# High-resolution simulation of the wind field at 10 m for the Canary Islands in the period 1994-2023

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## Introduction

- Wind speed at 10 m (V10) is a key climate variable in the Canary Islands, especially due to its influence on sectors such as wind energy, aviation and meteorological risk management.
- It is a challenge for the scientific community to obtain quality data in island regions, and even more so in those with orographic complexity such as the Canary region. Specifically, in these areas, low-resolution estimates do not adequately represent local variations.
- It is essential to improve the wind field spatial resolution in this region, in order to obtain more accurate predictions that help to better understand wind patterns and their variability at a local scale.

**General Objective**: *To simulate at high spatial resolution the V10 field for the Canary Islands and its corresponding spatial-temporal evaluation, within the framework of the PTI+Clima and the national EXMERISK project.*

## Data and Methodology

- **Models used:** WRF-ARWv.4.3.3 (Skamarock et al., 2008)
- **Data used to force WRF:** ERA5 reanalysis (spatial and temporal resolution: 0.25º and 6 h, Hersbach et al., 2020).
- **Period used**: 1994-2021 (28-years).
- **Evaluation dataset**: data from AEMET meteorological stations (SYNOP network) and the ERALand reanalysis.

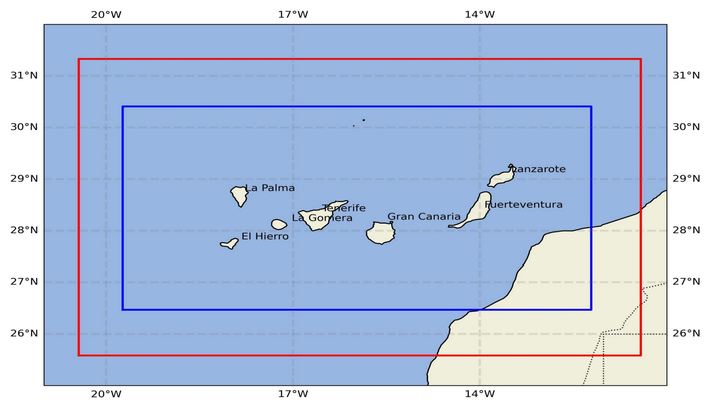


**Figure 1:** WRF-ARW model configuration nested domains: d01 [9 km, red] and d02 [3 km, blue].

## Results: Mean values

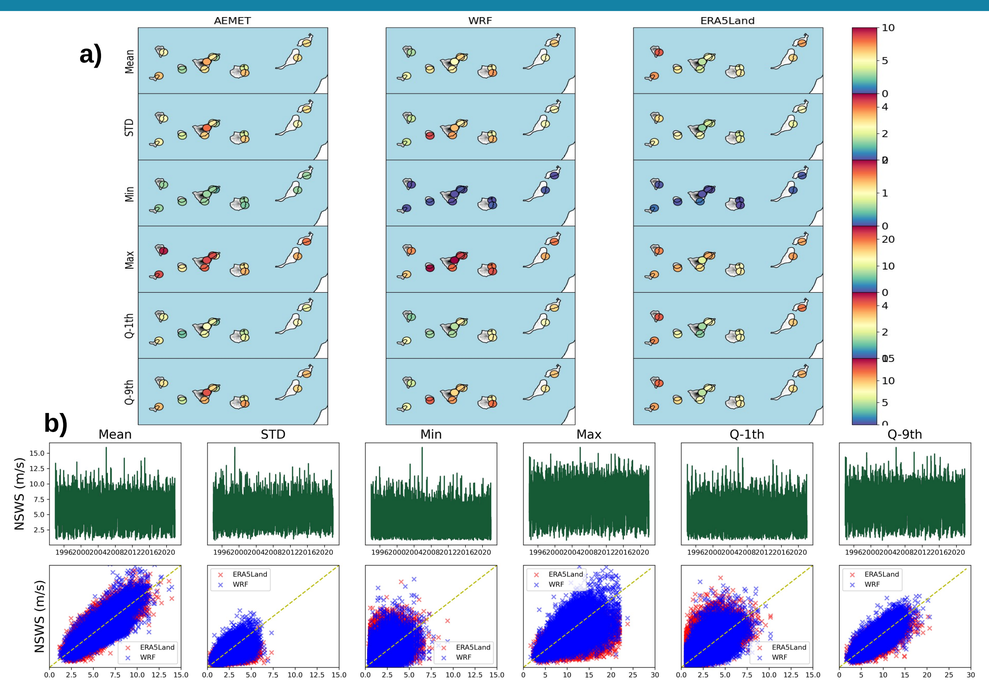


**Figure 2**: a) Behavior of stadistical values for the V10 field values corresponding to AEMET stations, ERA5Land and WRF outputs and b) Comparison of these statisticians for WRF and ERA5Land data and across time.

## Results: Evaluation of the WRF-ARW outputs

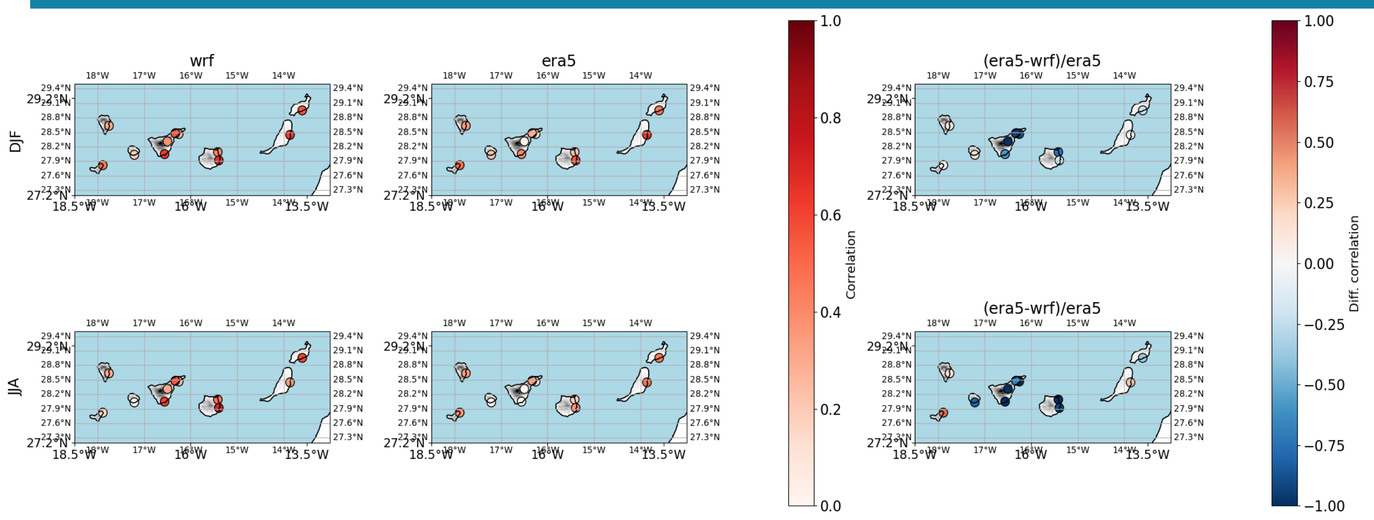


**Figure 3**: The correlation and their relative differences between WRF and ERA5Land. DJF (top) and JJA (bottom) .

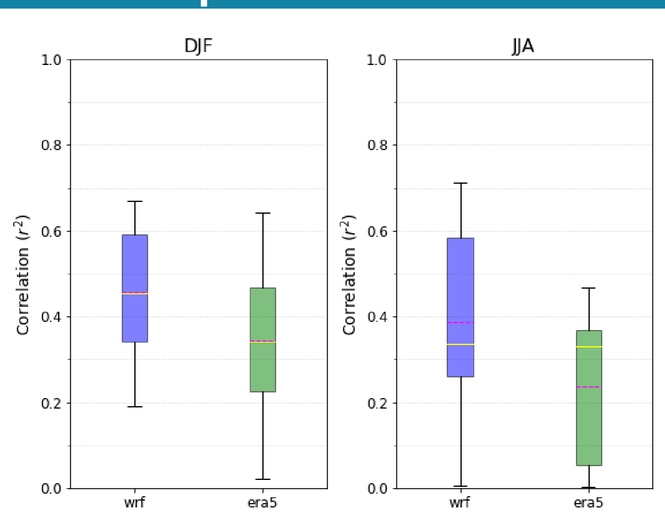


**Figure 4**: Boxplot corresponding to the correlation per station for WRF and ERA5Land with respect to AEMET station data. DJF (left) and JJA (right).

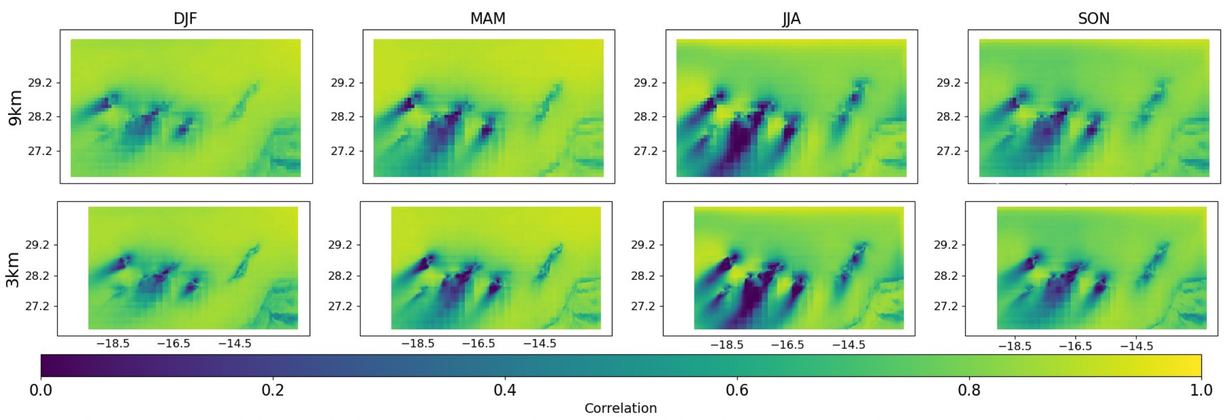


**Figure 5**: Spatial correlation of WRF and ERA5Land for the two nested domains.

## Conclusions

- The results show that the higher resolution simulation shows higher spatial correlations with observations than ERA5Land, improving the simulation of extreme winds.
- WRF underestimates the standard deviation in some islands, suggesting uncertainty in the simulation of subscale processes to represent local variability.
- The configuration of the WRF-ARWv4.3.3 model tends to overestimate the V10 field slightly.
- The generation of this high-resolution simulation in the Canary Islands opens the possibility of its subsequent use in the training of Artificial Intelligence tools, focused on wind prediction or the reconstruction of the spatial wind field based on observations.

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## References

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