

# Updates ESM Inversion

Transport Error

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# Previously...

- Model [ERA5] and data [LiDAR] mismatch in terms of **wind speed** and **wind direction**
- Using **vertical scaling factors** and **footprint intensities** -> weight the mismatch and in the end calculate **daily** values

# Previously...

date	mean_WSPD_diff	std_WSPD_diff	mean_WDIR_diff	std_WDIR_diff
01-Aug-2021	0.12	1.128	14.347	16.317
02-Aug-2021	-0.178	1.44	6.381	14.378
03-Aug-2021	0.11	0.848	5.543	42.847
04-Aug-2021	0.776	1.051	2.745	40.759
05-Aug-2021	-0.032	1.525	10.491	50.474
06-Aug-2021	1.011	1.069	-1.997	24.113
07-Aug-2021	-0.004	0.99	2.379	27.999
08-Aug-2021	0.29	0.978	6.837	6.635
09-Aug-2021	0.15	1.395	9.655	5.821
10-Aug-2021	0.738	1.148	16.799	21.778
11-Aug-2021	-0.054	0.913	9.859	20.247
12-Aug-2021	-0.06	0.575	-4.483	19.743
13-Aug-2021	-0.338	1.643	8.054	7.894
14-Aug-2021	-0.036	1.067	12.293	11.207
15-Aug-2021	-1.675	1.317	5.775	64.492
16-Aug-2021	0.315	1.105	10.925	12.709
17-Aug-2021	-0.076	1.274	13.017	8.02
18-Aug-2021	-0.835	0.9	7.042	7.956
19-Aug-2021	-0.408	1.275	8.954	12.442
20-Aug-2021	0.207	0.844	-10.94	18.547
21-Aug-2021	0.552	0.473	22.249	16.927
22-Aug-2021	-0.037	0.853	9.082	6.841
23-Aug-2021	0.698	0.662	5.97	6.468
24-Aug-2021	0.126	0.533	12.719	11.348
25-Aug-2021	0.337	1.256	8.961	5.444
26-Aug-2021	0.299	1.005	6.908	9.615
27-Aug-2021	0.371	1.389	11.601	11.539
28-Aug-2021	0.488	1.388	11.845	6.585

- Use **mean\_WDIR** to rotate the aggregated footprints

# Run Taylor's script

- Use **std WDIR + std WSPD** for Taylor's script
- 3 different inventories
  - HAM\_CH4\_inventory\_city\_and\_river\_smooth.nc
  - HAM\_CH4\_inventory\_corrected\_elev\_bothInstruments\_city\_and\_river\_smooth.nc
  - HAM\_CH4\_inventory\_corrected\_raw\_bothInstruments\_city\_and\_river\_smooth.nc

# For each particle file (\*.traj)

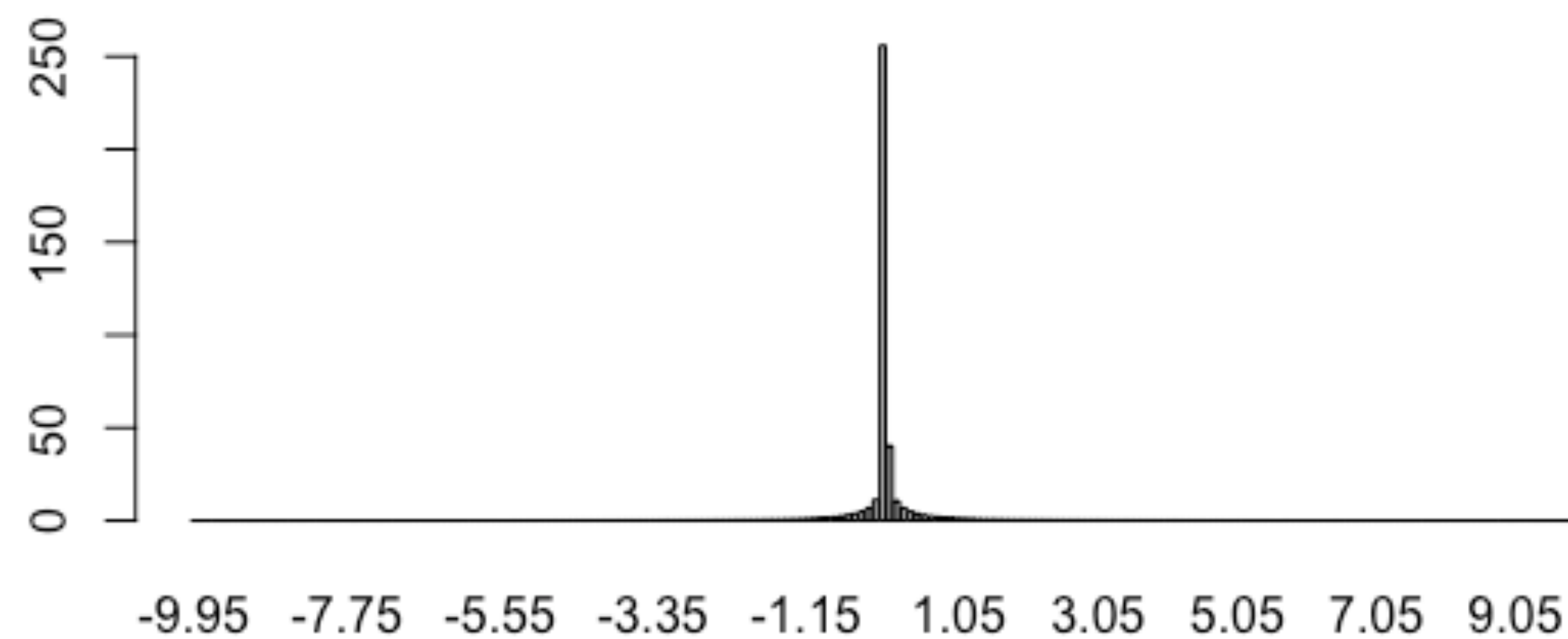
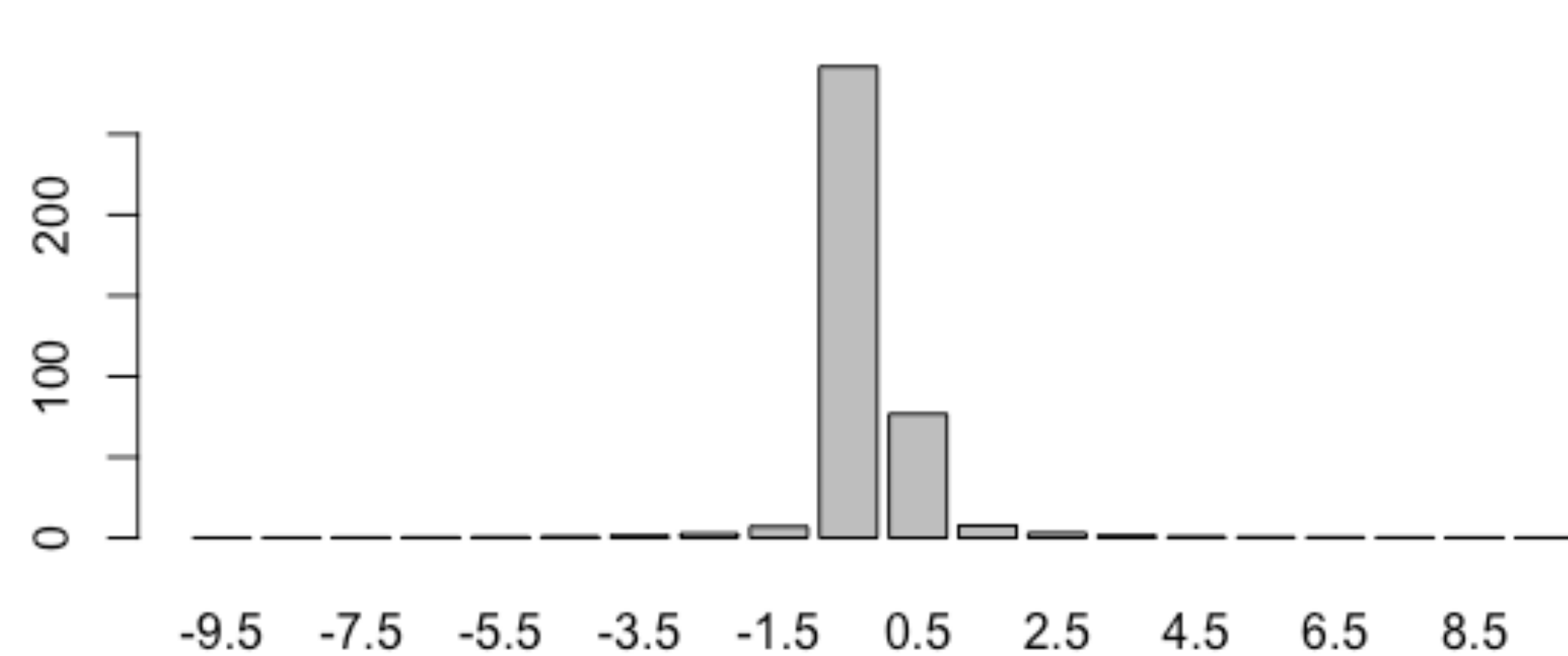
## A little more on Taylor's script

- Calculate **original total enhancement in ppb** using the footprint and inventories
- Build wind speed and direction error covariance matrices using std WDIR and std WSPD
- Run 400 simulations
  - Produce wind speed and direction error according to covariance matrices and then
  - Shift the particles
  - Calculate the new **total enhancement in ppb**
  - Find the difference between the original enhancement and the new enhancement with shifted -> ppb error
  - In the end we get 400 error values
  - Taylor plotted the histogram and find the standard deviation of these 400 error values

# Our case

- Idea: find **daily transport error**
- The days we're interested in: 20210806, 20210811, 20210812, 20210823, 20210824, 20210831, 20210901, 20210903, 20210905
- For one day -> **4 sites x 45 time points x 13 atm. layers** = ~2340 particle files
- **Run Taylor's code** for ~2340 particle files and **save the binned histogram counts** [currently 2 versions namely **fine** resolution bins and **low** resolution bins]
- [4x45x13] multiply with the **vertical scaling factor & sum up** -> [4x45] average over 45 time points -> [4] average over 4 sites -> **daily binned histogram counts** -> calculate the **standard deviation** of this distribution -> daily standard deviation transport error

# Daily distribution



Andreas to continue...