Evaluation of the differences between final ERA5 and ERA5T for Sep-Nov 2021

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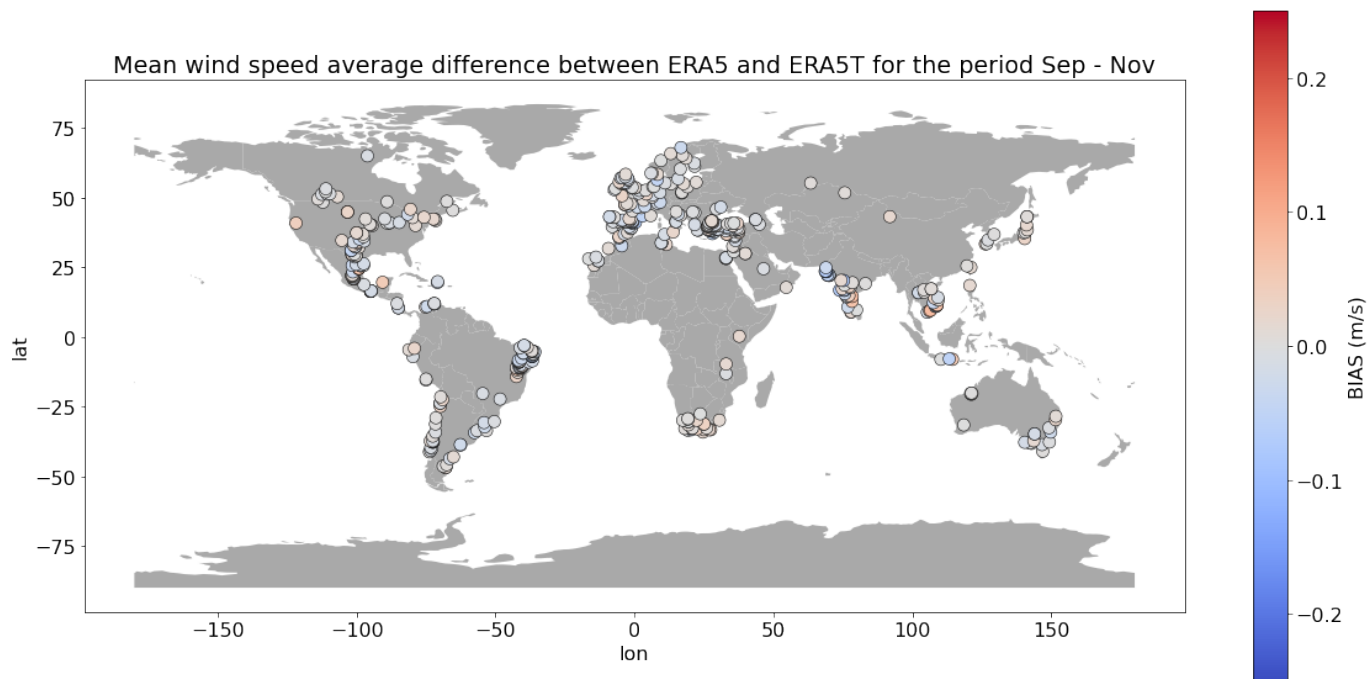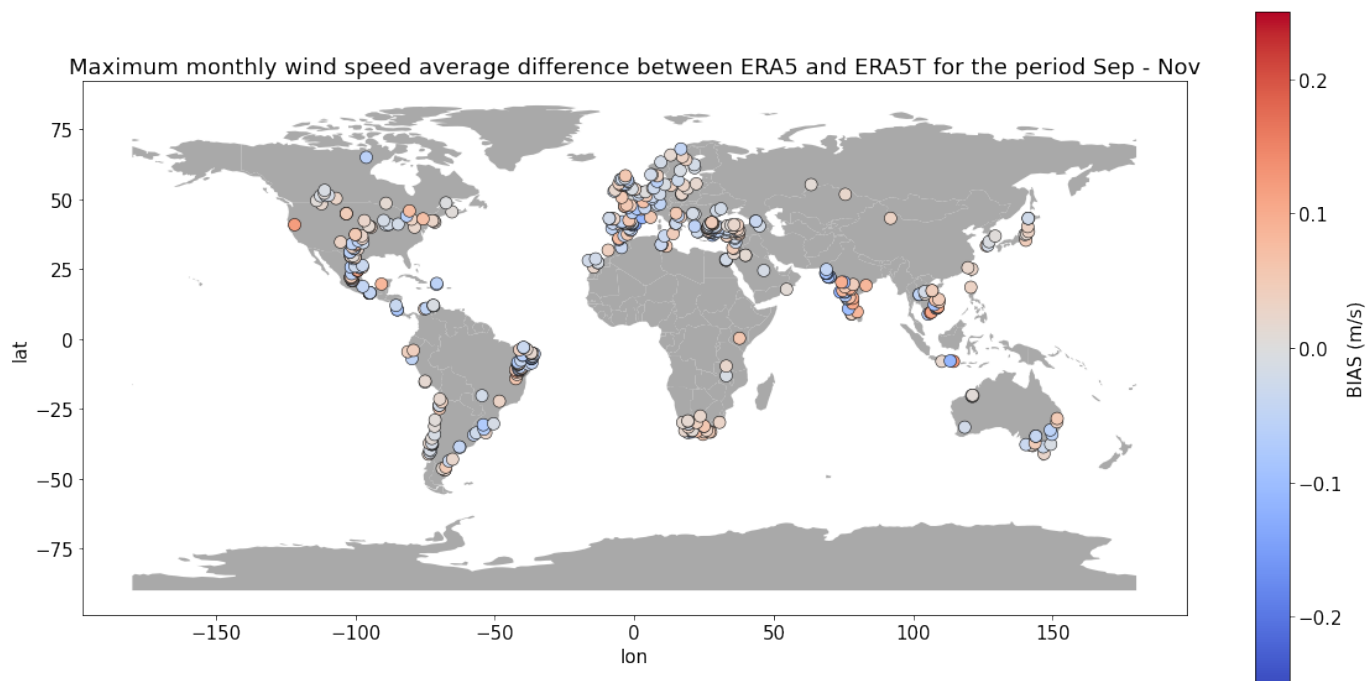
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1 Introduction

ERA5T provides preliminary data for ERA5 on a daily basis, with a 7-day delay with respect to the current date. The nature of preliminary data implies that ERA5 data younger than three months can be revised in case of any issue found. As detailed in the documentation, the ERA5T dataset will automatically become ERA5 after three months if no modifications are performed on the dataset. Potential differences between ERA5T and ERA5 might be due to later assimilation of meteorological observations that are not available with only a few days delay and might require a slower data filtering procedure resulting in a change in the ERA5 dataset compared to the preliminary ERA5T dataset.

A recent notification from the ECMWF-Copernicus team advised that there were some differences between ERA5 and ERA5T from Sep-Nov 2021 due to technical issues with the data assimilation of anomalous snow depth observations over Central Asia in ERA5T reanalysis. The magnitude of the difference is only significant at specific hourly outputs.

In Vortex, we've been aware of the potential differences between ERA5 and ERA5T since October 2019, when ERA5T was released. At that time, we carefully decided to store both datasets separately so that we can run the simulations by using either ERA5 or ERA5T if necessary. The default configuration for any of Vortex products is that data for periods before three months to the current date is generated by using the final ERA5 dataset, whereas data contained within the last three months is generated by using ERA5T. That is why Vortex SERIES is the main product affected by this issue.
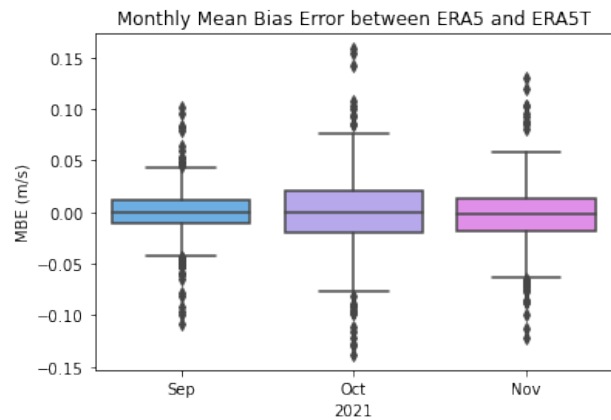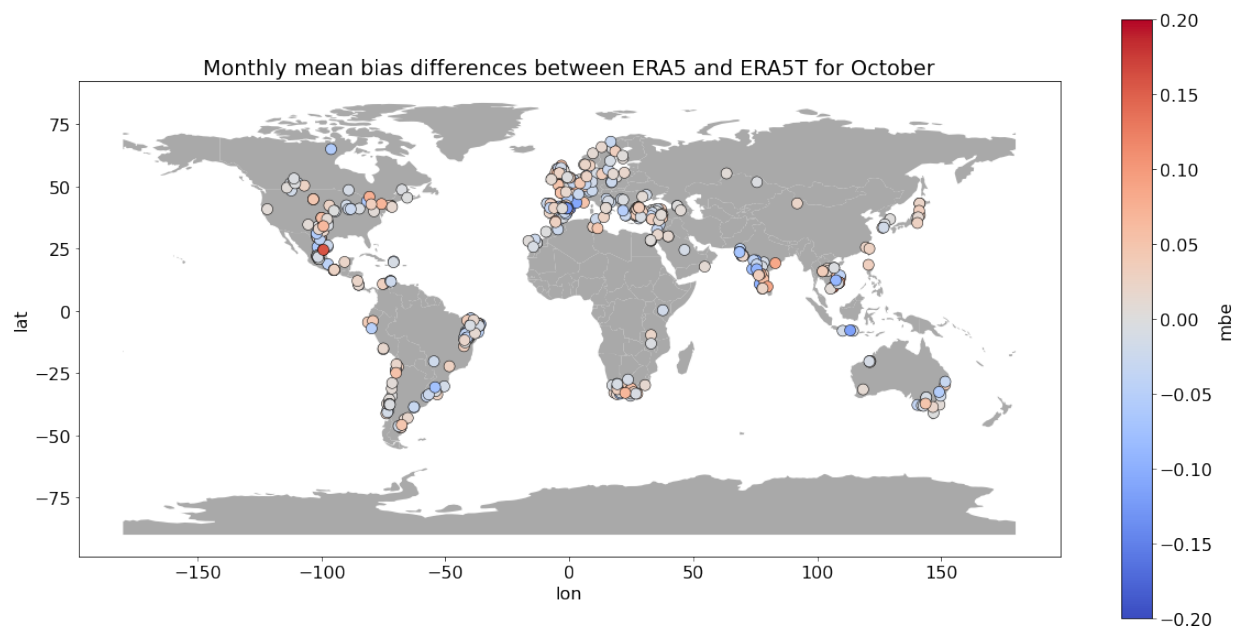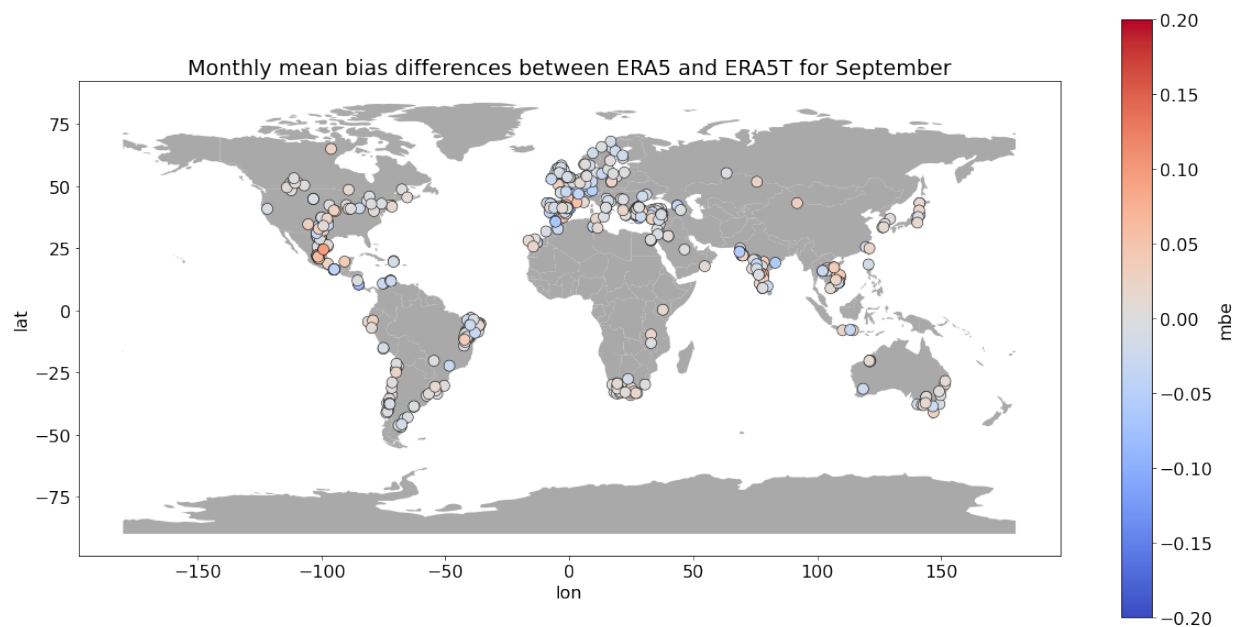
Maximum monthly wind speed average difference between ERA5 and ERA5T for the period Sep - Nov

Mean wind speed average difference between ERA5 and ERA5T for the period Sep - Nov
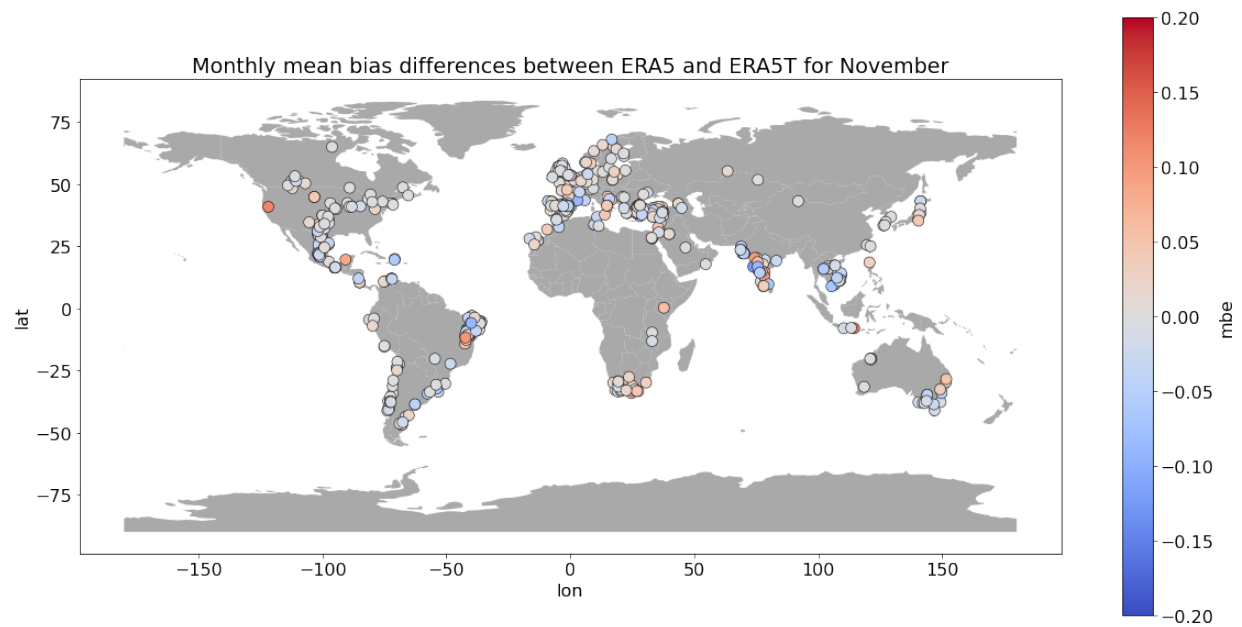
2 Validation

Vortex has conducted a validation study with 491 sites relevant to the wind industry to compare Vortex-ERA5 vs Vortex-ERA5T. Vortex has used the standard SERIES hourly product at 3km horizontal resolution downscaled with ERA5 and ERA5T for the 3 month period under study. The main goal of the validation is to determine whether the potential differences in the original ERA5 and ERA5T raw datasets have a relevant effect on the main target areas for the wind industry once the WRF model downscales the reanalysis datasets. That is, analyze the potential amplification or reduction of the raw datasets differences after the Vortex modelling chain is used.

Figure 1 shows the maximum differences in monthly average wind speeds between the ERA5T and ERA5 dataset use. It can be noiced that differences barely exceed 0.1 m/s in most parts of the world.

Figure 2 shows the averaged monthly differences for the entire period from September to November with no discernible trends anywhere. Figure 3 is a box plot for each month, showing the statistical distribution of differences across locations. Boxes and whiskers are below 0.1 and some outliers reach values of 0.15. Finally, the monthly differences for each month are included.

Monthly Mean Bias Error between ERA5 and ERA5T

Monthly mean bias differences between ERA5 and ERA5T for September

Monthly mean bias differences between ERA5 and ERA5T for October

Monthly mean bias differences between ERA5 and ERA5T for November

3 Conclusions

Differences in wind speed between both datasets are mostly below 0.1 on monthly basis.