LIAISE – Mesoscale intercomparison exercises

The main objective of the model intercomparison in LIAISE is to evaluate the representation of the surface features in numerical models and its impact in the organization of the flow at lower levels.

Two exercises are proposed. The first one (**PRE – LIAISE**) will be based on a case previous to the LIAISE campaign to evaluate the sensitivity of the results in the model parameters (parameterizations, surface features, initial conditions, resolution, …). The final goal is to find the best model configuration (that might be different for each model) that better captures the locally-generated circulations. The second exercise (**IOP – LIAISE**) will be based on an IOP of the LIAISE campaign (or several IOPs to assess how the models respond to the different land states and through different fluxes, atmospheric turbulence and the corresponding circulations) and it is expected that all the models will run with a setup defined in the PRE-LIAISE exercise.

Description of the 1st exercise (PRE – LIAISE)

The period 16th – 18th July 2016 is taken to perform the 1st intercomparison exercise (PRE-LIAISE) because it is close to the period when the LIAISE campaign will take place. Besides, the western Ebro river subbasin was under the influence of a high-pressure system centered in the NW France (Figure 1) and thermally-driven circulations were developed in the region of interest (close to Mollerussa) and also in coastal areas where sea/land breezes were present. This case has been already run at low resolution by the CNRM team.

The temporal evolution of the observations of several AWS from SMC in the studied region for the simulated period are shown at the end of this document. C6 and WL AWS are taken as an example to compare the evolution of the wet and dry sites, respectively. Besides, V8, C6, C7 and C8 are taken to illustrate the differences between the observations in the flat areas (V8) and the slopes that close the basin (C8). Find the locations of these AWS in Table 1 and in Figure 5.

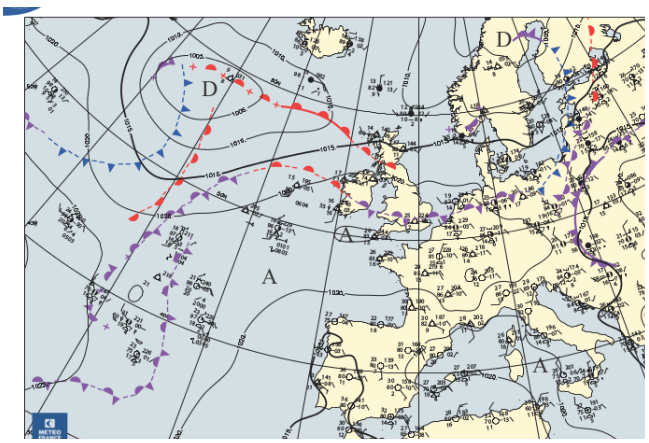


Figure 1. Large scale conditions at the surface level on 17th July 2016 at 1200 UTC.

The participant models will run the case with a commonly used setup (called ***default setup***). Sensitivity tests are welcome to show which model parameters (resolution, surface database, parameterizations, …) are important to properly characterize the organization of the flow at lower levels. The resolution and model domains are further explained in the **Appendix A.**

A preliminary list of the requested model outputs is found in the **Appendix B**.

The **validation** of the model outputs will be made through the comparison with the observations from the AWS network of Servei Meteorològic de Catalunya (SMC) and satellite-derived fields (such as LST from MSG or MODIS).

Schedule

December 2019: distribute the final version of this document with all the model outputs required (and the format to submit them) to participate in the intercomparision.

March 2020: submit the model results for the ***default setup***.

May 2020: distribution of the preliminary results (model intercomparison and validation with available observations) of the intercomparison for the **default setup**. A web page will be created to exchange information among participants.

End June 2020: deadline to submit the results of the sensitivity tests (before this deadline are also welcome).

End 2020: write a report with the main findings that can potentially evolve to a research paper to submit to a journal.

Beginning 2021: define the 2nd intercomparison exercise based on one or more IOPs during the LIAISE campaign.

Appendix A. Model setup

Length of the run
starting on 16th July at 1800 UTC and finishing on 18th July at 0600 UTC
day period: from sunrise to sunset 17th July
night period: from sunset 17th to sunrise 18th July

Model domains (nested, one_way)
2km resolution covering the Ebro valley (see Figure 2 left) with these limits
latitude: 40.5º – 43.5º
longitude: -3.1º – 3.6º
with a total number of points of 284 x 162 (N_x x N_y)

400m resolution covering the subbasin centered in Mollerussa
latitude: 41.0º – 42.2º
longitude: -0.5º – 1.8º
with a total number of points of 490 x 320 (N_x x N_y)

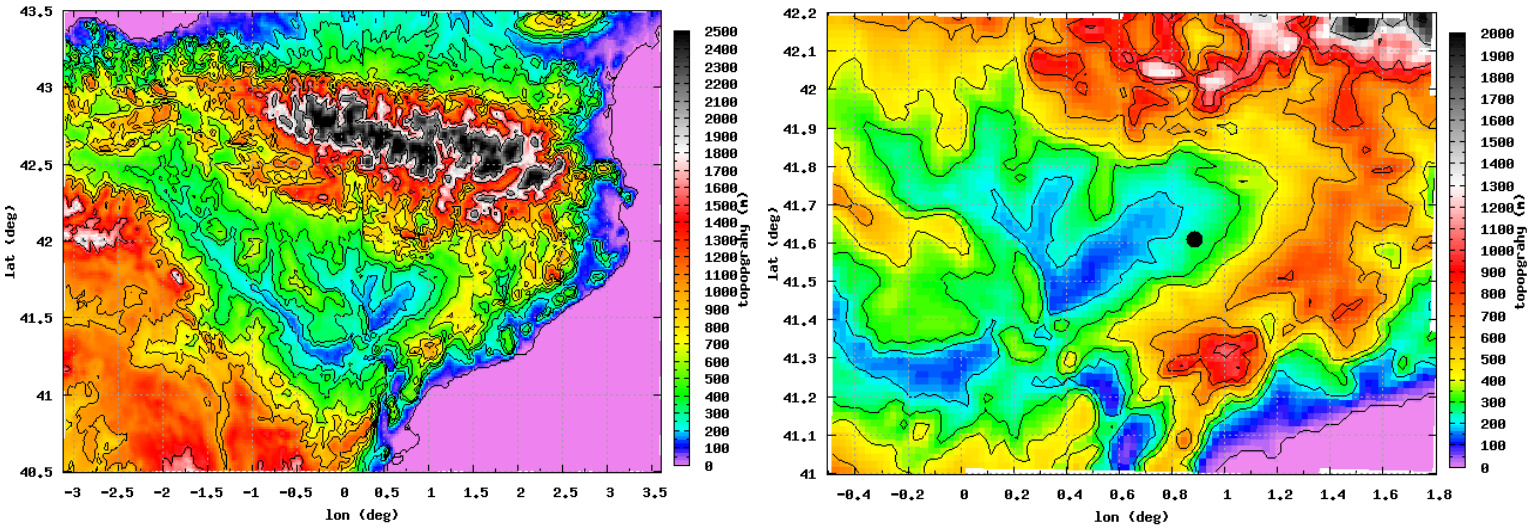


Figure 2. Outer (2km x 2km resolution) and inner (400m x 400m resolution) domains. The dot indicates the location of Mollerussa.

For those participant models that will run the case with 1 domain, the submitted results have to cover the eastern Ebro subbasin (Figure 2 right).

Vertical resolution
It is proposed that models use the following vertical grid (Figure 3) or at least choose one with similar features.

The first gridpoint is placed at 2m.
Vertical resolution at lower levels: 4m
Number of levels below 100m: 16
Number of levels below 500m: 37
Number of levels below 1000m: 48

Figure 3 shows the vertical grid resolution from the ground up to 2000m and in Table 1 there is the detailed list of the model levels and the vertical grid.

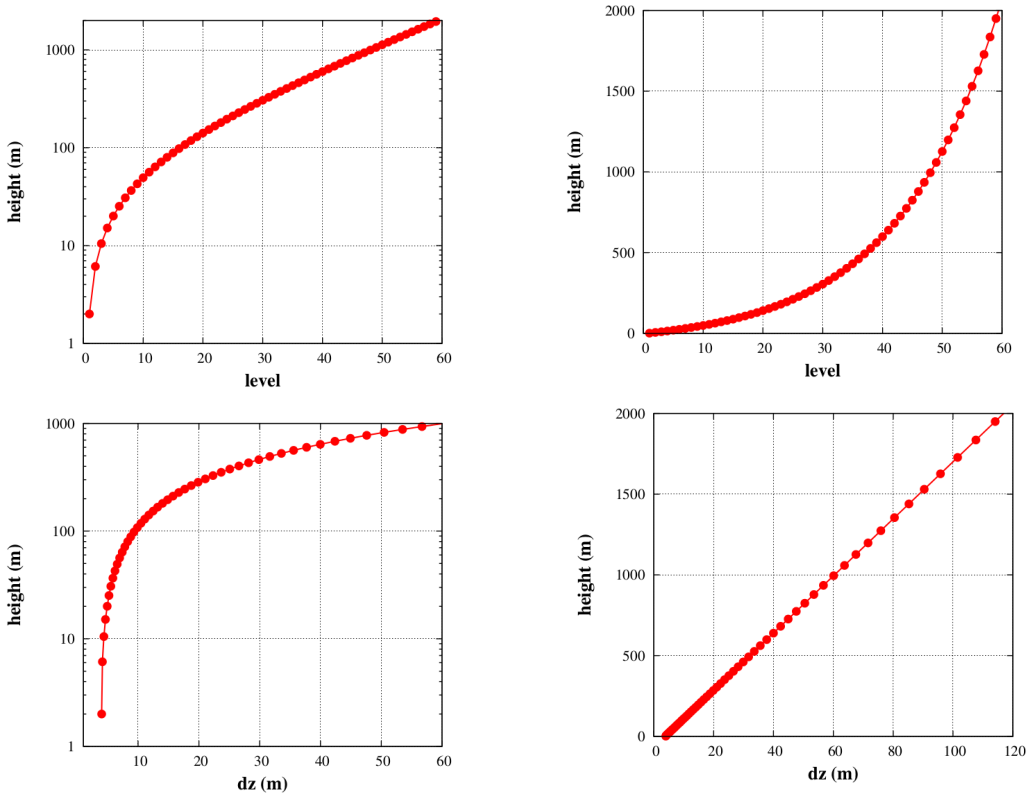


Figure 3. Proposed vertical grid: (top) number of levels and heights; (bottom) vertical resolution for each height.

Initial and lateral boundary conditions

It is expected that models use the analyses of ECMWF from the initial and lateral boundary conditions (refreshed every 6 hours). Tests exploring the different analyses (Arome, Arpege, NCEP, …) are also welcome to evaluate the sensivity of the models to the initial/lateral conditions in the organization of the flow at lower levels.

Parameterizations & Advection scheme

Each model will have its particular options but try to choose (if possible) the ones closest to the rest of the different model participants (listed in a table attached to this document).

level	height (agl)	Δz (m)
1	2	4
2	6.12	4.12
3	10.49	4.37
4	15.12	4.63
5	20.02	4.91
6	25.22	5.2
7	30.74	5.51
8	36.58	5.84
9	42.78	6.19
10	49.34	6.57
11	56.3	6.96
12	63.68	7.38
13	71.5	7.82
14	79.79	8.29
15	88.58	8.79
16	97.9	9.31
17	107.77	9.87
18	118.24	10.47
19	129.33	11.09
20	141.09	11.76
21	153.56	12.47
22	166.77	13.21
23	180.78	14.01
24	195.62	14.85
25	211.36	15.74
26	228.04	16.68
27	245.72	17.68
28	264.47	18.74
29	284.34	19.87
30	305.4	21.06
31	327.72	22.32
32	351.38	23.66
33	376.47	25.08
34	403.05	26.59
35	431.24	28.18
36	461.11	29.87
37	492.78	31.67
38	526.34	33.57
39	561.92	35.58
40	599.64	37.72
41	639.62	39.98
42	682	42.38
43	726.92	44.92
44	774.53	47.61
45	825	50.47
46	878.5	53.5
47	935.21	56.71
48	995.33	60.11
49	1059.05	63.72
50	1126.59	67.54

level	height (agl)	Δz (m)
51	1198.18	71.6
52	1274.07	75.89
53	1354.52	80.44
54	1439.79	85.27
55	1530.18	90.39
56	1625.99	95.81
57	1727.55	101.56
58	1835.2	107.65
59	1949.31	114.11
60	2070.27	120.96
61	2198.49	128.22
62	2336.71	138.22
63	2488.06	151.35
64	2653.79	165.73
65	2835.26	181.47
66	3033.97	198.71
67	3251.56	217.59
68	3489.82	238.26
69	3750.72	260.9
70	4036.4	285.68
71	4349.22	312.82
72	4691.76	342.54
73	5066.84	375.08
74	5477.55	410.71
75	5927.28	449.73
76	6419.73	492.45
77	6958.97	539.24
78	7549.43	590.46
79	8195.99	646.56
80	8903.97	707.98
81	9679.21	775.24
82	10528.1	848.89
83	11457.63	929.53
84	12475.47	1017.84
85	13590.01	1114.53

Table 1. A detailed description of the vertical levels and the corresponding resolution.

Appendix B. Model outputs required

The model outputs will be sent to mantonia.jimenez@uib.cat in netcdf format (preferably but also ascii files with a detailed description of the magnitudes in each column are welcome).

Only results for the inner domain (the one shown in Figure 2.right at 400m resolution and centered in Mollerussa) will be required.

Find below a list of the magnitudes requested (in bold the name of the file, incuding the affiliation and the submission date). Please, use the following units: u, v, w and wind speed in m/s; wind direction in º; T in ºC ; q in g/kg; TKE in m^2/s^2 ; surface fluxes in W/m^2

1. **TIME_SERIES_GROUND_affiliation_date.ncd** :Time series (at 2m and 10m agl) in some selected locations (sites of the AWS from the SMC network) for the wind speed, direction, T, q and TKE every 30min covering all the length of the run. See the complete list with the coordinates of these sites and their location in Figure 4 and in the table at the end of this file.

2. Time series of vertical profiles in the main sites during LIAISE for the wind speed, direction, T, q and TKE every 30min covering all the length of the run. The locations of these sites are (lat,lon):

wet site: 41.69316, 0.92984 → **TIME_SERIES_PROFILE_WET_affiliation_date.ncdf**
dry site: 41.58963, 1.03011 → **TIME_SERIES_PROFILE_DRY_affiliation_date.ncdf**
IRTA: 41.61817, 0.87182→ **TIME_SERIES_PROFILE_IRTA_affiliation_date.ncdf**

3. Surface parameters (LAI, vegetation fraction, soil cover, albedo) at the beginnig of the simulation. **GROUND_affiliation_date.ncdf**
   Besides, surface magnitudes (surface temperature, soil moisture and all the terms of the surface energy budget: RN, H, LE and G) every 30min covering all the length of the run. **GROUND_TIME_SERIES_affiliation_date.ncdf**

4. Horizontal cross-section every 30min for u, v, w, T, q and TKE for the following levels (above the ground level): 1st model level, 10m, 50m, 100m, 200m, 500m, 1000m.
   HOR_CROSS_1stlevel_affiliation_date.ncdf
   HOR_CROSS_10m_affiliation_date.ncdf
   HOR_CROSS_50m_affiliation_date.ncdf
   HOR_CROSS_100m_affiliation_date.ncdf
   HOR_CROSS_200m_affiliation_date.ncdf
   HOR_CROSS_500m_affiliation_date.ncdf
   HOR_CROSS_1000m_affiliation_date.ncdf

5. Vertical cross-sections every 30min for u, v, w, T, q, q_l and TKE following several axis across and along the Ebro western subbasin (see Figure 5). The coordinates of limits of these lines are:

black line: from -0.1,41.62 to 1.4,41.62 → **VER_CROSS_ALL_affiliation_date.ncdf**
brown line: from 0.0,41.3 to 1.40,42.00 → **VER_CROSS_LON_affiliation_date.ncdf**
blue line: from 0.62,42.00 to 1.22,41.40 → **VER_CROSS_SLO_affiliation_date.ncdf**
purple line: from -0.10,42.10 to 1.60,41.10 → **VER_CROSS_TRA_affiliation_date.ncdf**

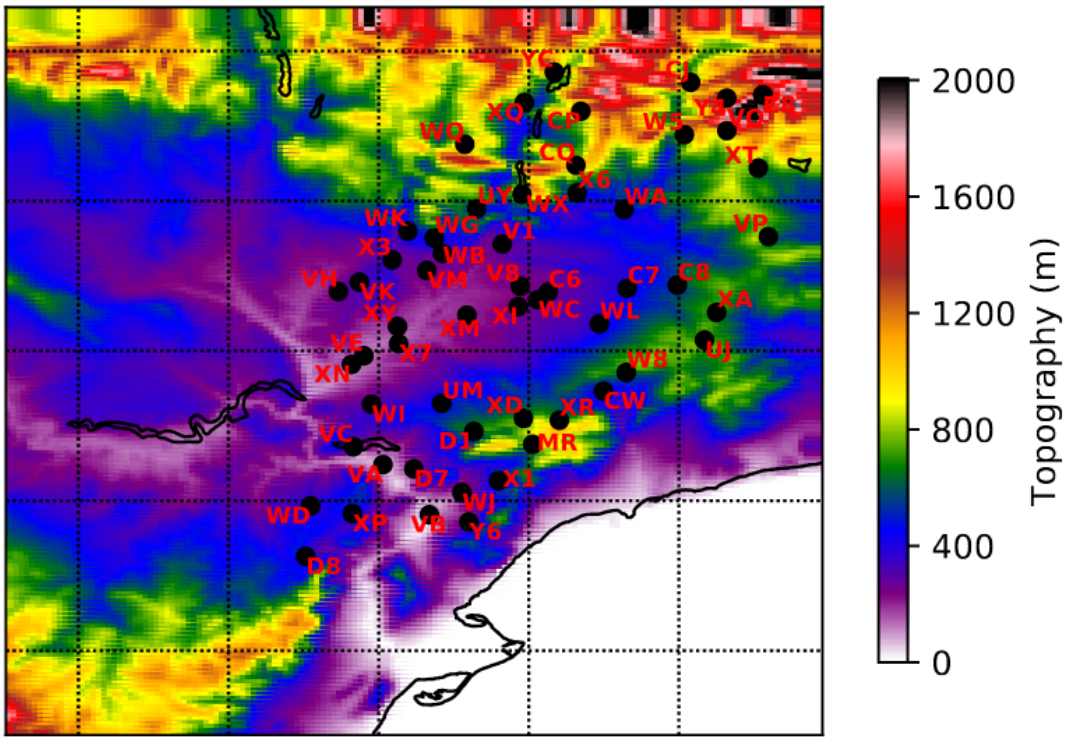


Figure 4. Location of the AWS from SMC that will be used to validate the model outputs.

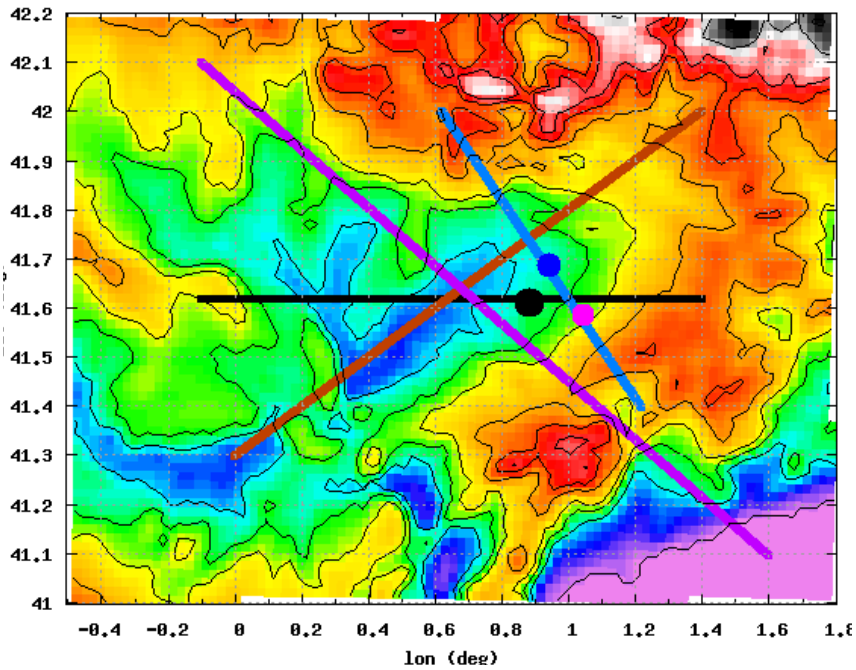
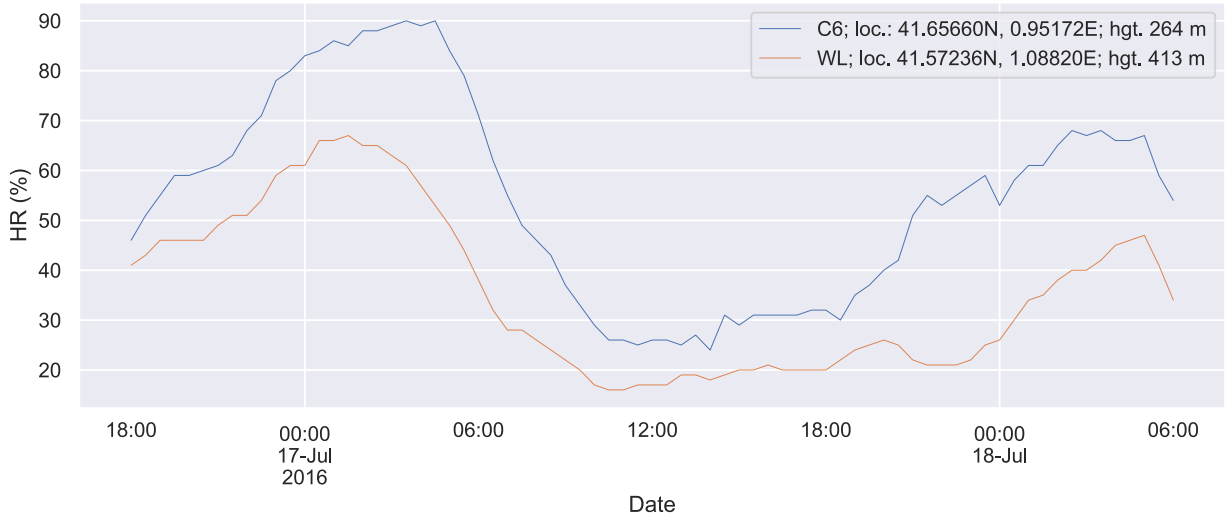


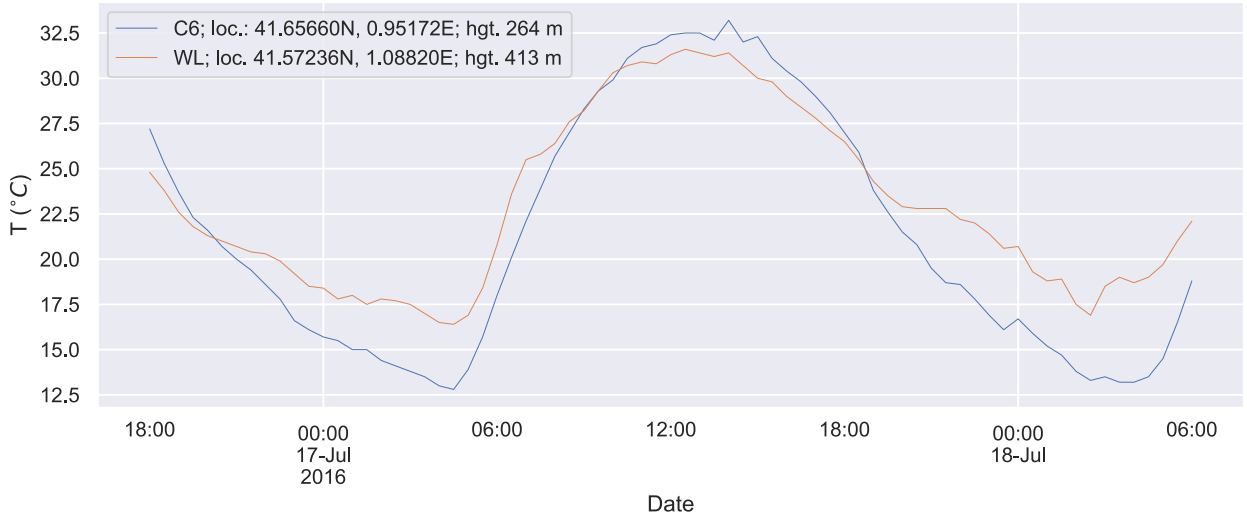
Figure 5. Topography with the lines indicating the position of the vertical cross-sections analyzed in the intercomparison. The measurement sites during LIAISE are indicated as follows: wet site (blue dot), dry site (magenta dot) and Mollerussa (black dot).

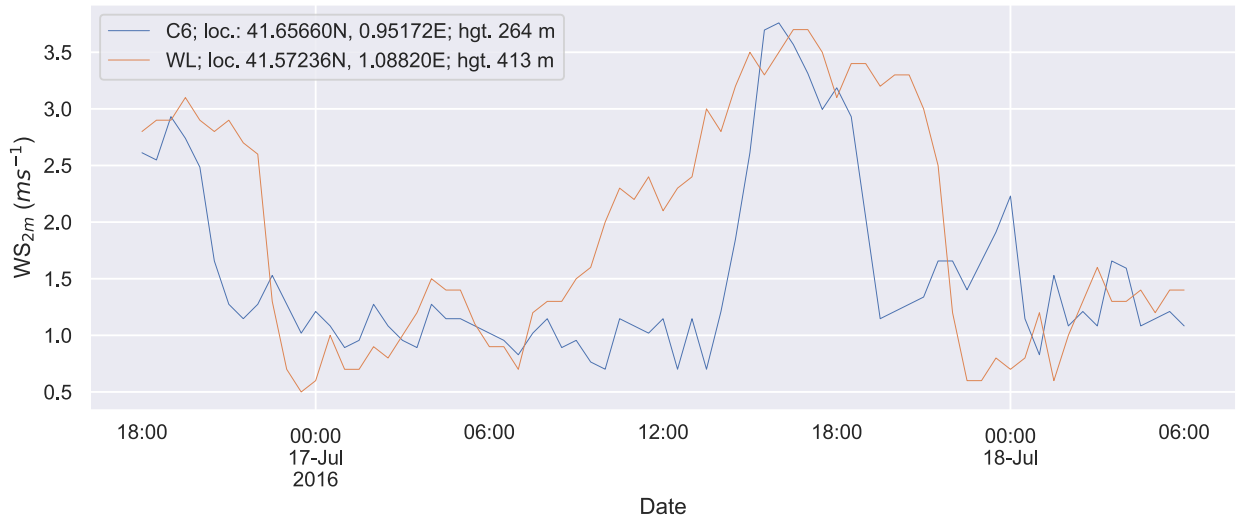
Name (code)	Alt. (m)	Lat. (°)	Lon. (°)
Mollerussa (XI)	247	41.61817	0.87182
Tàrrega (C7)	427	41.66695	1.16234
Sant Martí de Riucorb (WL)	413	41.57236	1.08820
La Granadella (UM)	505	41.35991	0.66789
Pantà de Riba-roja (VC)	69	41.24415	0.43266
Ascó (VA)	257	41.19645	0.51161
Vinebre (D7)	53	41.18499	0.59376
Maials (WI)	350	41.35741	0.48090
Seròs (XN)	89	41.46379	0.42765
Aitona (VE)	97	41.48692	0.46058
Torres de Segre (X7)	215	41.51909	0.55314
Gimenells (VH)	259	41.65814	0.39301
Batea (WD)	382	41.08671	0.31884
Gandesa (XP)	349	41.06581	0.43006
Horta de Sant Joan (D8)	515	40.95134	0.30565
Benissanet (VB)	32	41.06289	0.63517
Tivissa (Y6)	317	41.04343	0.74032
El Masroig (WJ)	141	41.12230	0.72182
Falset (X1)	359	41.15374	0.81953
l'Espluga de Francolí (CW)	446	41.39241	1.09894
Pantà de Siurana (MR)	500	41.25079	0.91060
Margalef (D1)	404	41,28521	0.75383
Ulldemolins (XD)	687	41.32000	0.88570
Prades (XR)	928	41.31481	0.98161
Blancafort (W8)	438	41.44237	1.15998
Cervera (C8)	554	41.67555	1.29609
Vallfogona de Balaguer (V1)	238	41.78487	0.82939
Os de Balaguer (UY)	576	41.87912	0.76103
Camarasa (WX)	668	41.91780	0.88175
la Panadella (XA)	785	41.60257	1.40070
Santa Coloma de Queralt (UJ)	709	41.52879	1.36830
Alcarràs (XY)	122	41.56509	0.55027
els Alamús (XM)	235	41.59522	0.73507
Raimat (VK)	349	41.68328	0.44870
Vilanova de Segrià (VM)	222	41.71450	0.62839
Alguaire (X3)	370	41.74281	0.53580
Algerri (WG)	301	41.80104	0.64804
Albesa (WB)	267	41.76036	0.67022
Alfarràs (WK)	268	41.81949	0.57768
Golmés (WC)	261	41.63642	0.92446
Castellnou de Seana (C6)	264	41.65660	0.95172
el Poal (V8)	223	41.67279	0.87741
		continues	

Table 1 – continuation

Name (code)	Alt. (m)	Lat. (°)	Lon. (°)
Baldomar (X6)	366	41.92173	1.02901
Oliola (WA)	443	41.87694	1.15410
Vilanova de Meià (CQ)	594	41.99546	1.02569
Montsec d'Ares (WQ)	1572	42.05130	072952
Tremp (XQ)	473	42.16252	0.88814
Sant Romà d'Abella (CP)	690	42.13924	1.03893
Oliana (W5)	490	42.07683	1.31489
Lladurs (VO)	785	42.08745	1.42792
Solsona (XT)	691	41.98766	1.51165
Pinós (VP)	659	41.80483	1.53853
Organyà (CJ)	566	42.21624	1.33132
Alinyà (Y4)	1162	42.17426	1.42775
el Port del Comte (Z8)	2316	42.18254	1.52407


C6; loc.: 41.65660N, 0.95172E; hgt. 264 m
WL; loc. 41.57236N, 1.08820E; hgt. 413 m
HR (%)
90
80
70
60
50
40
30
20
18:00
00:00
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date


C6; loc.: 41.65660N, 0.95172E; hgt. 264 m
WL; loc. 41.57236N, 1.08820E; hgt. 413 m
T (°C)
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
18:00
00:00
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date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WL; loc. 41.57236N, 1.08820E; hgt. 413 m
WS2m (ms−1)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
18:00
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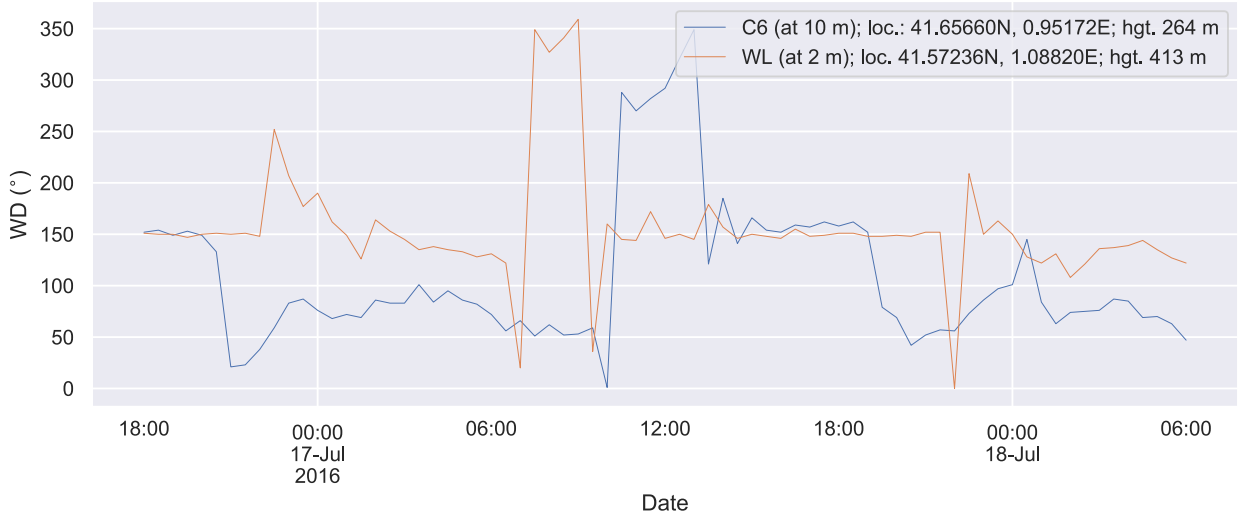
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date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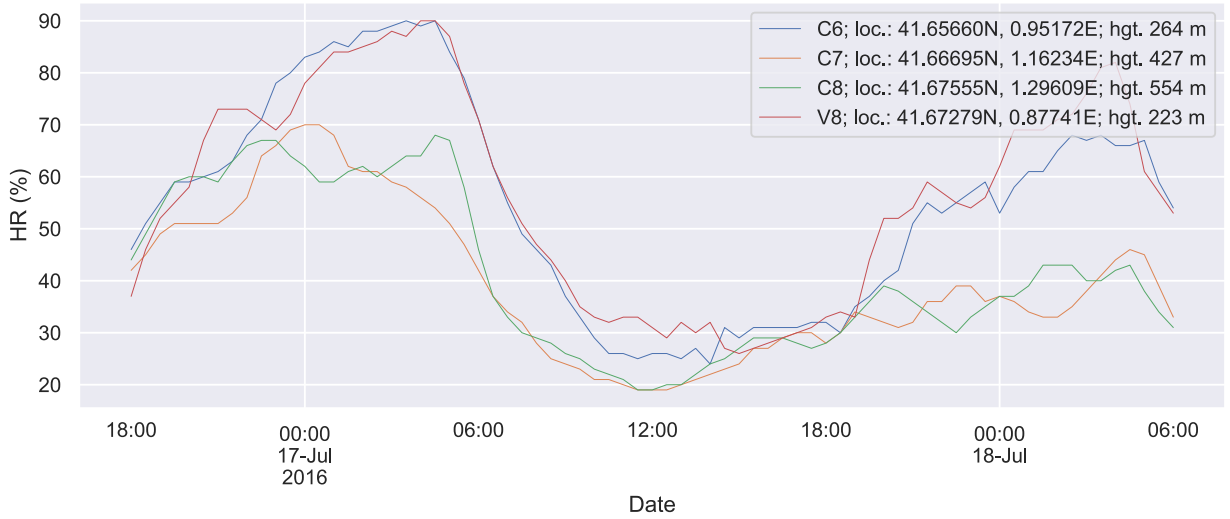
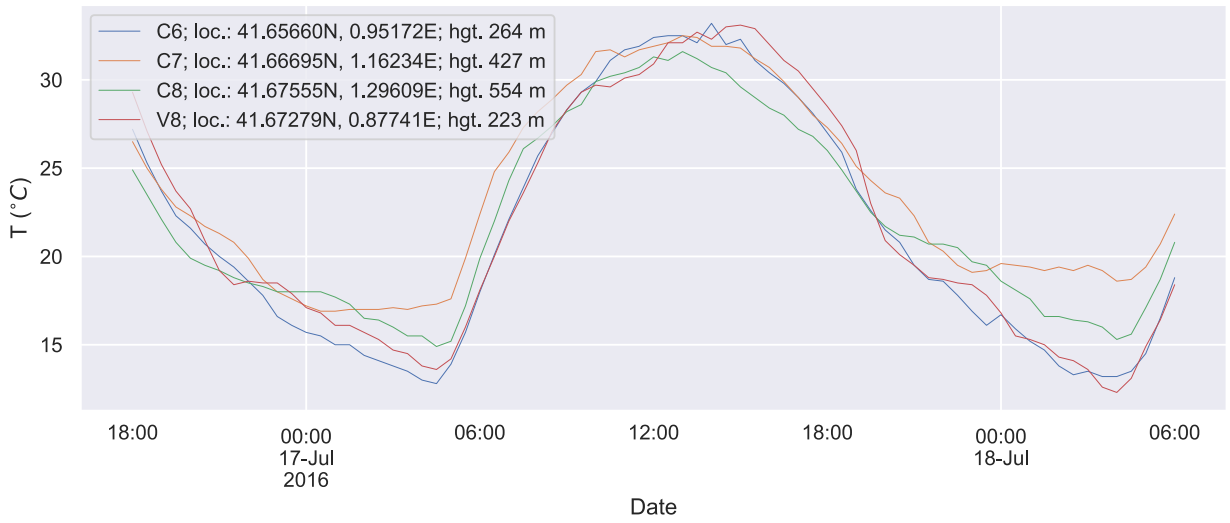
WL (at 2 m); loc. 41.57236N, 1.08820E; hgt. 413 m
WD (°)
350
300
250
200
150
100
50
0
18:00
00:00
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date


C6; loc.: 41.65660N, 0.95172E; hgt. 264 m
C7; loc.: 41.66695N, 1.16234E; hgt. 427 m
C8; loc.: 41.67555N, 1.29609E; hgt. 554 m
V8; loc.: 41.67279N, 0.87741E; hgt. 223 m
HR (%)
90
80
70
60
50
40
30
20
18:00
00:00
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date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C7; loc.: 41.66695N, 1.16234E; hgt. 427 m
C8; loc.: 41.67555N, 1.29609E; hgt. 554 m
V8; loc.: 41.67279N, 0.87741E; hgt. 223 m
T (°C)
30
25
20
15
18:00
00:00
17-Jul
2016
06:00
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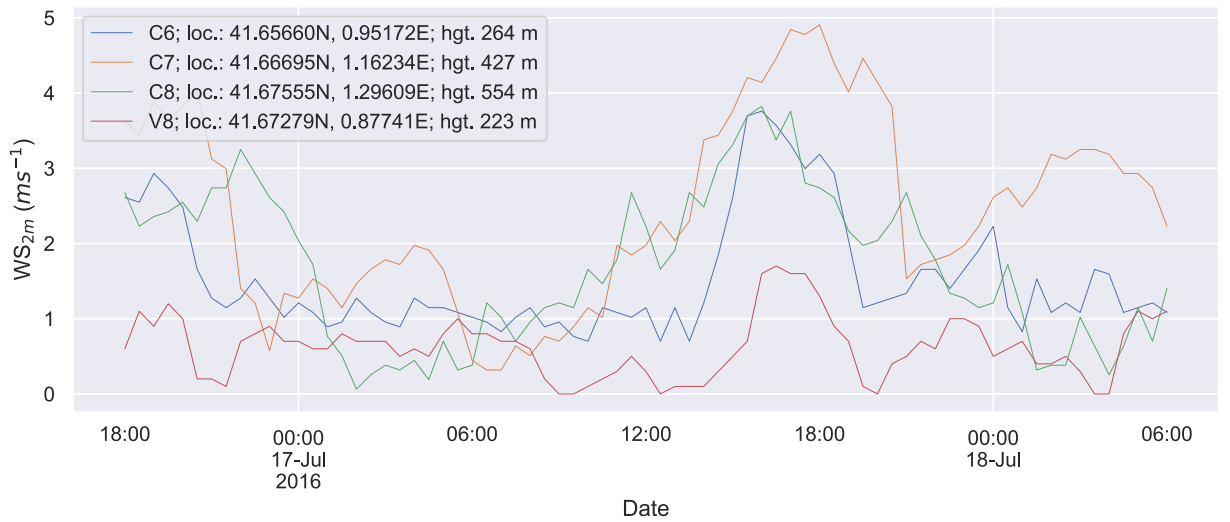
18-Jul
06:00
Date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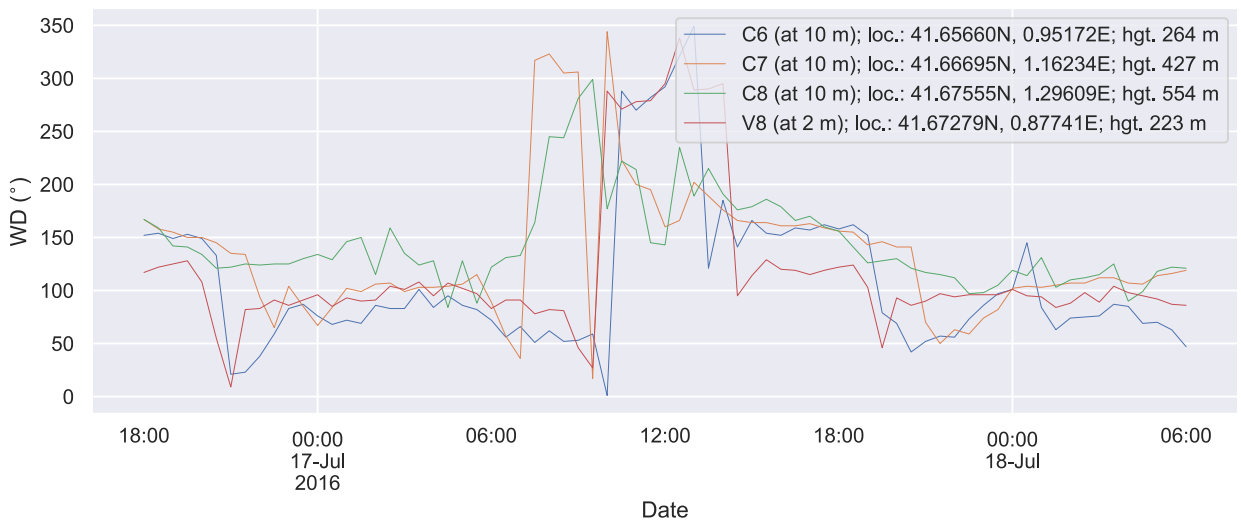
C7; loc.: 41.66695N, 1.16234E; hgt. 427 m
C8; loc.: 41.67555N, 1.29609E; hgt. 554 m
V8; loc.: 41.67279N, 0.87741E; hgt. 223 m
WS_{2m} (ms^{-1})
5
4
3
2
1
0
18:00
00:00
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date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C7 (at 10 m); loc.: 41.66695N, 1.16234E; hgt. 427 m
C8 (at 10 m); loc.: 41.67555N, 1.29609E; hgt. 554 m
V8 (at 2 m); loc.: 41.67279N, 0.87741E; hgt. 223 m
WD (°)
350
300
250
200
150
100
50
0
18:00
00:00
17-Jul
2016
06:00
12:00
18:00
00:00
18-Jul
06:00
Date