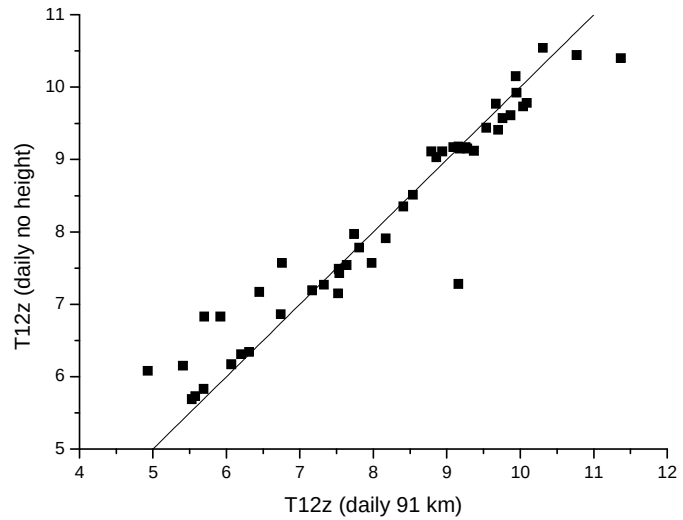

Zonal prevailing wind (m/s)
40
30
20
10
0
-10
-20
-30
U (monthly 91 km)
U (monthly no height)
U (daily no height)
U (daily 91 km)
0
6
12
18
24
30
36
42
48
Month, 1 = August 2004
Meridional prevailing wind (m/s)
20
10
0
-10
-20
-30
V (monthly 91 km)
V (monthly no height)
V (daily no height)
V (daily 91 km)
0
6
12
18
24
30
36
42
48
Month, 1 = August 2004


Zonal semidiurnal amplitude (m/s)
60
50
40
30
20
10
0
-10
A12z (monthly 91 km)
A12z (monthly no height)
A12z (daily no height)
A12z (daily 91 km)
A12z (vector 91 km)
A12z (vector no height)
0
6
12
18
24
30
36
42
48
Month, 1 = August 2004
Zonal semidiurnal phase (LT)
12
10
8
6
4
2
T12z (monthly 91 km)
T12z (monthly no height)
T12z (daily no height)
T12z (daily 91 km)
0
6
12
18
24
30
36
42
48
Month, 1 = August 2004


U (daily no height)
U (daily 91 km)
30
20
10
0
-10
-20
-20
-10
0
10
20
30
40


V (daily no height)
V (daily 91 km)
10
5
0
-5
-10
-15
-10
-5
0
5
10


A12z (vector no height)
A12z (vector 91 km)
35
30
25
20
15
10
5
0
0
10
20
30
40
50

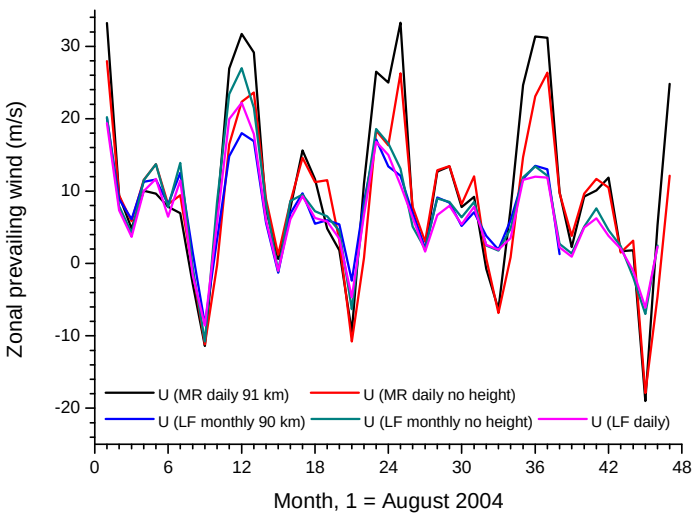

T12z (daily no height)
T12z (daily 91 km)
11
10
9
8
7
6
5
4
5
6
7
8
9
10
11
12

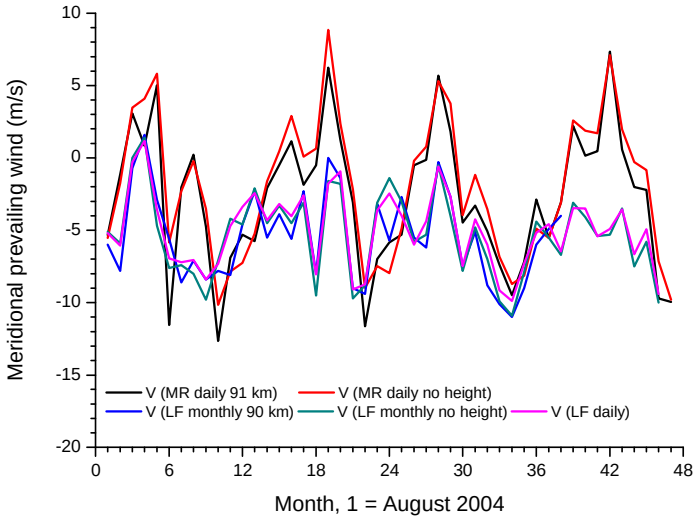
Conclusions on Collm MR

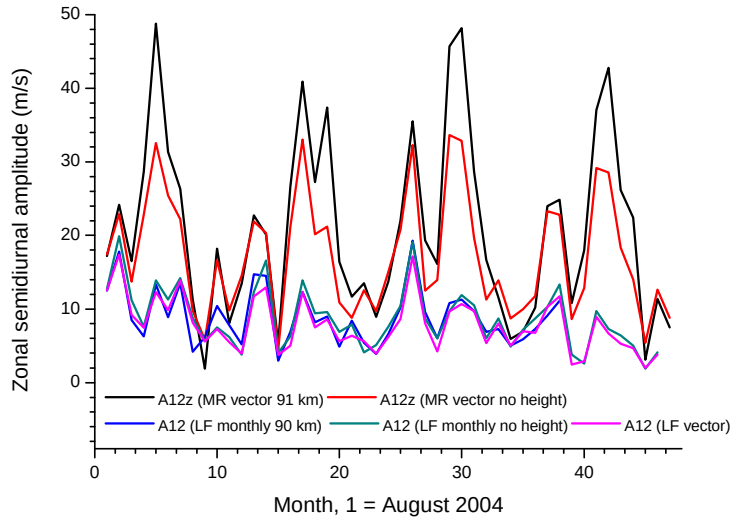
1. Differences between monthly values calculated as one regression including all data and those averaging daily values are extremely small.
2. Disregarding height finding leads to decreasing zonal prevailing winds during summer. This effect is owing to the vertical gradients then.
3. SDT amplitudes are also underestimated. This is especially the case during winter, however, the secondary maximum during late summer/early autumn is not affected, probably owing to the small vertical amplitude gradients then.

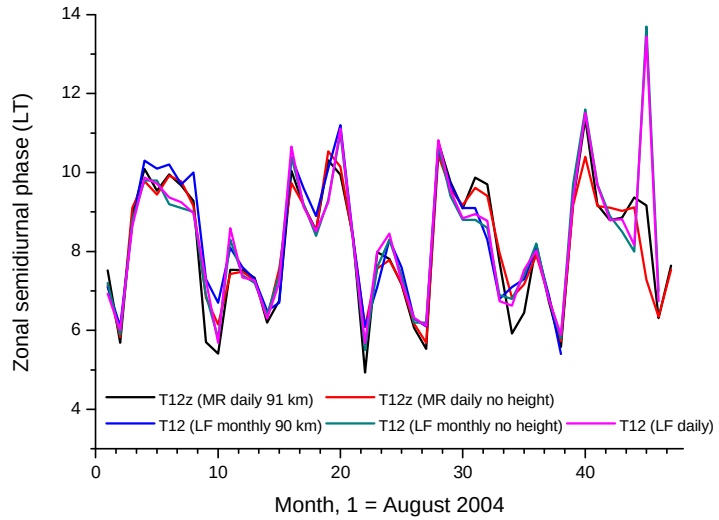
Direct comparison of MR and D1 LF

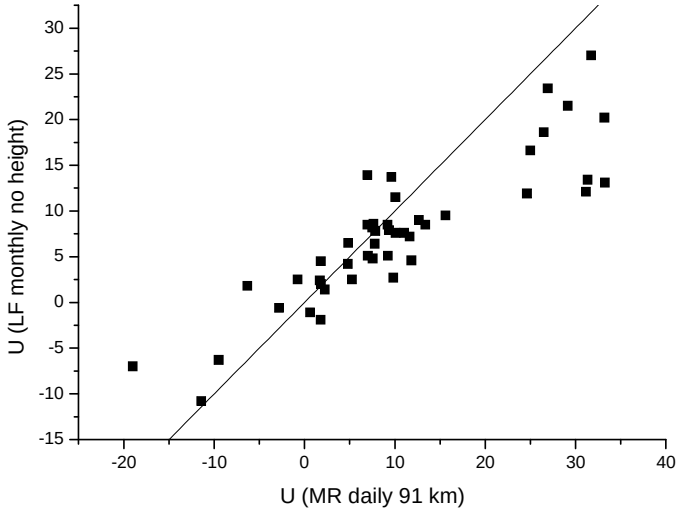
1. Monthly means calculated from MR daily analysed are used, both with and without height finding applied.
2. Data are compared to LF winds analysed with all three methods described above.
3. Comparison is made for mean winds, and the zonal SDT amplitudes and phases.

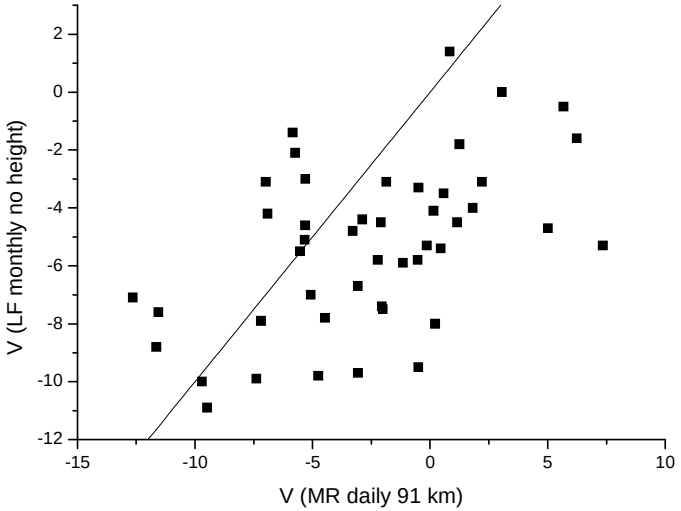

Zonal prevailing wind (m/s)
U (MR daily 91 km)
U (MR daily no height)
U (LF monthly 90 km)
U (LF monthly no height)
U (LF daily)
Month, 1 = August 2004

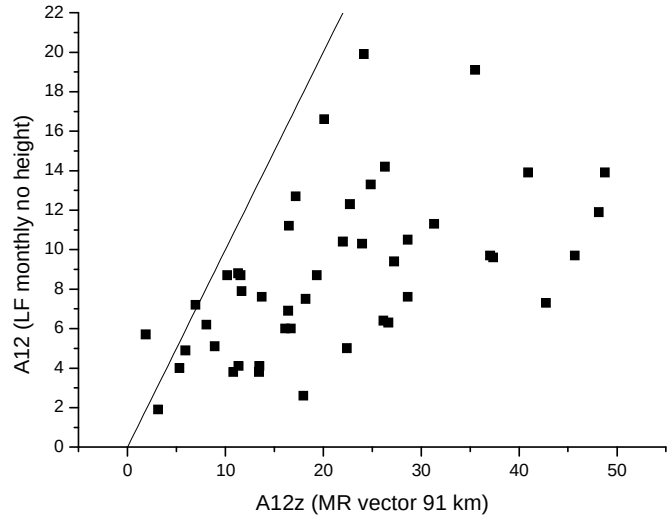

Meridional prevailing wind (m/s)
V (MR daily 91 km)
V (MR daily no height)
V (LF monthly 90 km)
V (LF monthly no height)
V (LF daily)
Month, 1 = August 2004

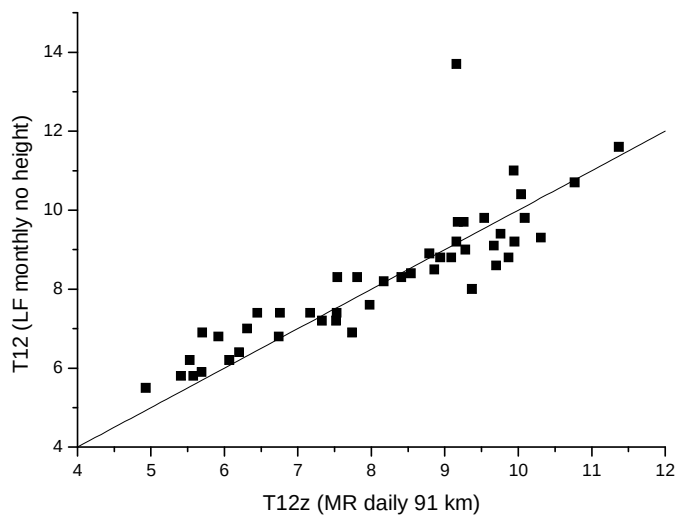

Zonal semidiurnal amplitude (m/s)
A12z (MR vector 91 km)
A12z (MR vector no height)
A12 (LF monthly 90 km)
A12 (LF monthly no height)
A12 (LF vector)
Month, 1 = August 2004


Zonal semidiurnal phase (LT)
T12z (MR daily 91 km)
T12z (MR daily no height)
T12 (LF monthly 90 km)
T12 (LF monthly no height)
T12 (LF daily)
Month, 1 = August 2004


U (LF monthly no height)
U (MR daily 91 km)


V (LF monthly no height)
V (MR daily 91 km)


A12 (LF monthly no height)
A12z (MR vector 91 km)


T12 (LF monthly no height)
T12z (MR daily 91 km)

Conclusions on the comparison of MR and LF D1

1. LF D1 underestimates zonal prevailing winds with respect to the MR winds. This is particularly visible in summer, but is also true for larger negative (westward) winds.
2. Meridional winds measured with MR show a bias of about 5 m/s towards more northward winds, mainly caused by winter months.
3. SDT amplitudes are strongly underestimated by the LF D1 method. Again, the late summer/early autumn is less affected than the winter months. This suggests that the effect is, at least partly, owing to an influence of vertical wind or tide gradients.
4. SDT phases measured by MR and LF are in good agreement.