Reproducing summer wind systems over the eastern Mediterranean by high resolution climate simulations

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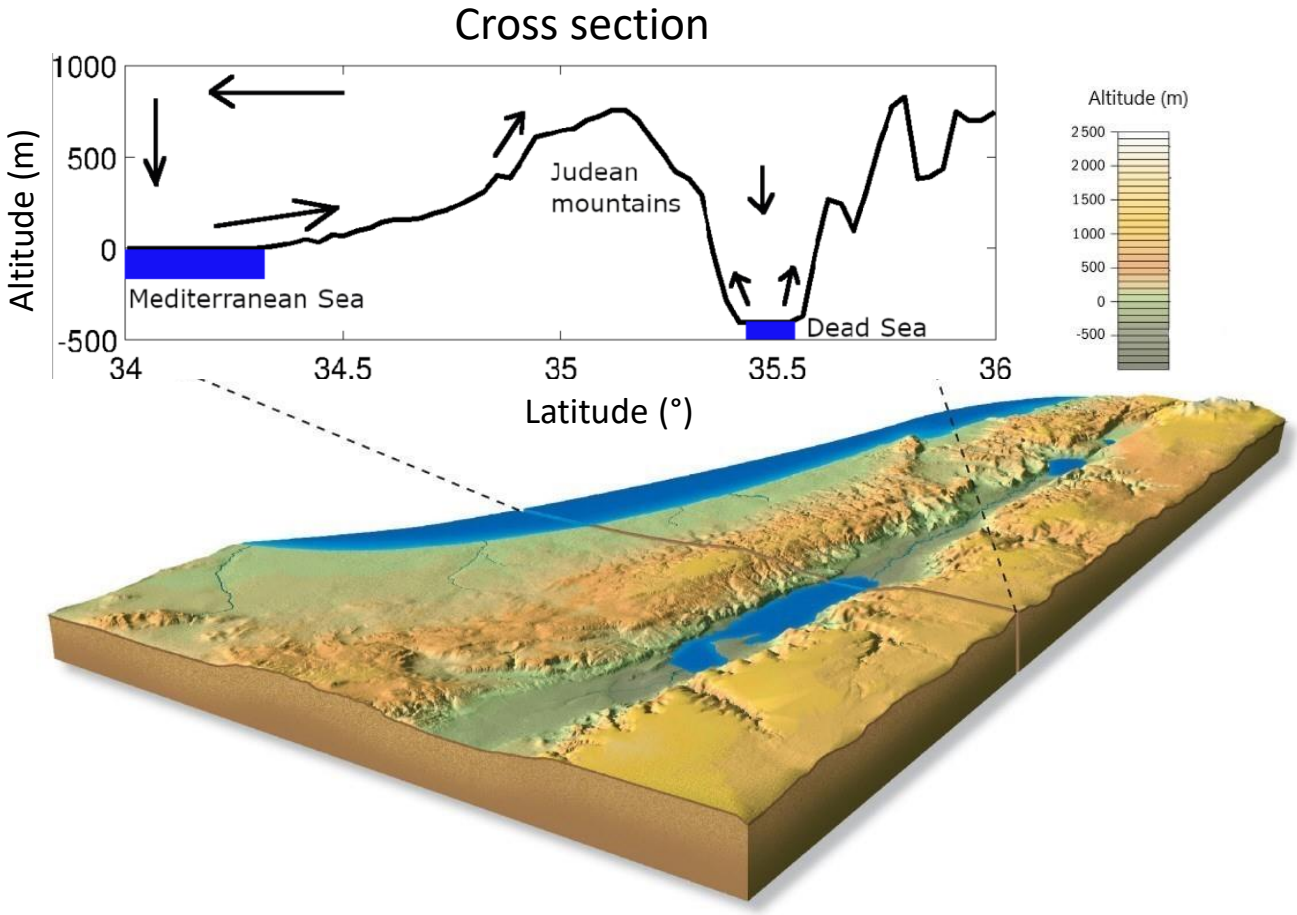
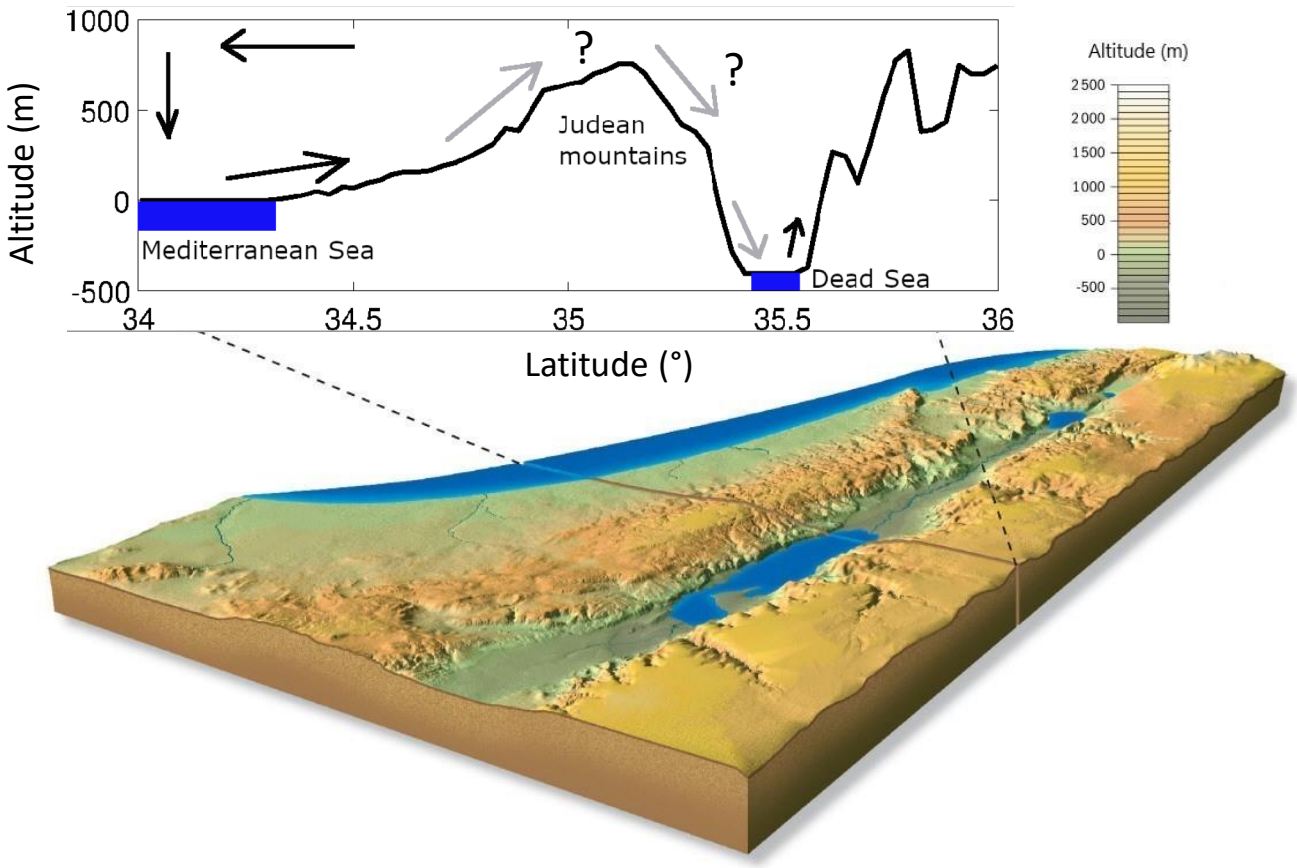
Local wind systems in the eastern Mediterranean



(https://diercke.westermann.de, 20.01.2020)

Local wind systems in the eastern Mediterranean

Cross section



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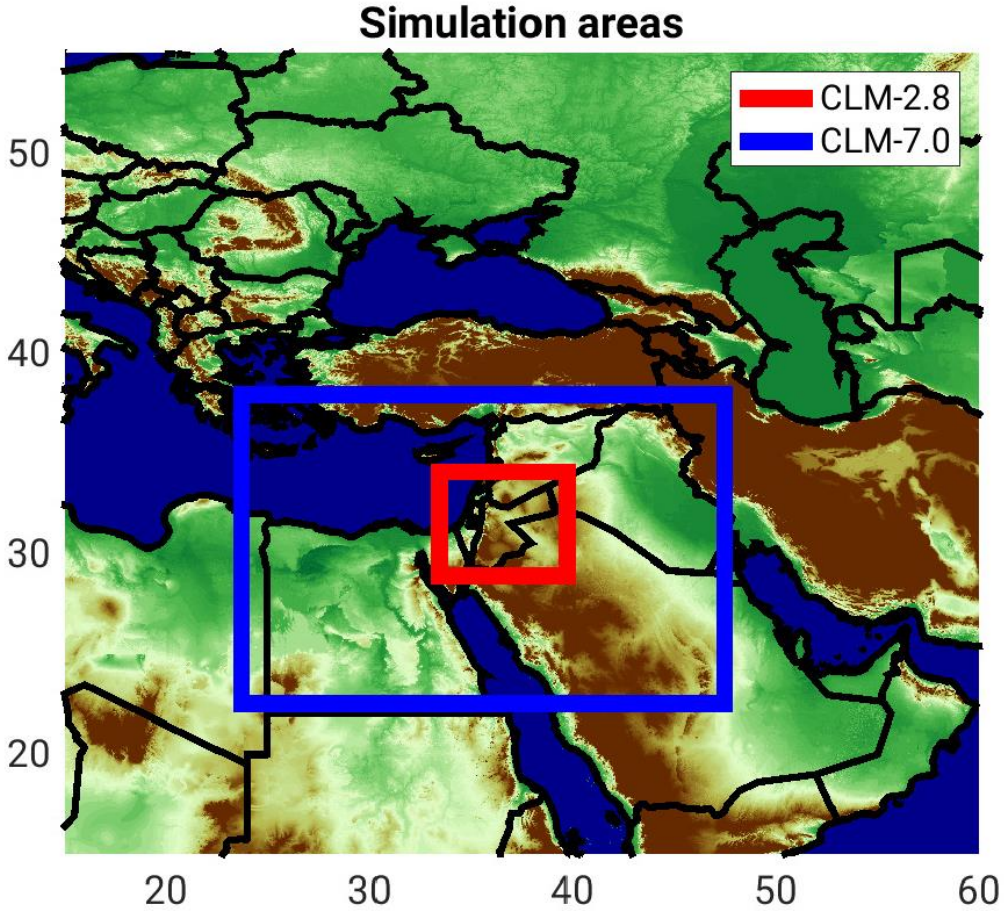
Research questions

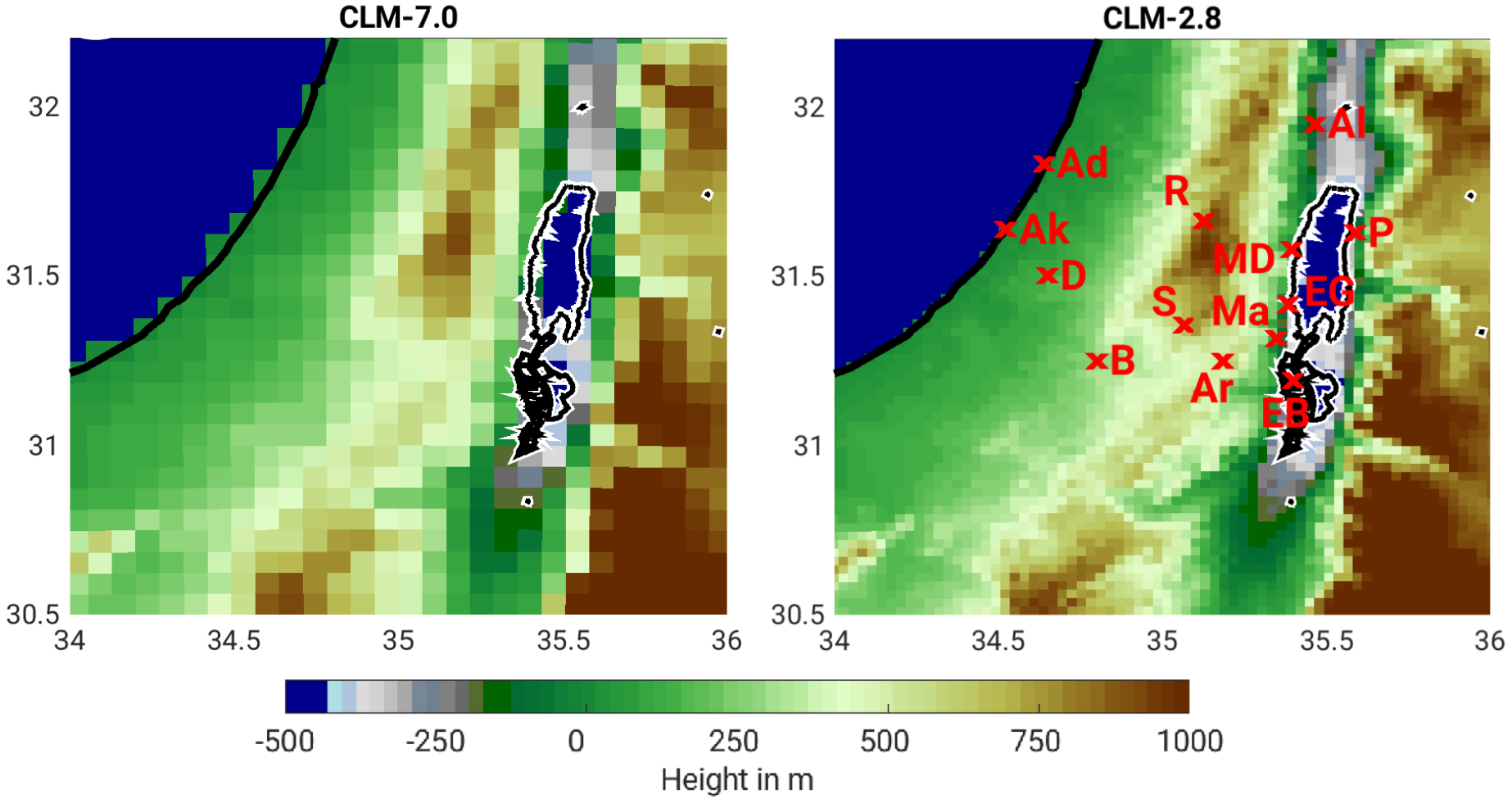
1) Can a high-resolution model **reproduce the climatology** of complex thermal summer wind systems over a region with a highly variable orography?
2) Does a higher resolution lead to a **better statistical agreement** with station data in terms of near surface wind systems?
3) Can a high-resolution model **reproduce the interaction** of several complex thermal summer wind systems over a region with a highly variable orography in terms of single days?

COSMO-CLM setup

- COSMO-CLM (**clm_15, COSMO_v5.0**)
- **Simulation period:** 2006 – 2018
- **Temporal resolution output:** Hourly and 3 hourly (depending on the parameter)
- **Model output level:** 500 hPa, 600 hPa, 700 hPa, 800 hPa, 850 hPa, 900 hPa, 950 hPa, 1000 hPa, 1050 hPa
- **Forcing data:** ERA-5 reanalysis (hourly on a 30 km grid, 137 Level)
- **Orography:** GLOBE 1km
- **Spatial resolutions**: 7 km (deep and shallow convection active, 50 levels) und 2,8 km (shallow convection active, 60 levels)
- **One-way nesting**

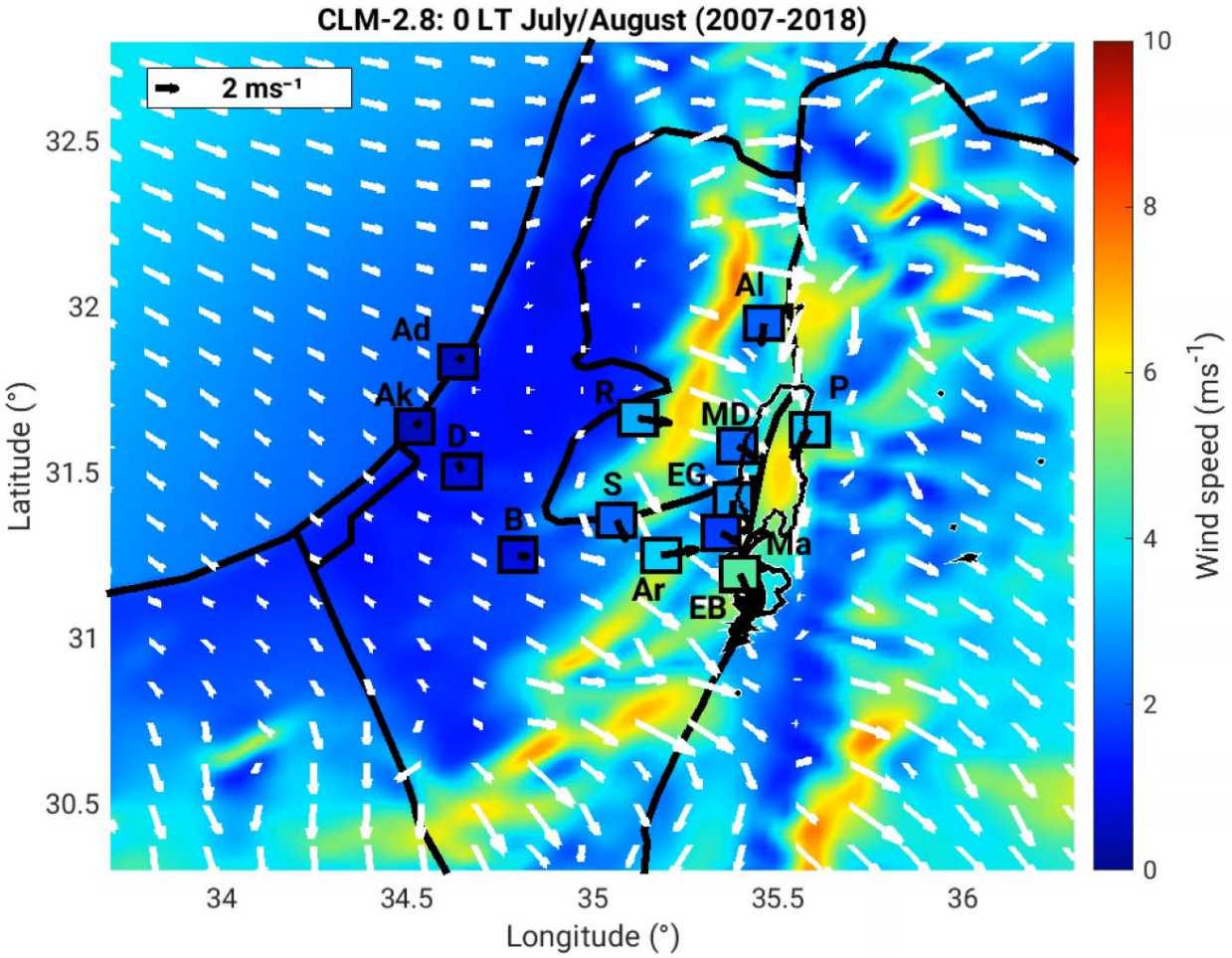


Model orography and observations



DESERVE
DEAD SEA RESEARCH VENUE
Helmholtz Virtual Institute

Wind climatology (2007 – 2018)



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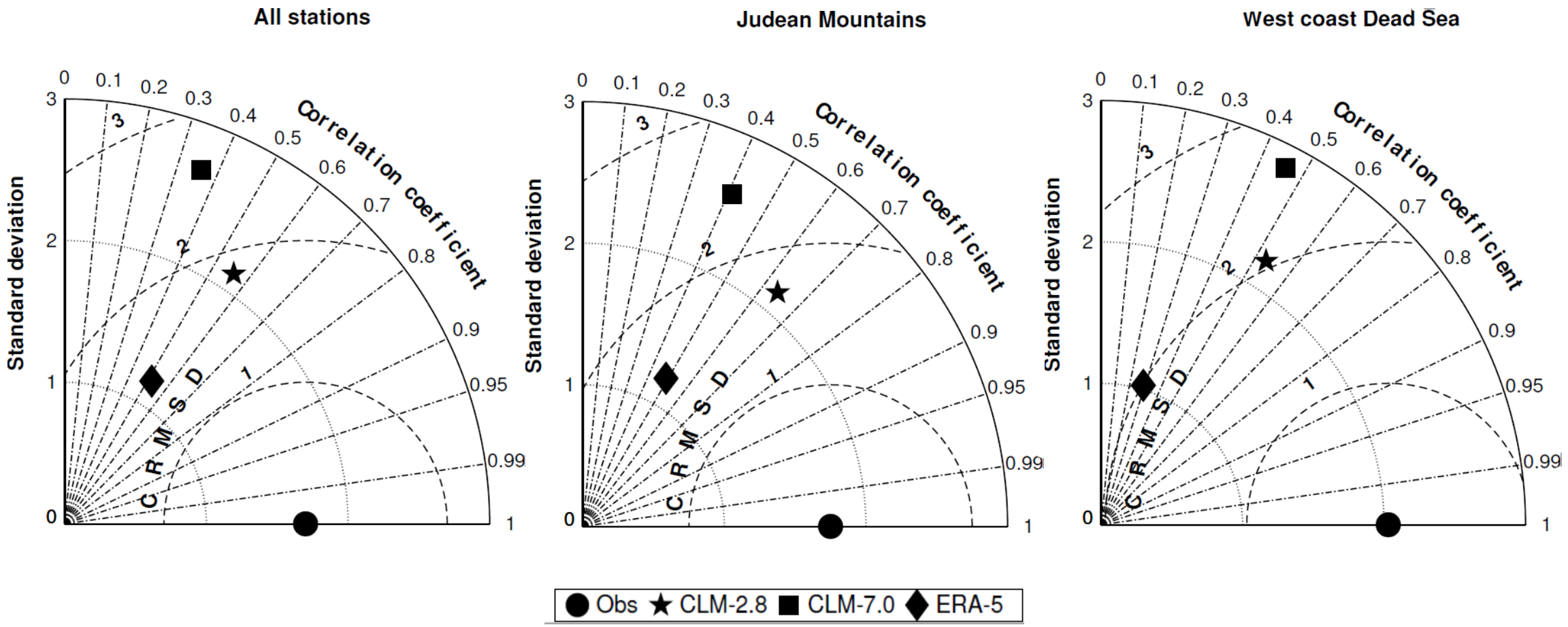

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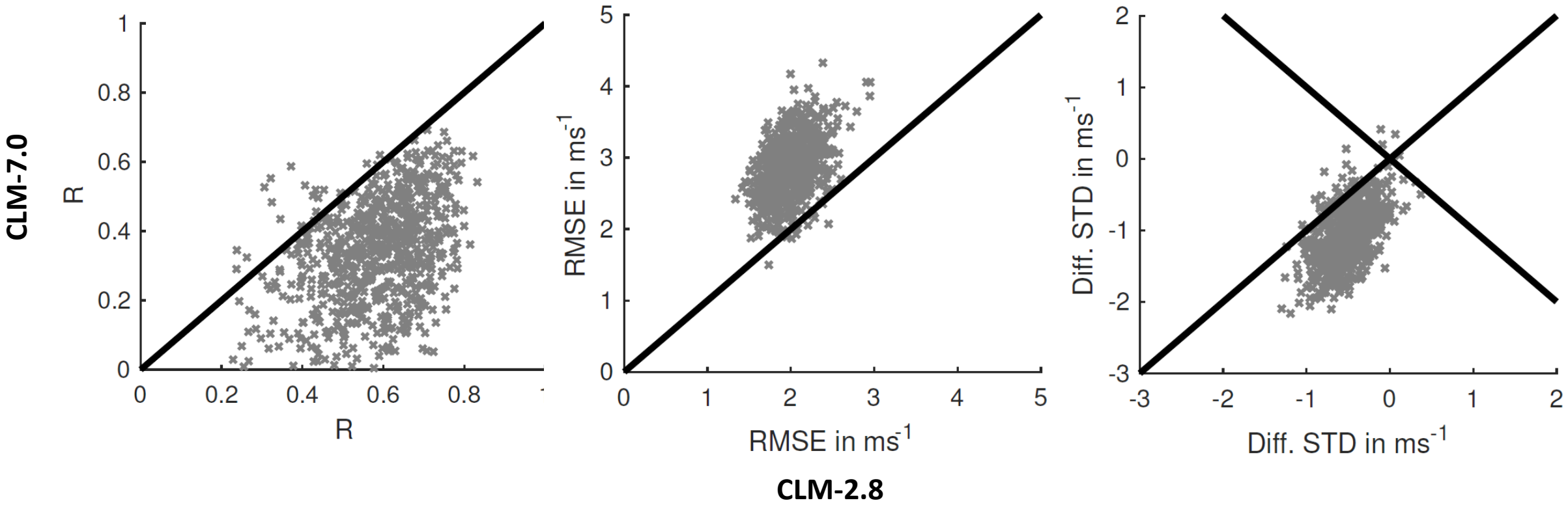
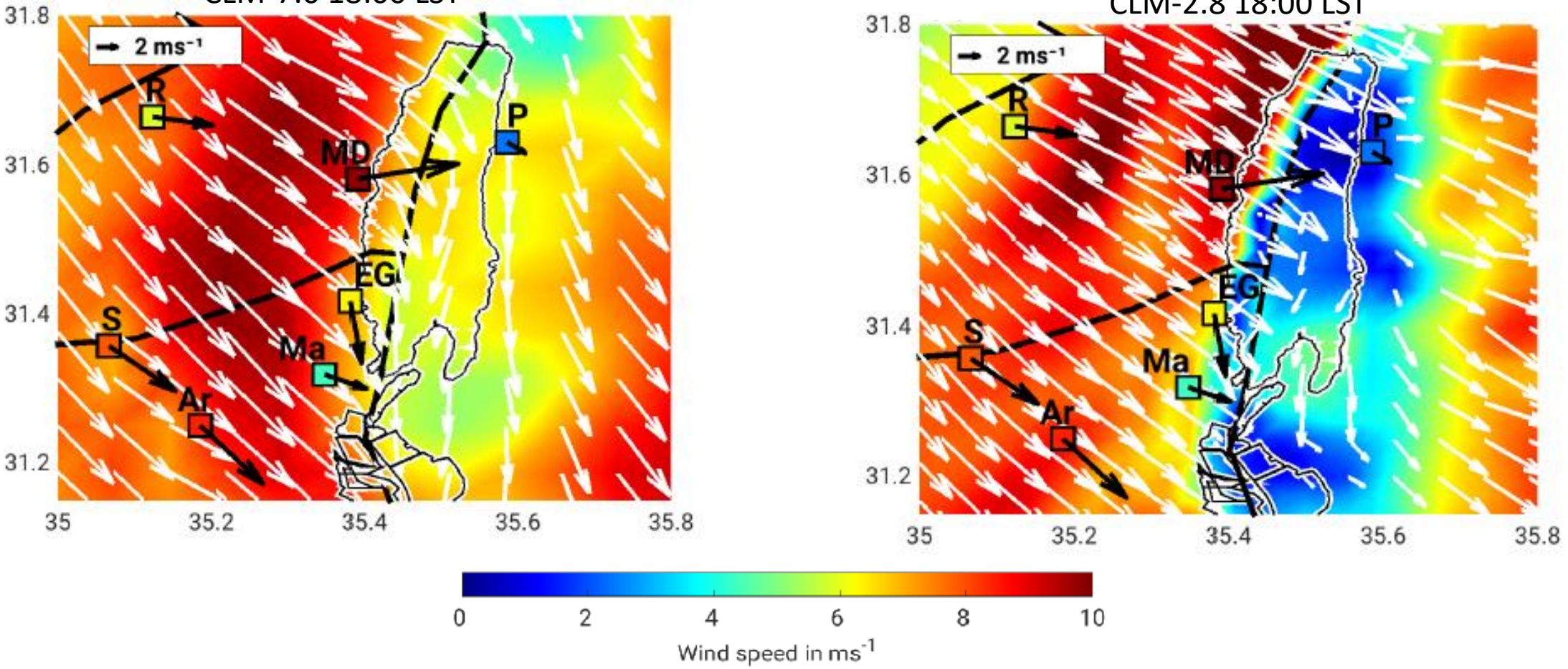


Case study: July 16, 2015

CLM-7.0 18:00 LST

CLM-2.8 18:00 LST



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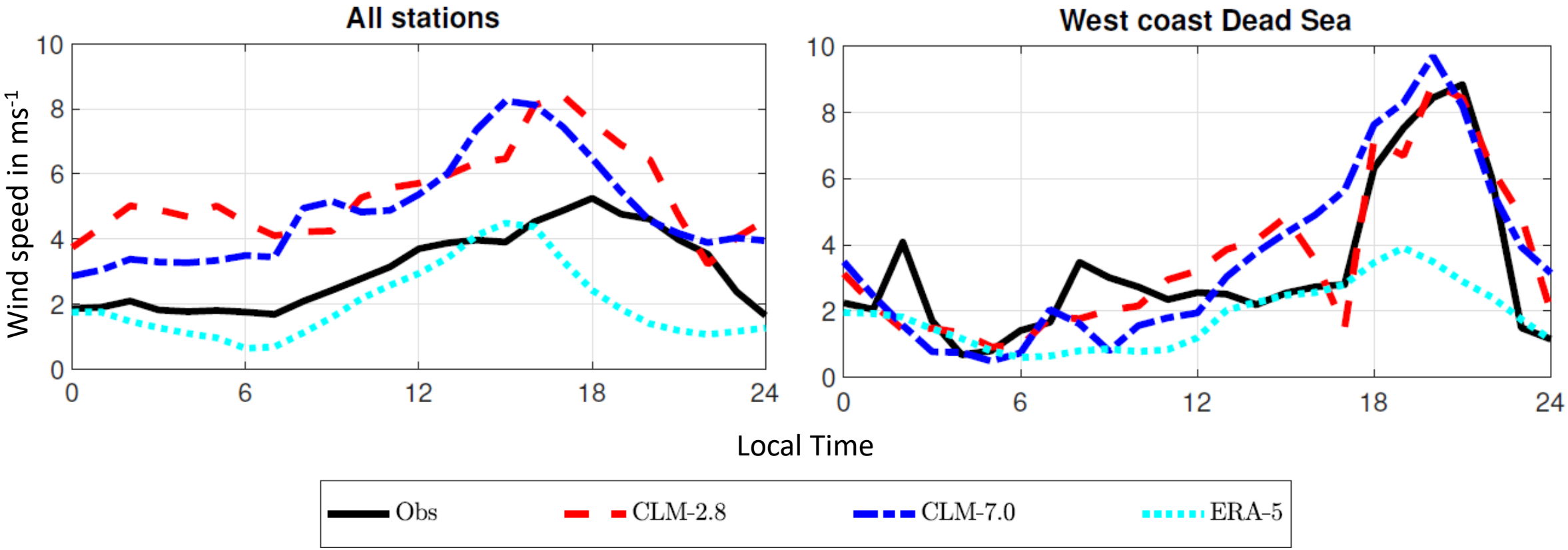

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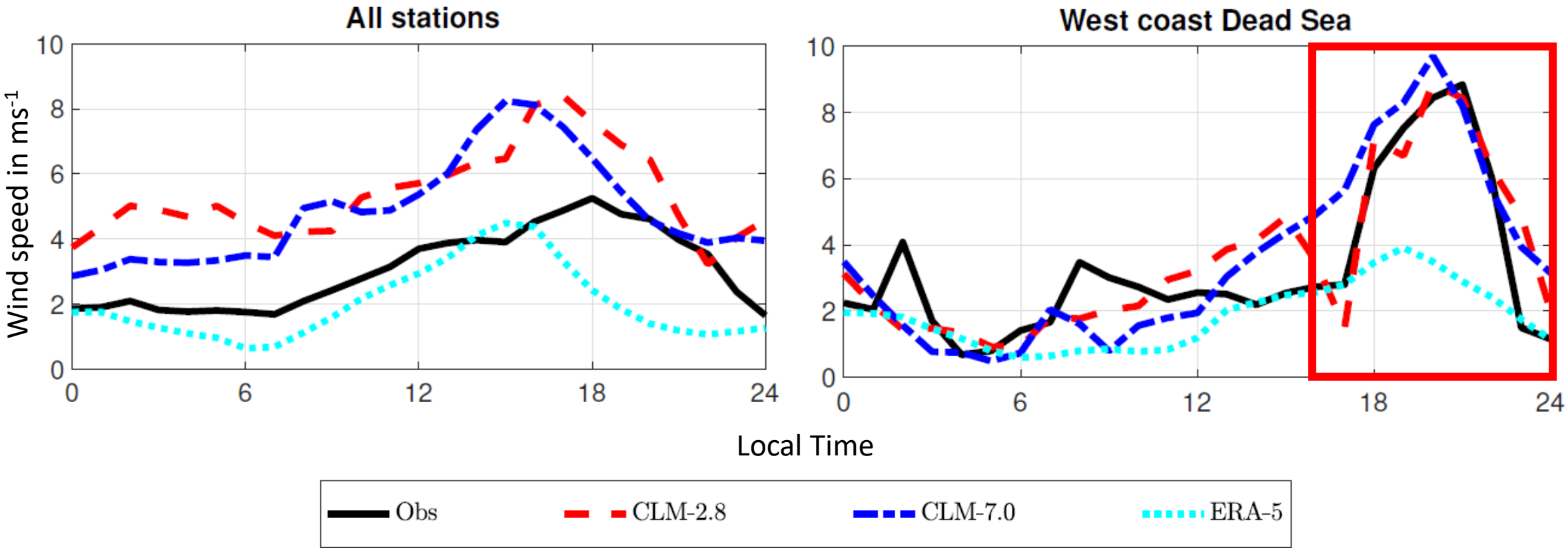
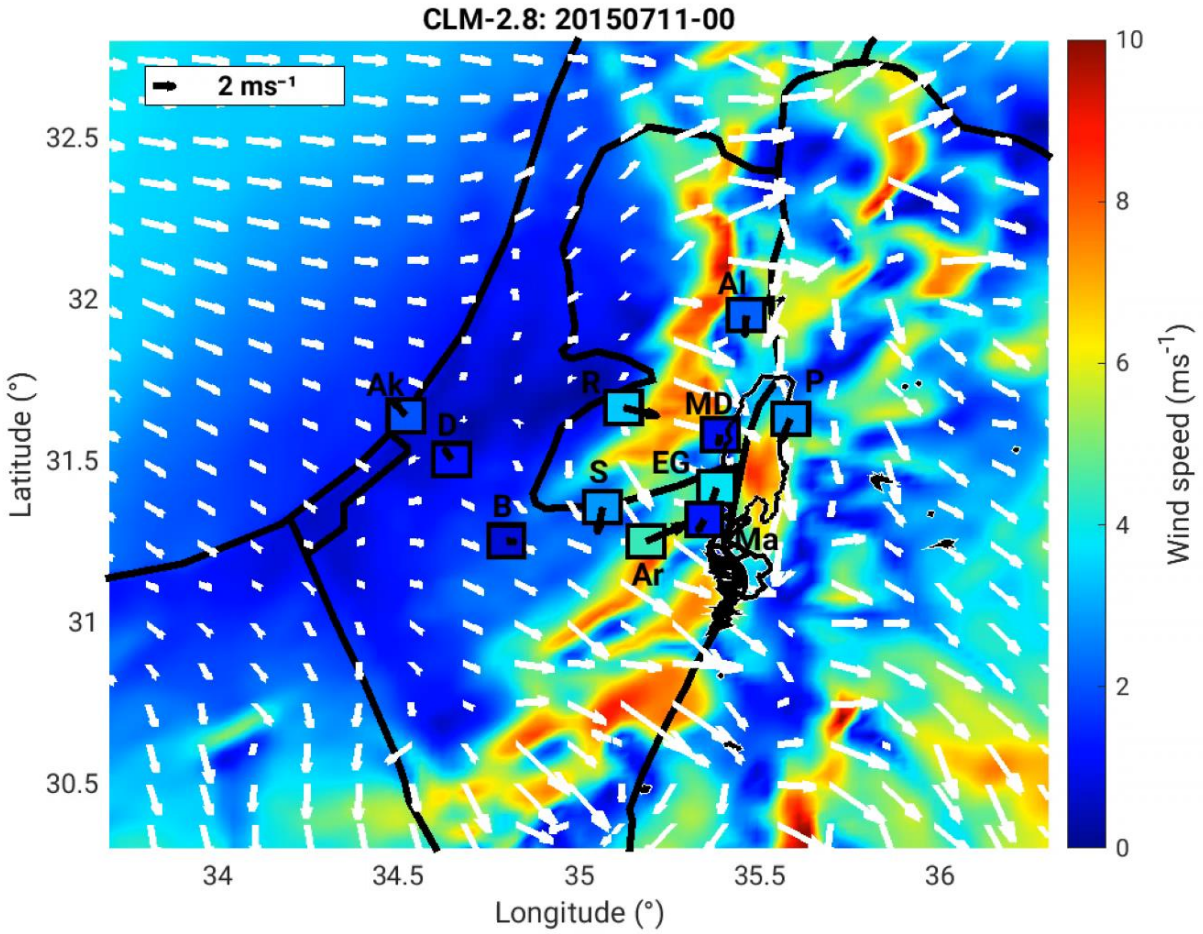


Case studies



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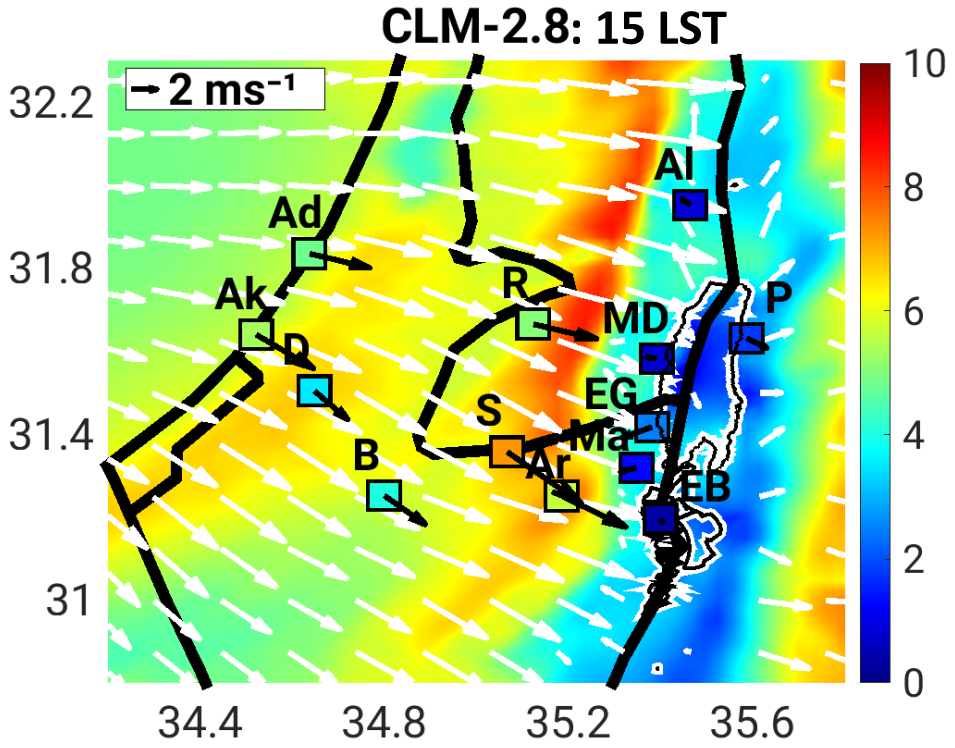

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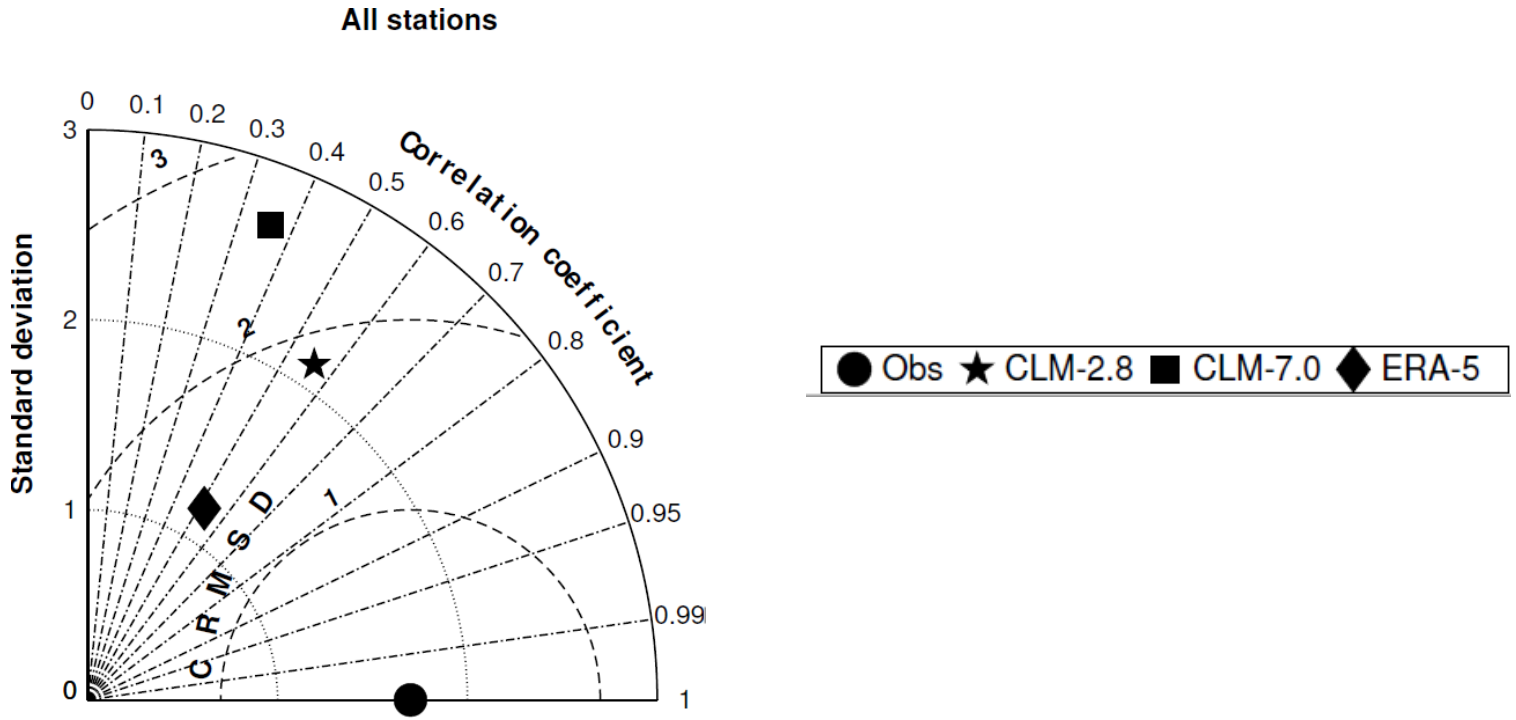

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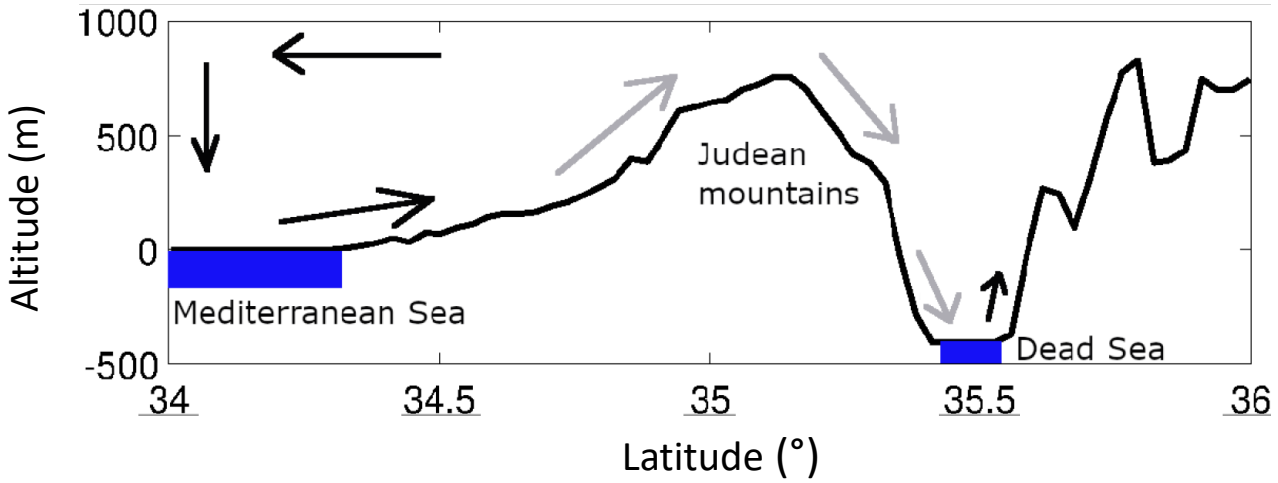

Acknowledgements

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- A big thanks to all co authors for making this work possible
- Thanks to Alberto Caldas-Alvarez and Sebastian Helgert for running the COSMO-CLM simulations
- Thanks to Helmholtz Association of German Research Centers for funding
- Many thanks to the Israel Meteorological Service (IMS) for providing us with data of its synoptical network

Conclusions

- Can a high-resolution model **reproduce the climatology** of complex thermal summer wind systems over a region with a highly variable orography?
  - ✓ The high-resolution **COSMO-CLM simulations largely reproduce the main characteristics of the regional wind systems** in the eastern Mediterranean, whereas ERA-5 is only able to represent the Mediterranean Sea breeze.
- Does a higher resolution lead to a **better statistical agreement** with station data in terms of near surface wind systems?
  - ✓ The **high-resolution simulations substantially improve visually and statistically the representation of regional near surface wind** systems both for climatology and single days, particularly over complex orography.
- Can a high-resolution model **reproduce the interaction** of several complex thermal summer wind systems over a region with a highly variable orography in terms of single days?
  - ✓ Case studies show that **only CLM-2.8 can reproduce the daily small-scale interactions** of the three prevailing wind systems in the region.