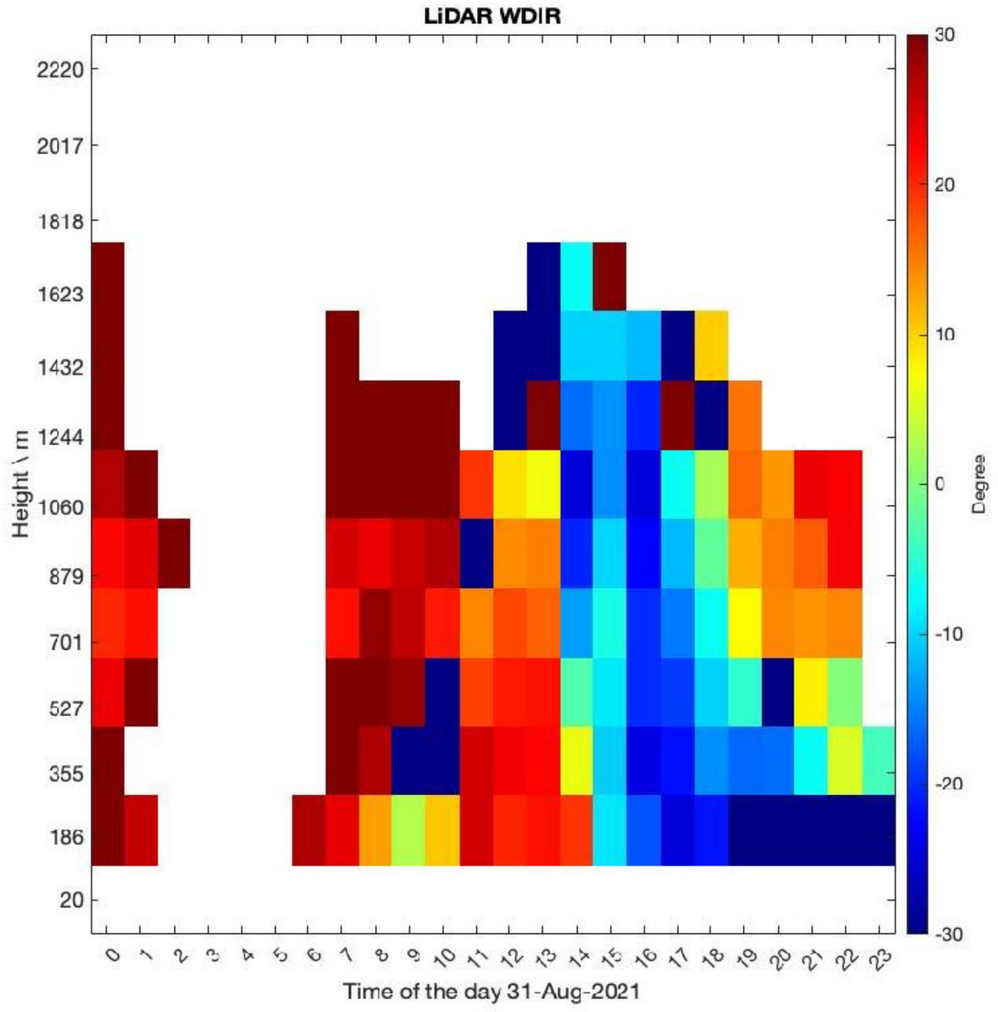
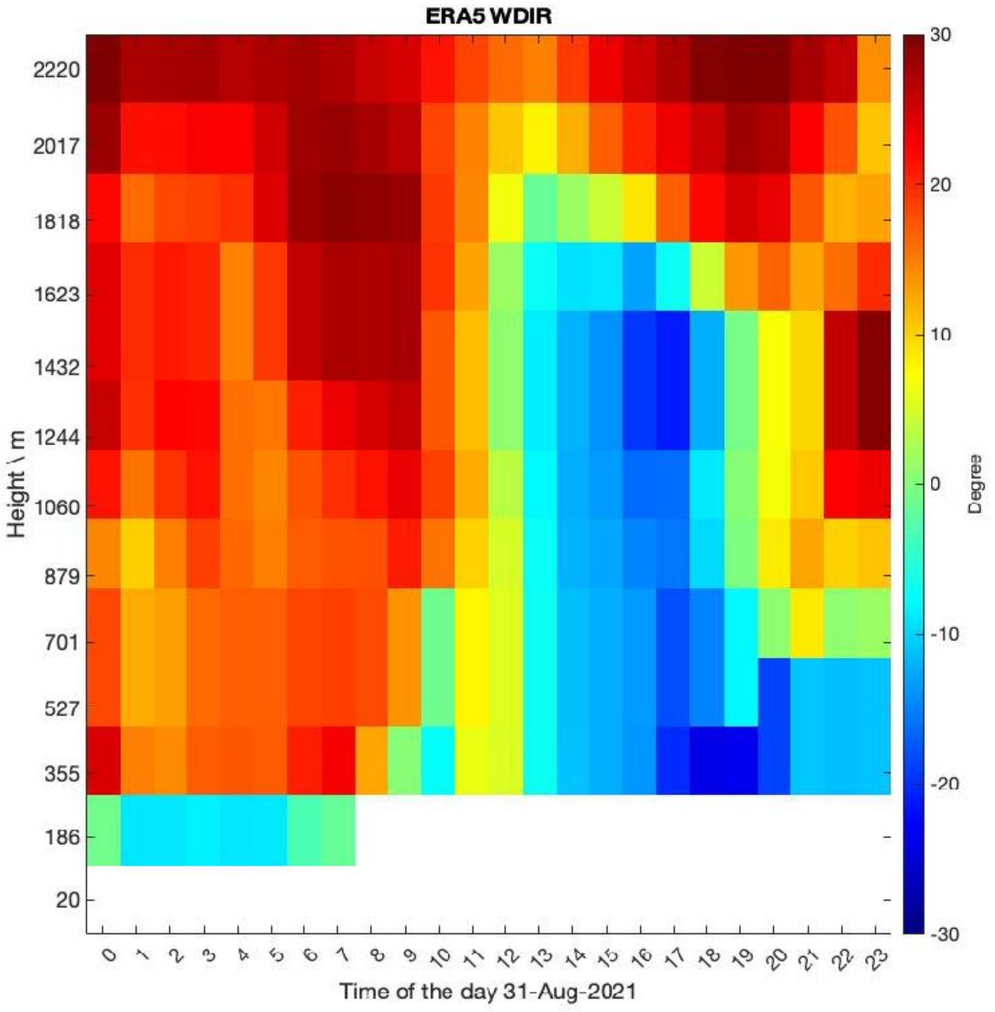
Updates FP - ESM

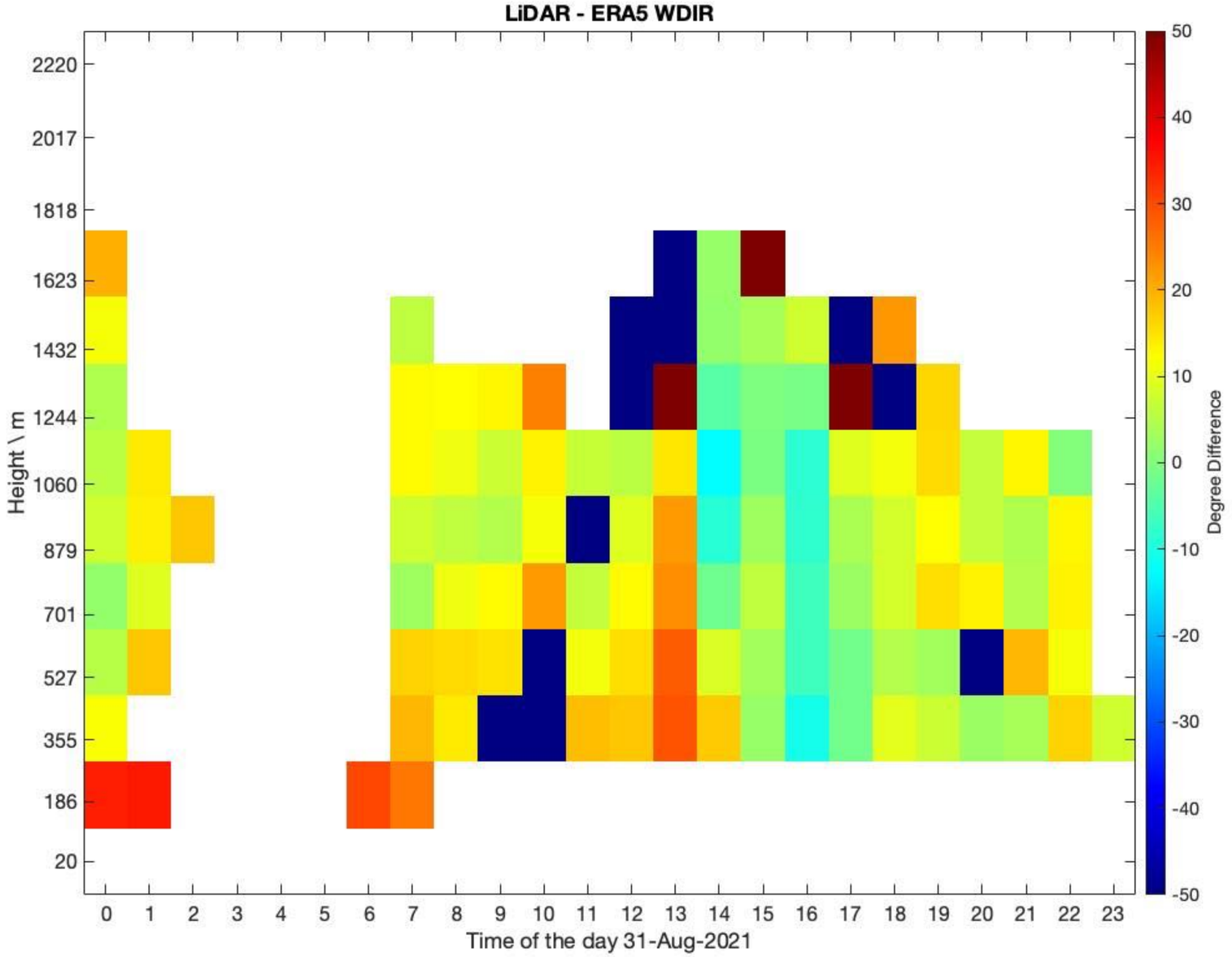
Aydin Uzun

Task 1

- Ignore WS
- Calculate WDIR differences between Lidar and ERA5


LiDAR WDIR
Height \ m
2220
2017
1818
1623
1432
1244
1060
879
701
527
355
186
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time of the day 31-Aug-2021
30
20
10
0
-10
-20
-30
Degree


ERA5 WDIR
Height \ m
2220
2017
1818
1623
1432
1244
1060
879
701
527
355
186
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time of the day 31-Aug-2021
30
20
10
0
-10
-20
-30
Degree


LiDAR - ERA5 WDIR
Height \ m
2220
2017
1818
1623
1432
1244
1060
879
701
527
355
186
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time of the day 31-Aug-2021
Degree Difference
50
40
30
20
10
0
-10
-20
-30
-40
-50

Altitude?

- + 20m for the instrument

```
equire(insol)      #needed to compute solar elevation and azimuth angles
equire(geosphere)  #needed to compute the lat-lon offset from these angles

 start_original <- '2021-08-01 06:00:00'  #first particle release
_end_original   <- '2021-08-01 18:00:00'  #last  particle release
_step  <- '15 mins' #'15 mins'

Munich 2020
esignators  <- c('mb','mc','md','me')
elease_type <- c('slant','slant','slant','slant') # choose either slant, point, or vertical
atitudes    <- c(53.495,53.536,53.421,53.568)    #location of the instruments
ongitudes   <- c(10.200,9.677,9.892,9.974)   #
ensor_agls  <- c(20,20,20,20)  #meters above ground for each instrument (building height)
elative_release_heights <- c(0,166,335,507,681,859,1040,1224,1412,1603,1798,1997,2200) #release points above the instrument
ile_name <- 'HAM_20210801_receptors_ERA5.rds' #output of this program
ngle_limit <- 75 #unit:degree

The .map file from the em27 retrieval contains the vertical profile
ertical_profile <- 'map' # select either 'map' or 'met'
ap_directory    <- '/dss/dsstumfs01/pn69ki/pn69ki-dss-0004/STILT/map/HAM/'
et_directory    <- '/dss/dsstumfs01/pn69ki/pn69ki-dss-0004/STILT/Hamburg/arl/'

-------------------------------------------------
 END OF USER INPUTS
-------------------------------------------------

 add the criteria here to define the appropriate running period:

un_times_original <- seq(from = as.POSIXct(t_start_original, tz='UTC'),to = as.POSIXct(t_end_original, tz='UTC'),by = t_step )

distance_original <- function(release_heights, designator, run_time){
  des_idx = which(designators == designator)
  s_vec <- sunvector(JD(run_time),latitudes[des_idx],longitudes[des_idx],0)
  az_sza <- sunpos( s_vec )
  return(max(relative_release_heights)/1000*tan(pi*az_sza[2]/180) )
}
```

Questions

Query points : 20 , 186, 355, 557, 701, 879, 1060

- Which interpolation type to use for ERA5 WDIR ? Nearest ?

+6 | WDIR_mat_interp | WDIR_single_date | degree_mat | dates_interval | time_vec | geopotential_height | v_interp | u_ma

37x24 double

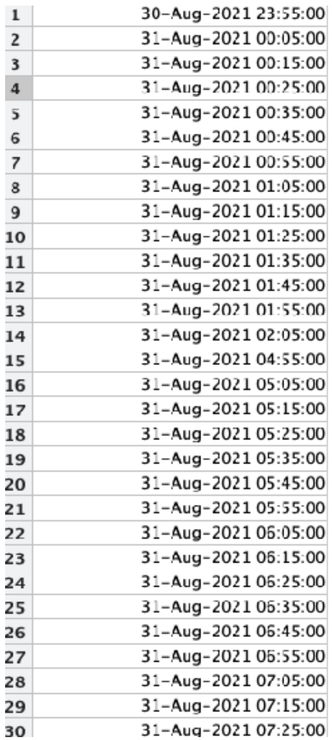
	14	15	16	17	18	19	20	21	22	23	24	25
1	452e...	4.8439e...	4.8478e...	4.8513e...	4.8520e...	4.8529e...	4.8542e...	4.8531e...	4.8494e...	4.8473e+04	4.8466e+04	
2	109e...	4.3124e...	4.3129e...	4.3130e...	4.3124e...	4.3111e...	4.3113e...	4.3117e...	4.3106e...	4.3085e+04	4.3086e+04	
3	015e...	4.0020e...	4.0044e...	4.0050e...	4.0053e...	4.0048e...	4.0044e...	4.0041e...	4.0033e...	4.0009e+04	3.9994e+04	
4	298e...	3.6300e...	3.6302e...	3.6309e...	3.6309e...	3.6320e...	3.6318e...	3.6309e...	3.6302e...	3.6290e+04	3.6283e+04	
5	935e...	3.3942e...	3.3943e...	3.3946e...	3.3941e...	3.3941e...	3.3947e...	3.3943e...	3.3930e...	3.3925e+04	3.3921e+04	
6	492e...	3.1499e...	3.1496e...	3.1493e...	3.1496e...	3.1499e...	3.1499e...	3.1499e...	3.1492e...	3.1493e+04	3.1483e+04	
7	885e...	2.6880e...	2.6885e...	2.6885e...	2.6881e...	2.6885e...	2.6884e...	2.6881e...	2.6876e...	2.6884e+04	2.6875e+04	
8	241e...	2.4239e...	2.4238e...	2.4241e...	2.4241e...	2.4246e...	2.4250e...	2.4244e...	2.4236e...	2.4239e+04	2.4230e+04	
9	948e...	2.0951e...	2.0947e...	2.0945e...	2.0943e...	2.0950e...	2.0956e...	2.0958e...	2.0954e...	2.0955e+04	2.0948e+04	
10	781e...	1.8784e...	1.8785e...	1.8784e...	1.8781e...	1.8785e...	1.8786e...	1.8789e...	1.8786e...	1.8787e+04	1.8782e+04	
11	491e...	1.6489e...	1.6488e...	1.6491e...	1.6490e...	1.6495e...	1.6498e...	1.6500e...	1.6501e...	1.6504e+04	1.6499e+04	
12	059e...	1.5058e...	1.5058e...	1.5062e...	1.5064e...	1.5067e...	1.5070e...	1.5072e...	1.5075e...	1.5082e+04	1.5078e+04	
13	891e...	1.3892e...	1.3894e...	1.3898e...	1.3901e...	1.3907e...	1.3909e...	1.3911e...	1.3913e...	1.3920e+04	1.3919e+04	
14	908e...	1.2911e...	1.2913e...	1.2916e...	1.2919e...	1.2927e...	1.2931e...	1.2934e...	1.2937e...	1.2943e+04	1.2944e+04	
15	065e...	1.2069e...	1.2073e...	1.2078e...	1.2080e...	1.2089e...	1.2094e...	1.2096e...	1.2098e...	1.2105e+04	1.2109e+04	
16	821e...	1.1327e...	1.1332e...	1.1337e...	1.1341e...	1.1349e...	1.1355e...	1.1358e...	1.1359e...	1.1366e+04	1.1370e+04	
17	645e...	1.0652e...	1.0658e...	1.0663e...	1.0666e...	1.0674e...	1.0680e...	1.0684e...	1.0687e...	1.0692e+04	1.0696e+04	
18	361e...	9.4420e...	9.4465e...	9.4502e...	9.4539e...	9.4629e...	9.4703e...	9.4740e...	9.4770e...	9.4852e+03	9.4882e+03	
19	715e...	8.3774e...	8.3819e...	8.3849e...	8.3878e...	8.3953e...	8.4027e...	8.4072e...	8.4102e...	8.4199e+03	8.4221e+03	
20	193e...	7.4237e...	7.4267e...	7.4304e...	7.4327e...	7.4394e...	7.4453e...	7.4483e...	7.4520e...	7.4625e+03	7.4654e+03	
21	564e...	6.5601e...	6.5624e...	6.5661e...	6.5676e...	6.5728e...	6.5773e...	6.5795e...	6.5817e...	6.5907e+03	6.5944e+03	
22	673e...	5.7703e...	5.7725e...	5.7762e...	5.7770e...	5.7822e...	5.7859e...	5.7881e...	5.7904e...	5.7963e+03	5.7986e+03	
23	384e...	5.0407e...	5.0437e...	5.0466e...	5.0481e...	5.0526e...	5.0571e...	5.0600e...	5.0623e...	5.0667e+03	5.0682e+03	
24	625e...	4.3647e...	4.3669e...	4.3699e...	4.3706e...	4.3751e...	4.3796e...	4.3826e...	4.3848e...	4.3885e+03	4.3900e+03	
25	311e...	3.7328e...	3.7349e...	3.7371e...	3.7378e...	3.7416e...	3.7460e...	3.7498e...	3.7520e...	3.7557e+03	3.7572e+03	
26	385e...	3.1393e...	3.1408e...	3.1430e...	3.1430e...	3.1475e...	3.1519e...	3.1557e...	3.1579e...	3.1624e+03	3.1638e+03	
27	809e...	2.5809e...	2.5817e...	2.5832e...	2.5824e...	2.5869e...	2.5913e...	2.5951e...	2.5966e...	2.6025e+03	2.6040e+03	
28	144e...	2.3137e...	2.3137e...	2.3151e...	2.3144e...	2.3181e...	2.3226e...	2.3256e...	2.3278e...	2.3338e+03	2.3345e+03	
29	553e...	2.0546e...	2.0546e...	2.0553e...	2.0538e...	2.0576e...	2.0613e...	2.0643e...	2.0657e...	2.0717e+03	2.0732e+03	
30	029e...	1.8029e...	1.8022e...	1.8029e...	1.8015e...	1.8044e...	1.8074e...	1.8104e...	1.8111e...	1.8163e+03	1.8186e+03	
31	588e...	1.5580e...	1.5580e...	1.5580e...	1.5558e...	1.5588e...	1.5617e...	1.5640e...	1.5647e...	1.5692e+03	1.5714e+03	
32	198e...	1.3190e...	1.3190e...	1.3190e...	1.3168e...	1.3198e...	1.3220e...	1.3250e...	1.3250e...	1.3295e+03	1.3317e+03	
33	860e...	1.0853e...	1.0845e...	1.0845e...	1.0830e...	1.0853e...	1.0882e...	1.0912e...	1.0920e...	1.0950e+03	1.0979e+03	
34	8.7179	855.2289	855.2289	855.2289	853.7400	855.9734	858.9513	861.9292	862.6737	866.3960	868.6295	
35	1.8861	630.3971	629.6526	630.3971	628.1637	631.8861	634.8640	637.8419	638.5863	641.5642	643.7977	
36	1.5211	409.2877	408.5432	409.2877	407.7987	410.7766	414.4990	417.4769	418.2214	421.9438	424.1772	
37	4.8785	192.6451	191.9006	191.9006	191.1562	194.8785	199.3454	203.0678	203.8123	207.5346	209.7681	

22x149 double

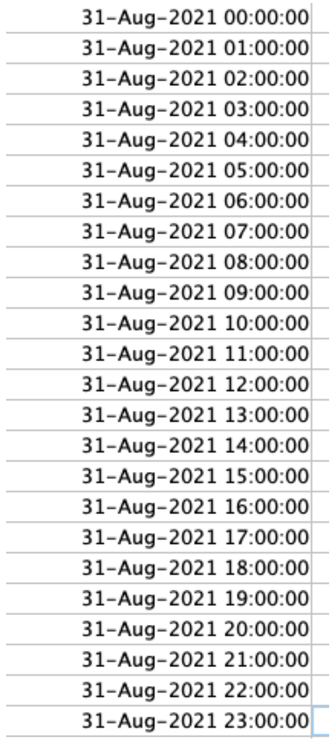
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	57.7843	72.2304	86.6765	101.1226	115.5687	130.0148	144.4608	158.9069	173.3530	187.7991	202.2452	216.6913	231.1374	245.5834	260.0295	274.4756	
2	57.7843	72.2304	86.6765	101.1226	115.5687	130.0148	144.4608	158.9069	173.3530	187.7991	202.2452	216.6913	231.1374	245.5834	260.0295	274.4756	
3	57.7843	72.2304	86.6765	101.1226	115.5687	130.0148	144.4608	158.9069	173.3530	187.7991	202.2452	216.6913	231.1374	245.5834	260.0295	274.4756	
4	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
5	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
6	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
7	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
8	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
9	57.7843	72.2304	86.6765	101.1226	115.5687	130.0148	144.4608	158.9069	173.3530	187.7991	202.2452	216.6913	231.1374	245.5834	260.0295	274.4756	
10	57.7843	72.2304	86.6765	101.1226	115.5687	130.0148	144.4608	158.9069	173.3530	187.7991	202.2452	216.6913	231.1374	245.5834	260.0295	274.4756	
11	57.7829	72.2286	86.6744	101.1201	115.5658	130.0116	144.4573	158.9030	173.3487	187.7945	202.2402	216.6859	231.1317	245.5774	260.0231	274.4688	
12	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
13	57.7843	72.2304	86.6765	101.1226	115.5687	130.0148	144.4608	158.9069	173.3530	187.7991	202.2452	216.6913	231.1374	245.5834	260.0295	274.4756	
14	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
15	57.7872	72.2340	86.6808	101.1276	115.5744	130.0212	144.4680	158.9148	173.3616	187.8084	202.2552	216.7020	231.1487	245.5956	260.0423	274.4891	
16	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
17	57.7872	72.2340	86.6808	101.1276	115.5744	130.0212	144.4680	158.9148	173.3616	187.8084	202.2552	216.7020	231.1487	245.5956	260.0423	274.4891	
18	57.7872	72.2340	86.6808	101.1276	115.5744	130.0212	144.4680	158.9148	173.3616	187.8084	202.2552	216.7020	231.1487	245.5956	260.0423	274.4891	
19	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
20	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
21	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
22	57.7858	72.2322	86.6786	101.1251	115.5715	130.0180	144.4644	158.9108	173.3573	187.8037	202.2502	216.6966	231.1431	245.5895	260.0359	274.4824	
23																	

Questions

- Idea was to give a global turn per 15 minutes
- Lidar



1	30-Aug-2021 23:55:00
2	31-Aug-2021 00:05:00
3	31-Aug-2021 00:15:00
4	31-Aug-2021 00:25:00
5	31-Aug-2021 00:35:00
6	31-Aug-2021 00:45:00
7	31-Aug-2021 00:55:00
8	31-Aug-2021 01:05:00
9	31-Aug-2021 01:15:00
10	31-Aug-2021 01:25:00
11	31-Aug-2021 01:35:00
12	31-Aug-2021 01:45:00
13	31-Aug-2021 01:55:00
14	31-Aug-2021 02:05:00
15	31-Aug-2021 04:55:00
16	31-Aug-2021 05:05:00
17	31-Aug-2021 05:15:00
18	31-Aug-2021 05:25:00
19	31-Aug-2021 05:35:00
20	31-Aug-2021 05:45:00
21	31-Aug-2021 05:55:00
22	31-Aug-2021 06:05:00
23	31-Aug-2021 06:15:00
24	31-Aug-2021 06:25:00
25	31-Aug-2021 06:35:00
26	31-Aug-2021 06:45:00
27	31-Aug-2021 06:55:00
28	31-Aug-2021 07:05:00
29	31-Aug-2021 07:15:00
30	31-Aug-2021 07:25:00



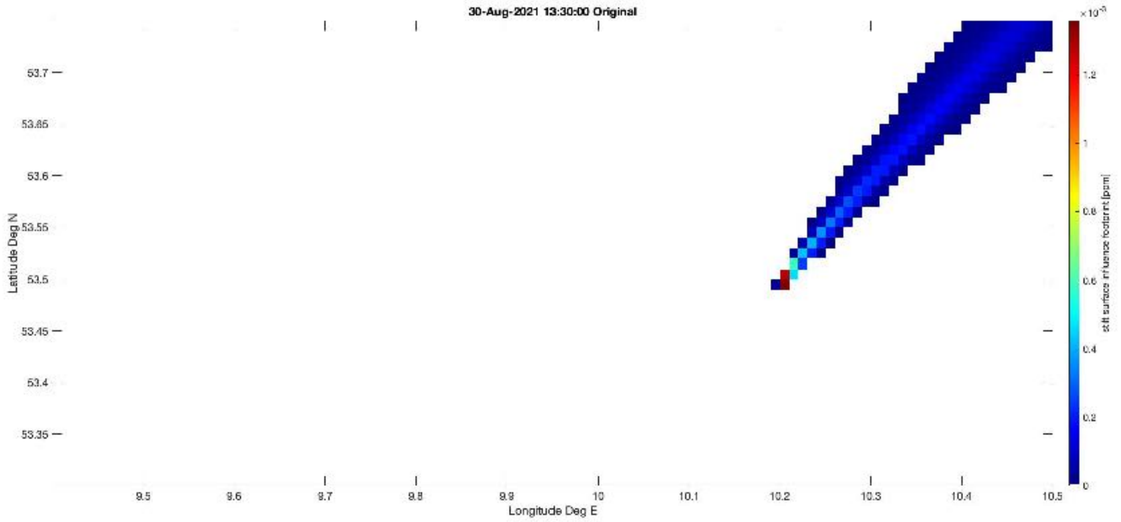
31-Aug-2021 00:00:00
31-Aug-2021 01:00:00
31-Aug-2021 02:00:00
31-Aug-2021 03:00:00
31-Aug-2021 04:00:00
31-Aug-2021 05:00:00
31-Aug-2021 06:00:00
31-Aug-2021 07:00:00
31-Aug-2021 08:00:00
31-Aug-2021 09:00:00
31-Aug-2021 10:00:00
31-Aug-2021 11:00:00
31-Aug-2021 12:00:00
31-Aug-2021 13:00:00
31-Aug-2021 14:00:00
31-Aug-2021 15:00:00
31-Aug-2021 16:00:00
31-Aug-2021 17:00:00
31-Aug-2021 18:00:00
31-Aug-2021 19:00:00
31-Aug-2021 20:00:00
31-Aug-2021 21:00:00
31-Aug-2021 22:00:00
31-Aug-2021 23:00:00

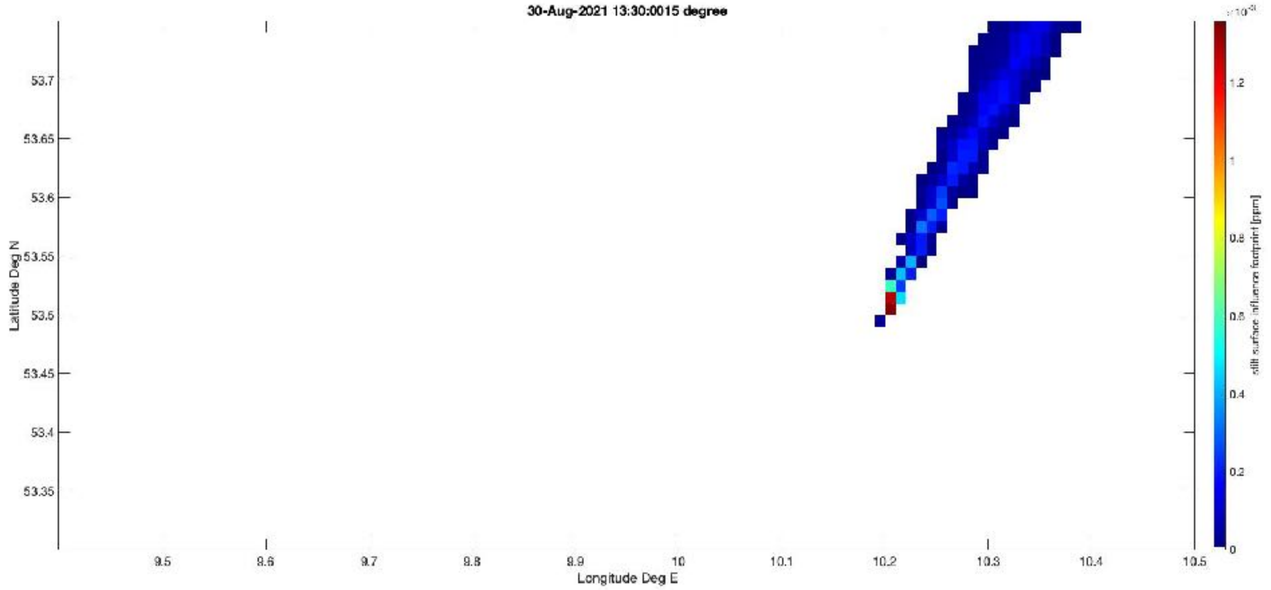
ERA5

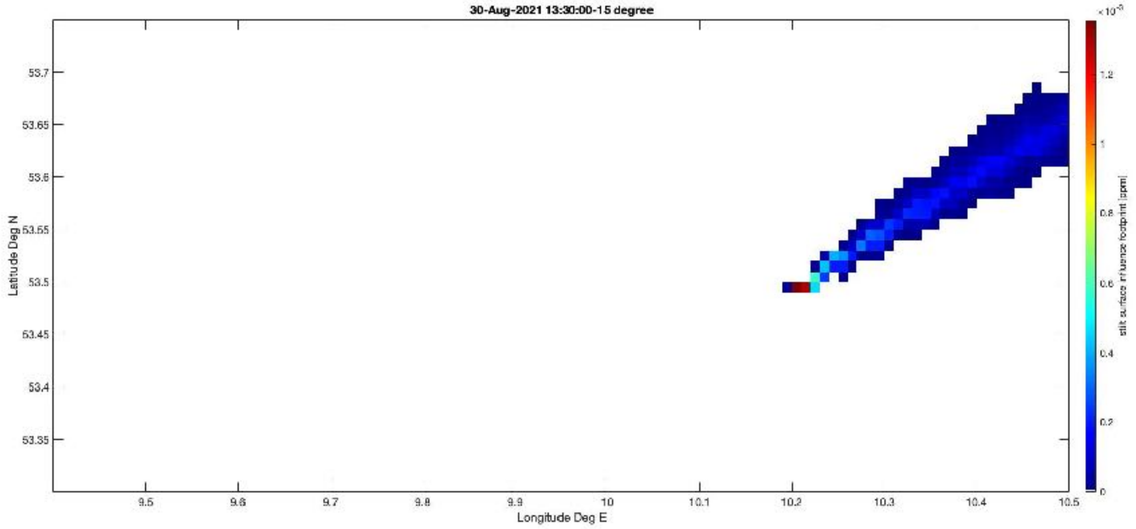
Interpolating ERA5 ? How ?

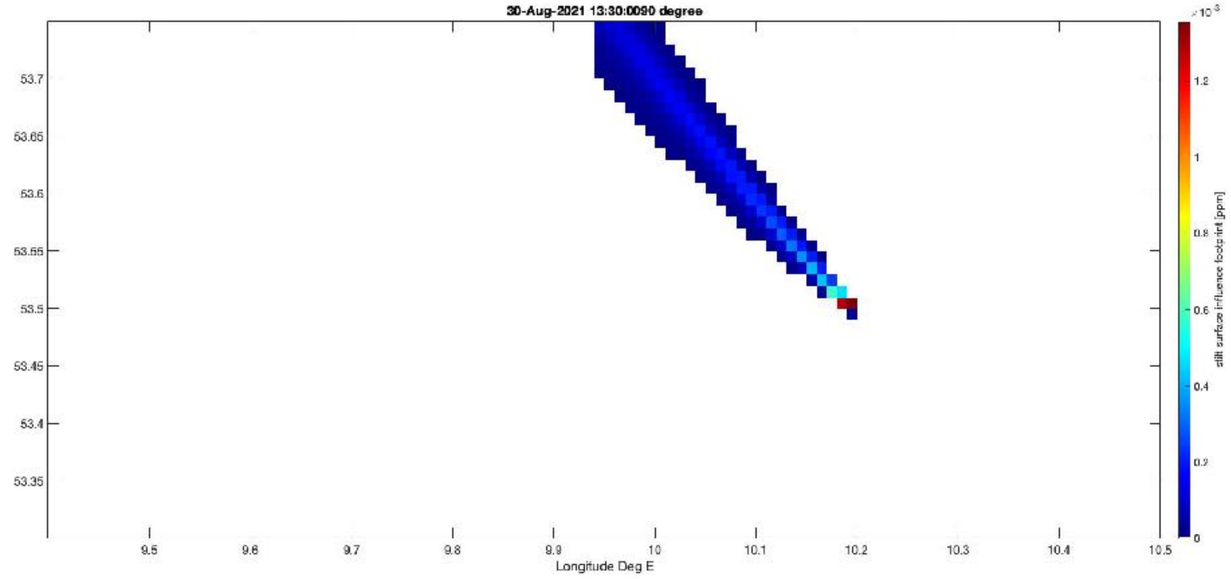
Task 2 : Rotating a FP

- Footprint step : 15 min






30-Aug-2021 13:30:00-15 degree
Latitude Deg N
Longitude Deg E
53.7
53.65
53.6
53.55
53.5
53.45
53.4
53.35
9.5
9.6
9.7
9.8
9.9
10
10.1
10.2
10.3
10.4
10.5
stilt surface influence footprint [ppm]
0
0.2
0.4
0.6
0.8
1
1.2


30-Aug-2021 13:30:0090 degree
Longitude Deg E
53.7
53.65
53.6
53.55
53.5
53.45
53.4
53.35
9.5
9.6
9.7
9.8
9.9
10
10.1
10.2
10.3
10.4
10.5
stilt surface influence footprint [ppm]
0
0.2
0.4
0.6
0.8
1
1.2

Next steps ?