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UNIVERSITAT POLITÈCNICA DE CATALUNYA

Wave component anisotropy at the NW Mediterranean sea

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CEASELESS

Motivation

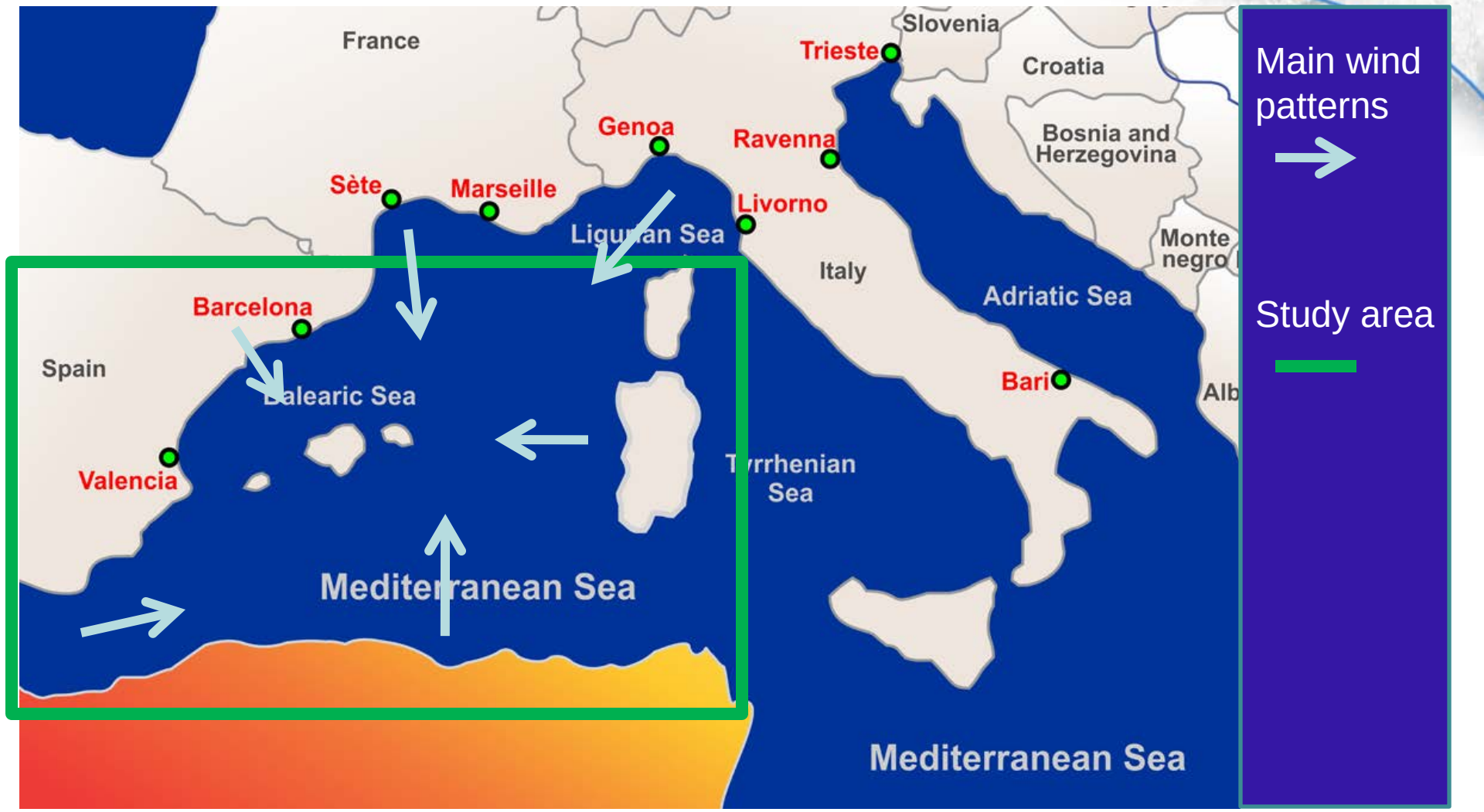
Objectives

•To **explore** the **anisotropy** present in the coastal area, compared to the offshore area

•To **characterize** the **error** of the **wind** modulus and significant **wave** height with **altimeter** data

•To **analyze** its **relationship** with other variables **(Tp, Dir)**

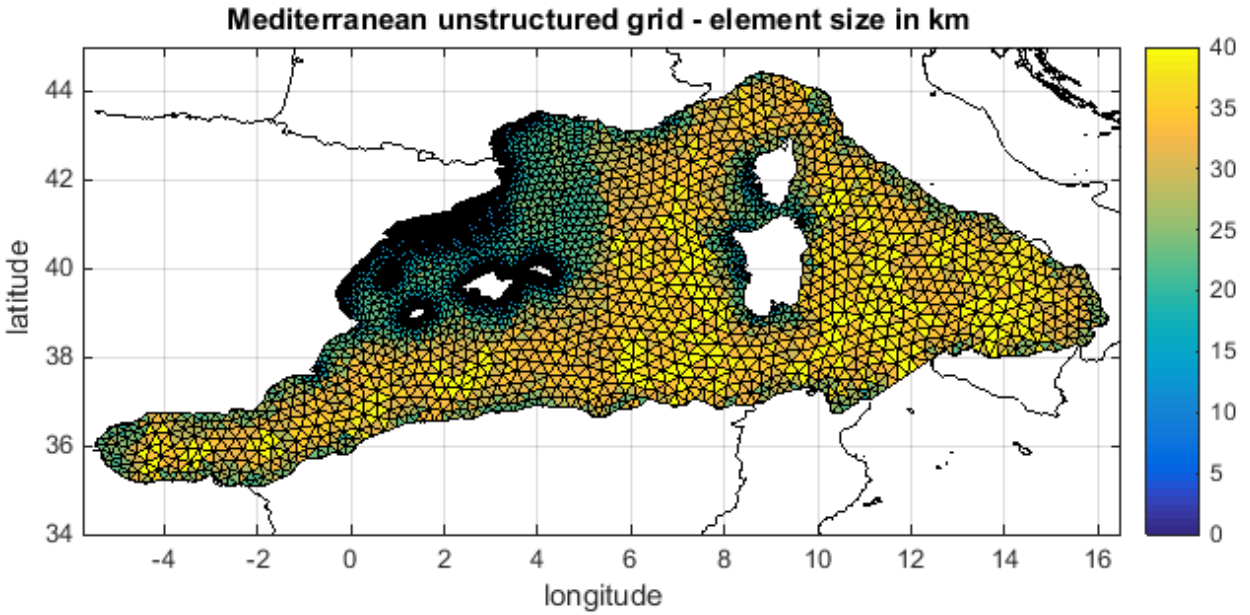
Study area


France
Slovenia
Trieste
Croatia
Genoa
Ravenna
Bosnia and Herzegovina
Sète
Marseille
Livorno
Ligurian Sea
Monte negro
Italy
Barcelona
Adriatic Sea
Spain
Balearic Sea
Bari
Alb
Valencia
Tyrrhenian Sea
Mediterranean Sea
Mediterranean Sea
Main wind patterns
Study area

Data set and variables

- Datasets:
  - SWAN: $H_s(t)$, $V_w(t)$, $T_p(t)$, Dir(t)
  - Altimeter: H_s (t), V_w (t)

- Time span: 2013
- SWAN run resolution:
  - Temporal: 1h
  - Spatial: 600m-40km
- Wind field for SWAN comes from AEMet



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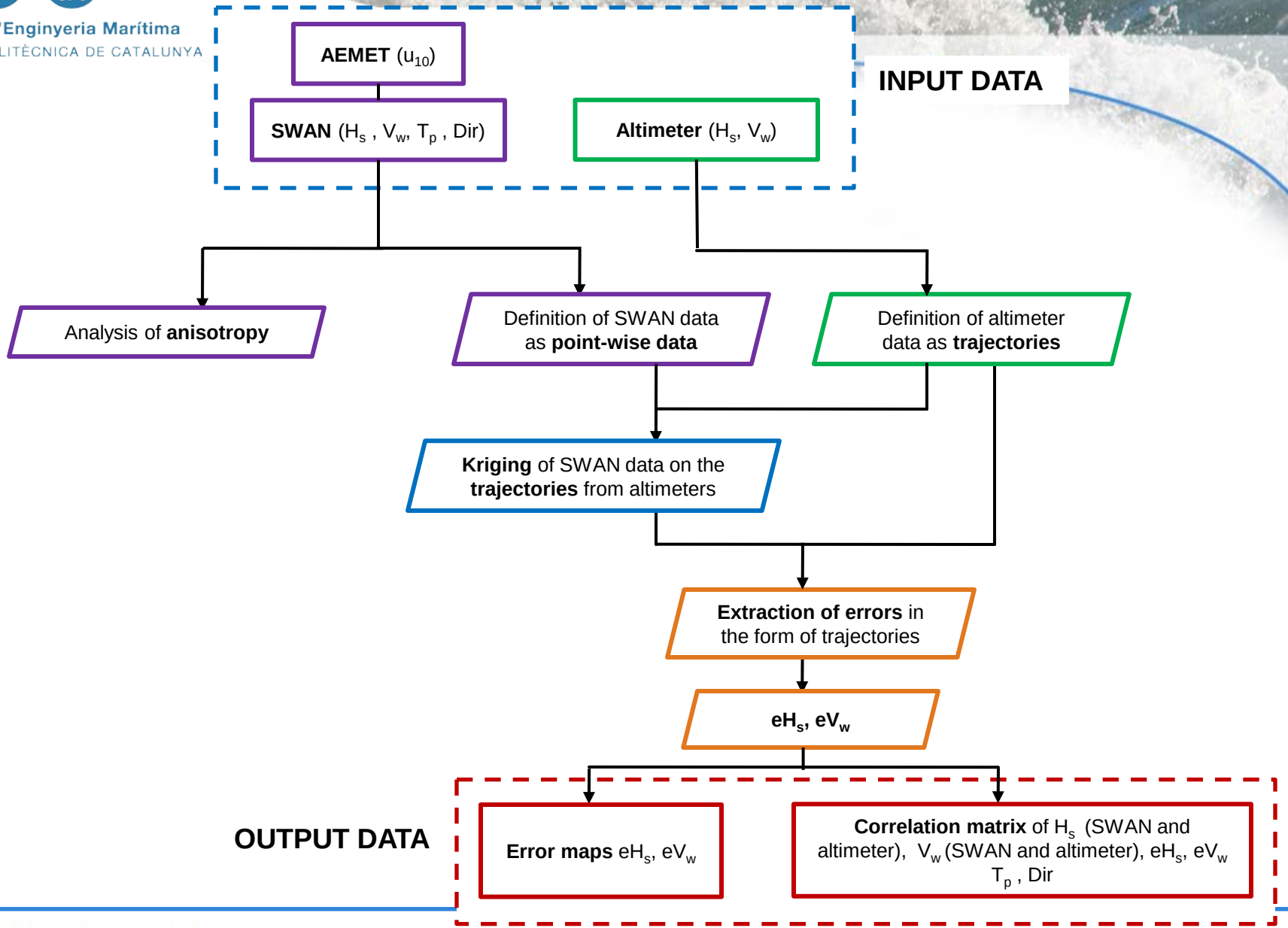
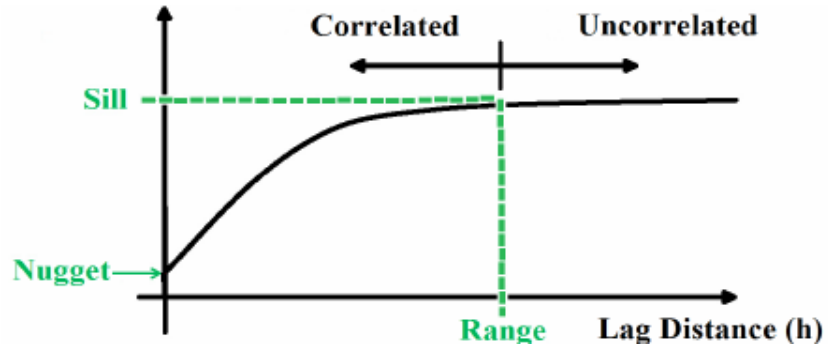
Methodology: Flow chart

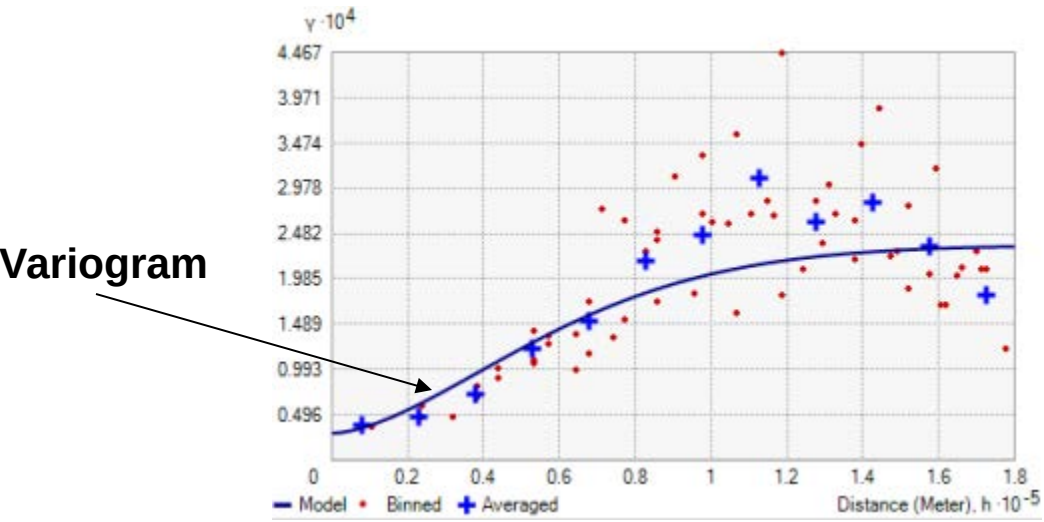


e=SWAN-altimeter

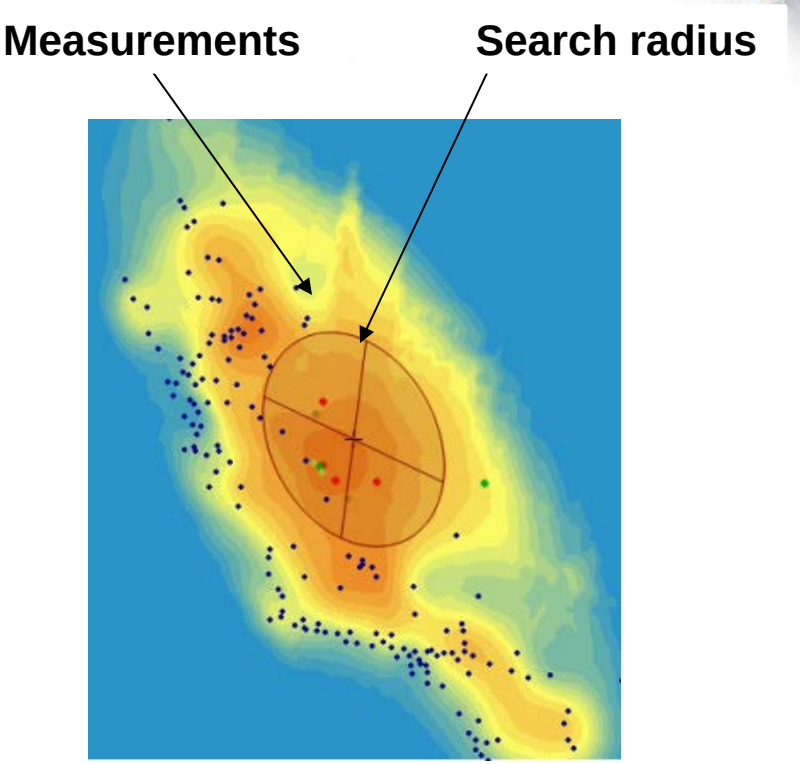
Methodology: Summary

VARIOGRAM



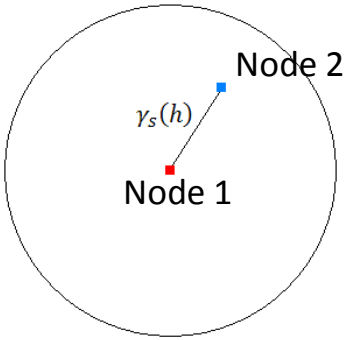


KRIGING



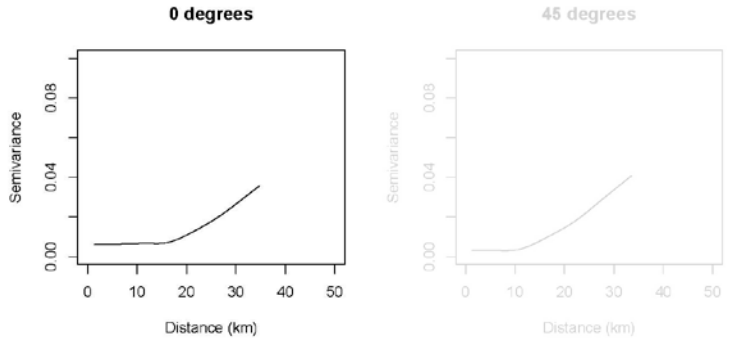
Methodology: semivariogram

•A **semivariogram** between two nodes tells how much the value at node 1 differs from value at node 2



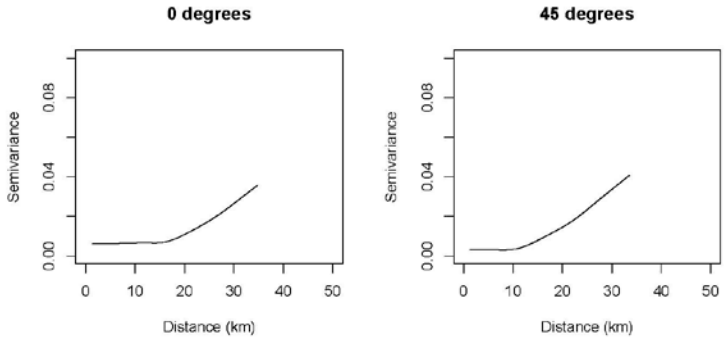
Methodology: semivariogram

•The **semivariogram** applied on all the nodes forming a **certain angle** (e.g. 0 degrees) with Node 1 tells the **homogeneity** at that direction



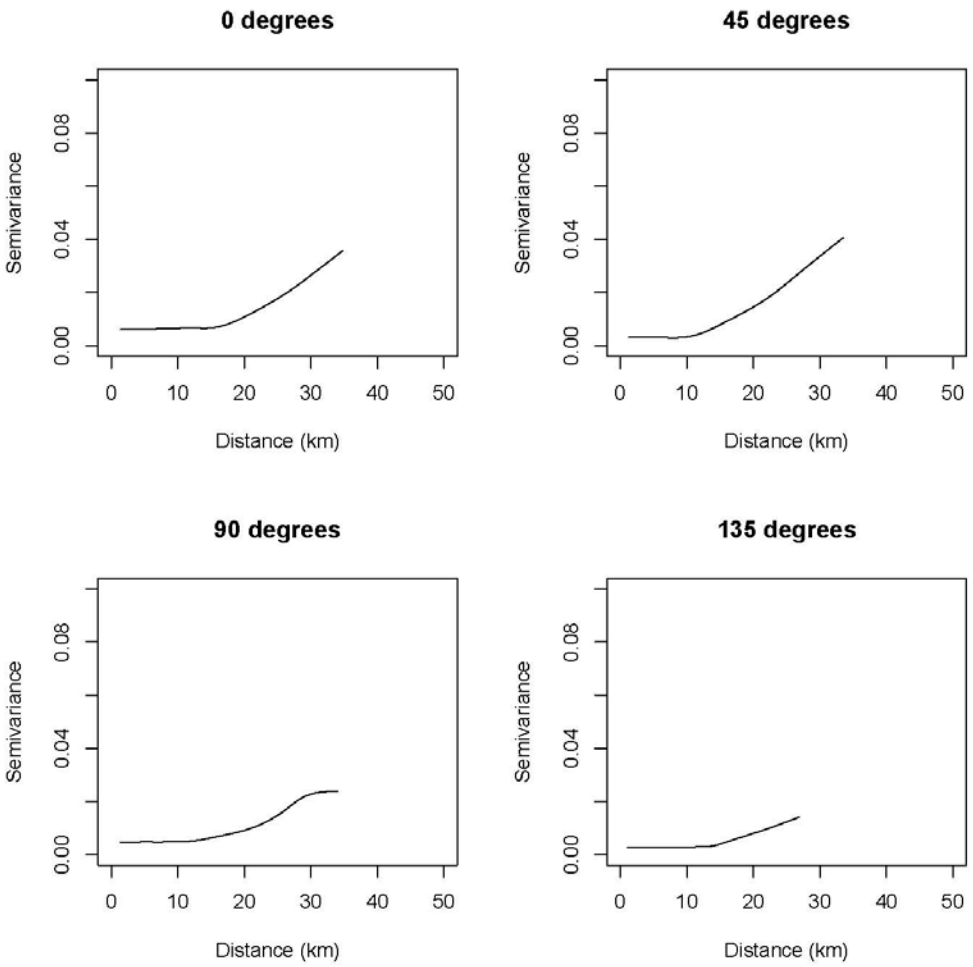
Methodology: semivariogram

•The **slopes** of the **semivariograms** for two directions can tell about **anisotropy**. In this case, we have isotropy of these two directions.



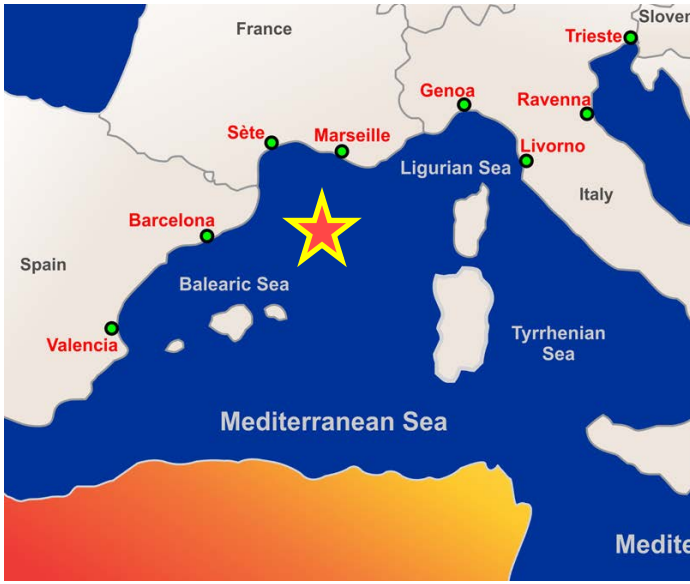
•**Semivariograms** are applied to four directions that represent the circle: **0º, 45º, 90º, 135º**

Results and discussion: Anisotropy of H_s offshore

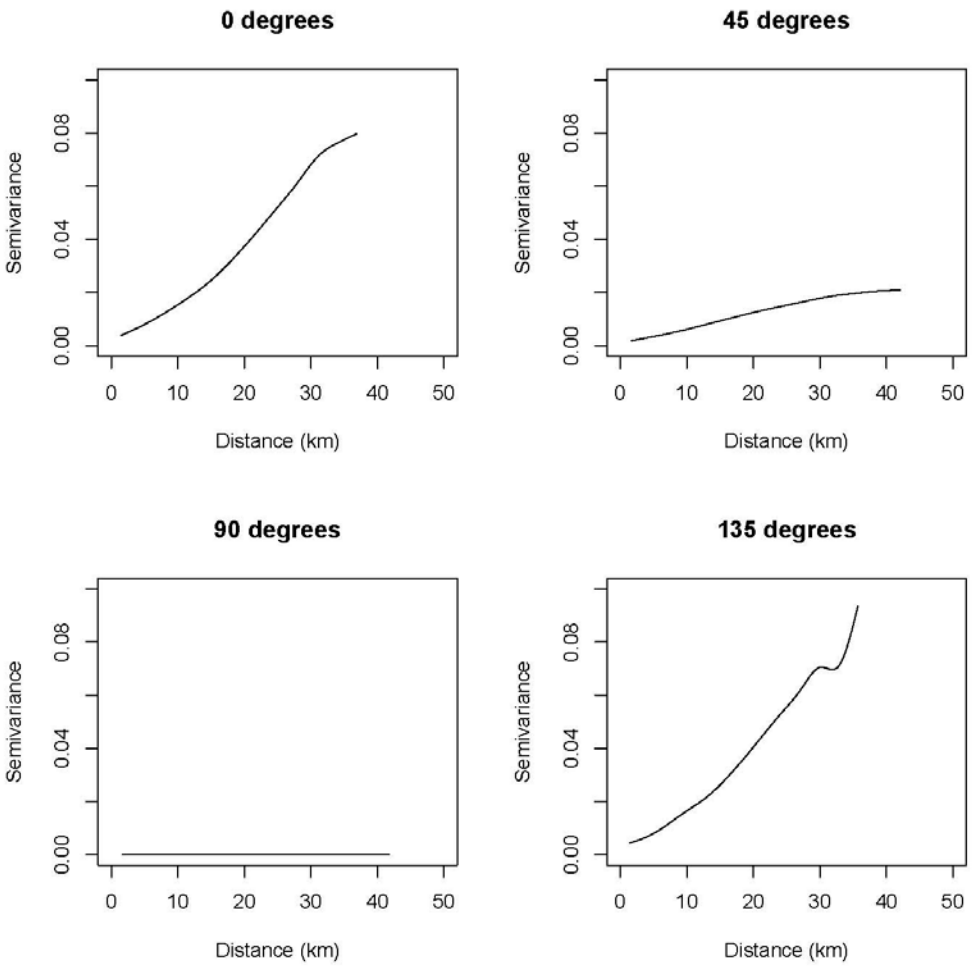


Relatively gentle slope (0.04/30metres)→homogeneity at each direction

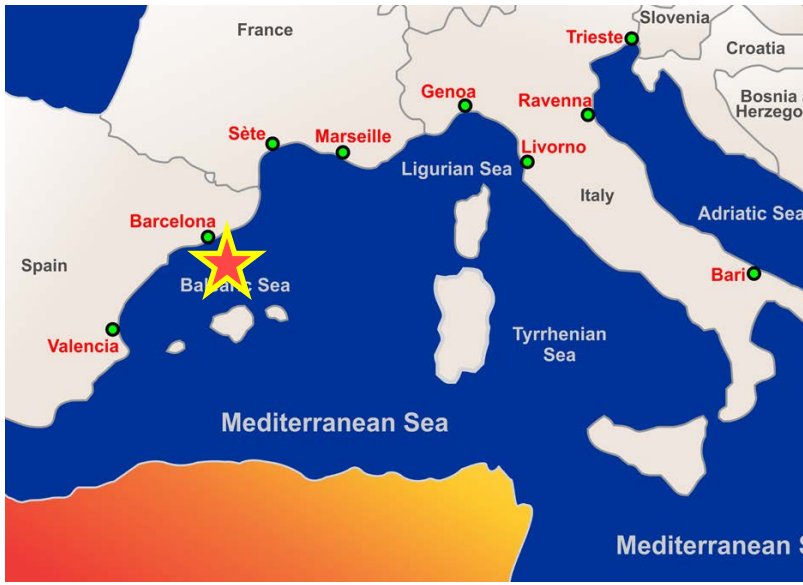
Same slopes for the four directions→isotropy



Results and discussion: Anisotropy of H_s near the coast

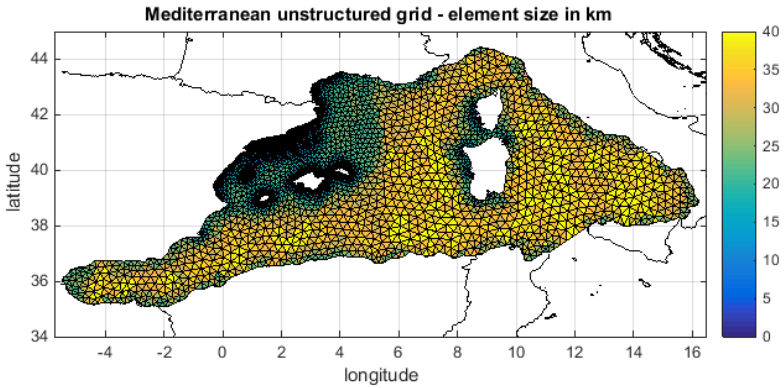


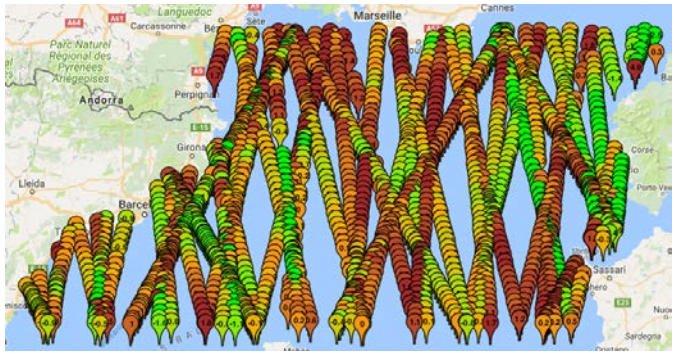
Larger slope (0.08/30metres)→less homogeneity at 0 and 135 degrees
Different slopes for the four directions→anisotropy
More anisotropy→affect **kriging**



Methodology: Data merging through Kriging

- **Kriging** is the interpolation of points by using the spatial variance, a concept related to semivariograms
- Here, we use **spatio-temporal** kriging
- The values kriged are the residuals: e=SWAN-altimeter

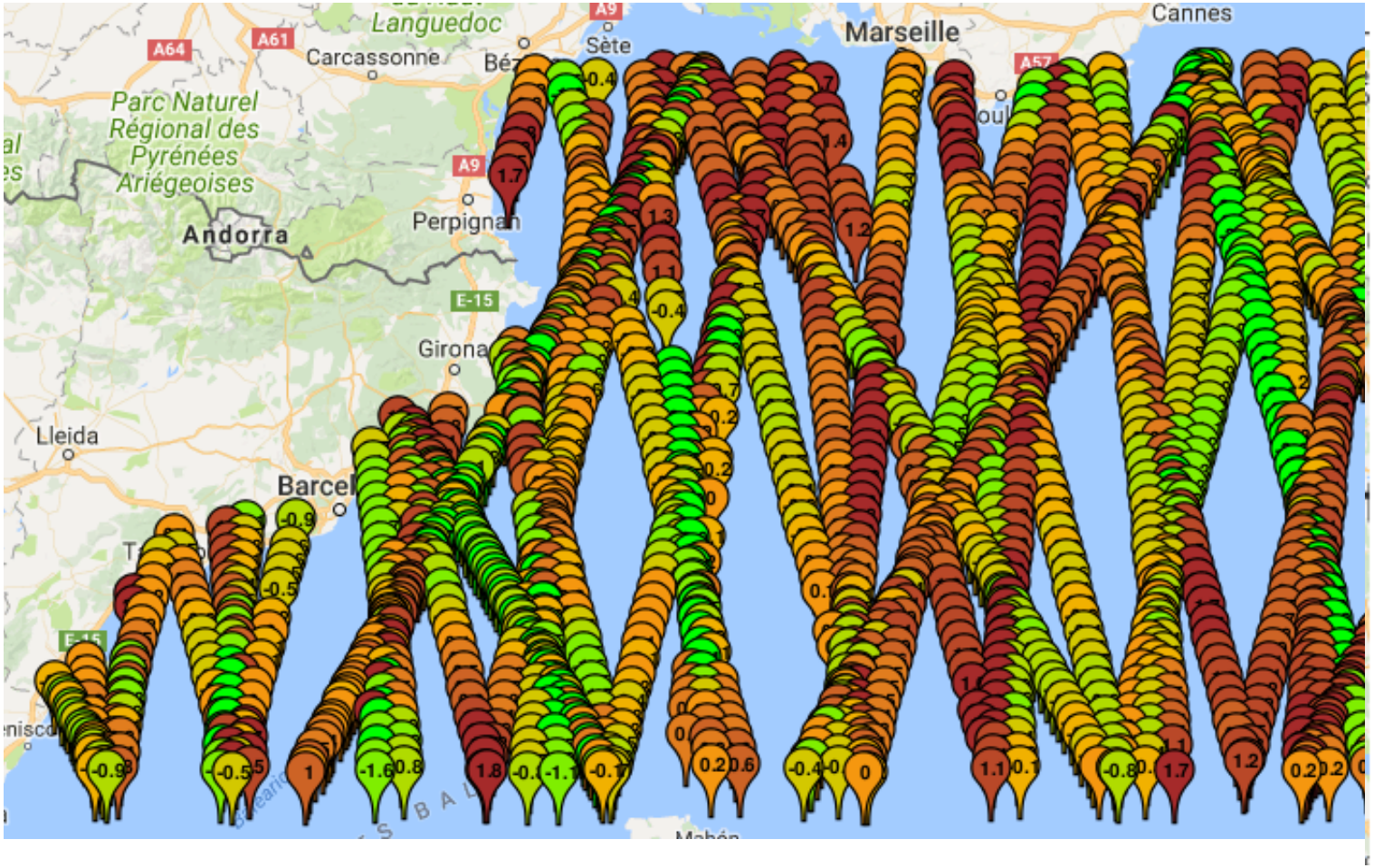




Kriging point-wise data on trajectories

Results: residuals of wind velocity

Residual of wind velocity in m/s



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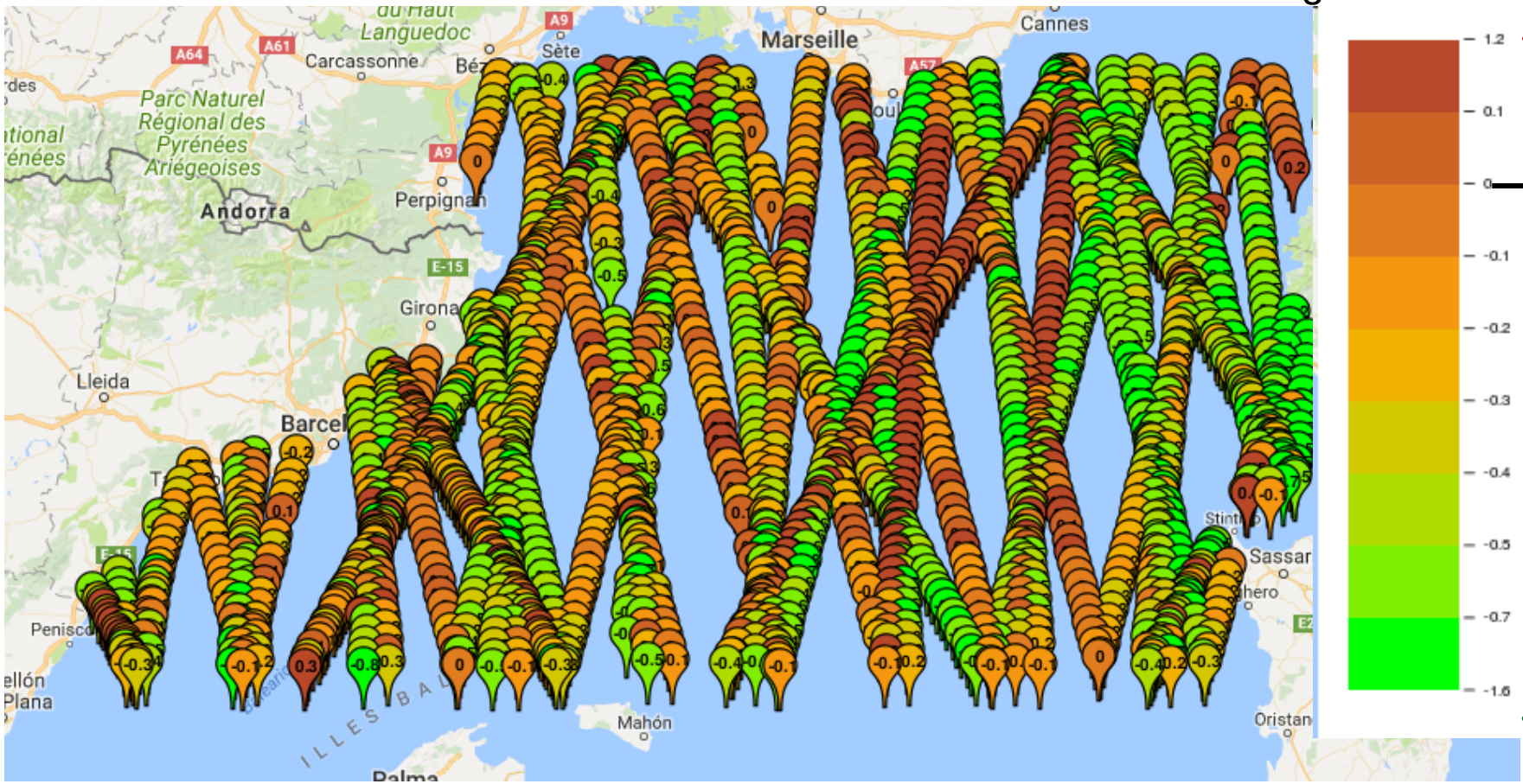
Results: residual of signif. wave height

Residual of wave height in m



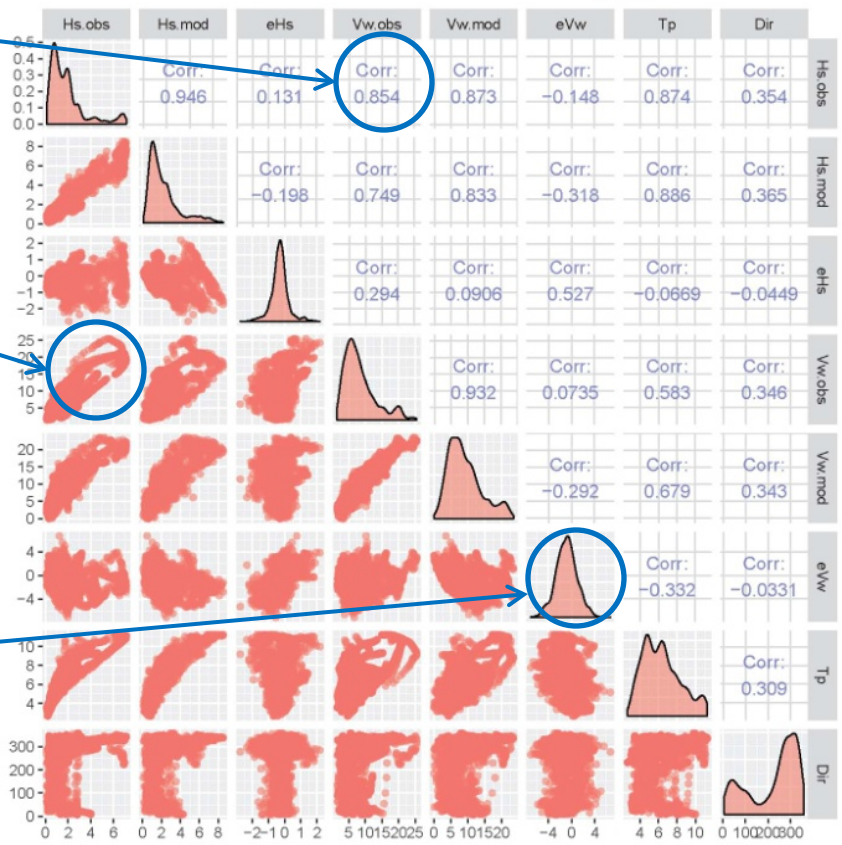
Results: correlation matrix

Variables →

Coefficient of correlation

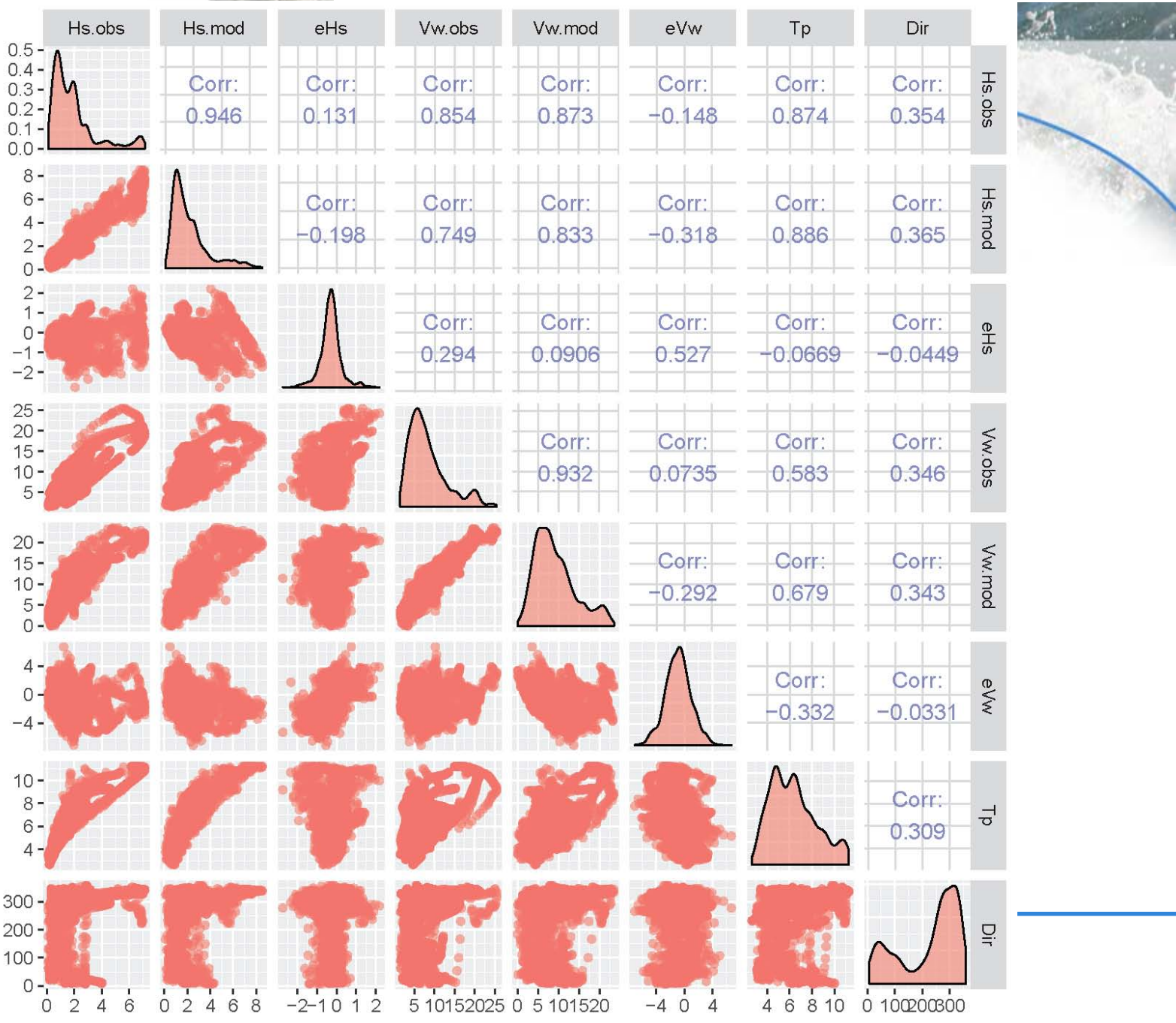
Scatter plots

Histograms

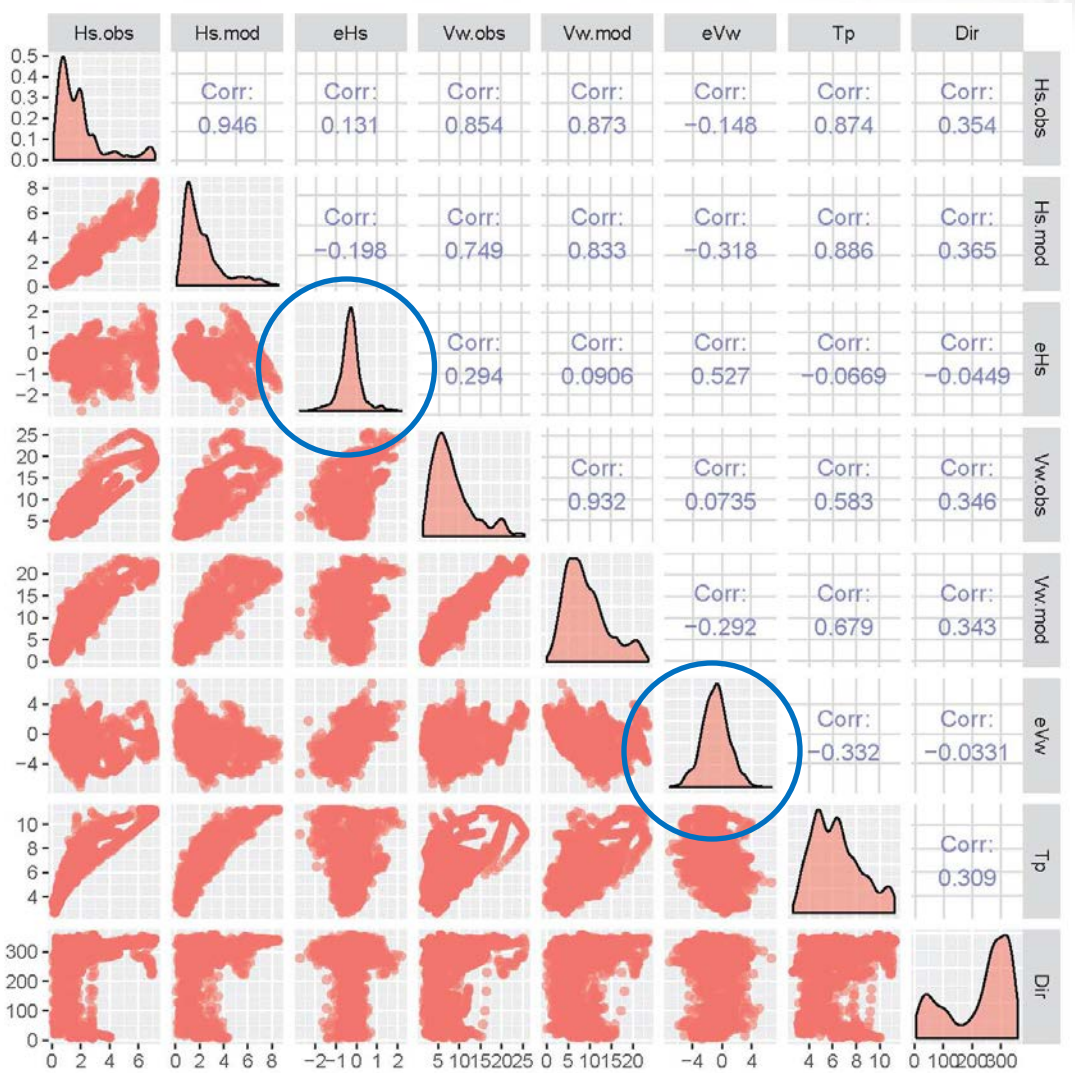


Variables →

Results and discussion: correlation matrix

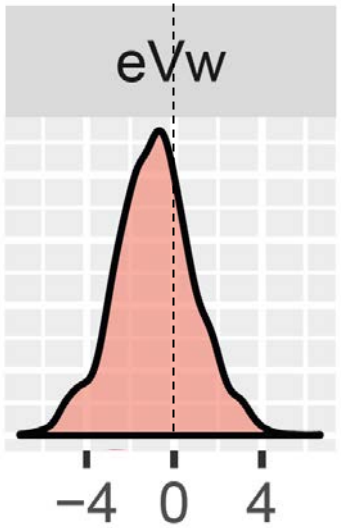


Results and discussion: correlation matrix

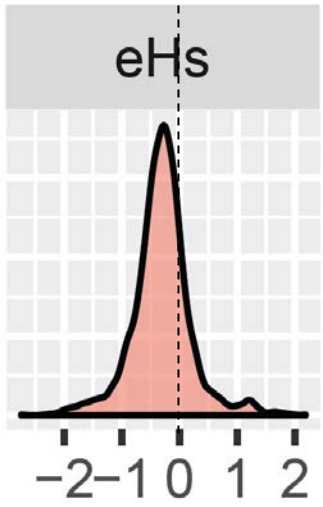


Results and discussion: correlation matrix

Underprediction

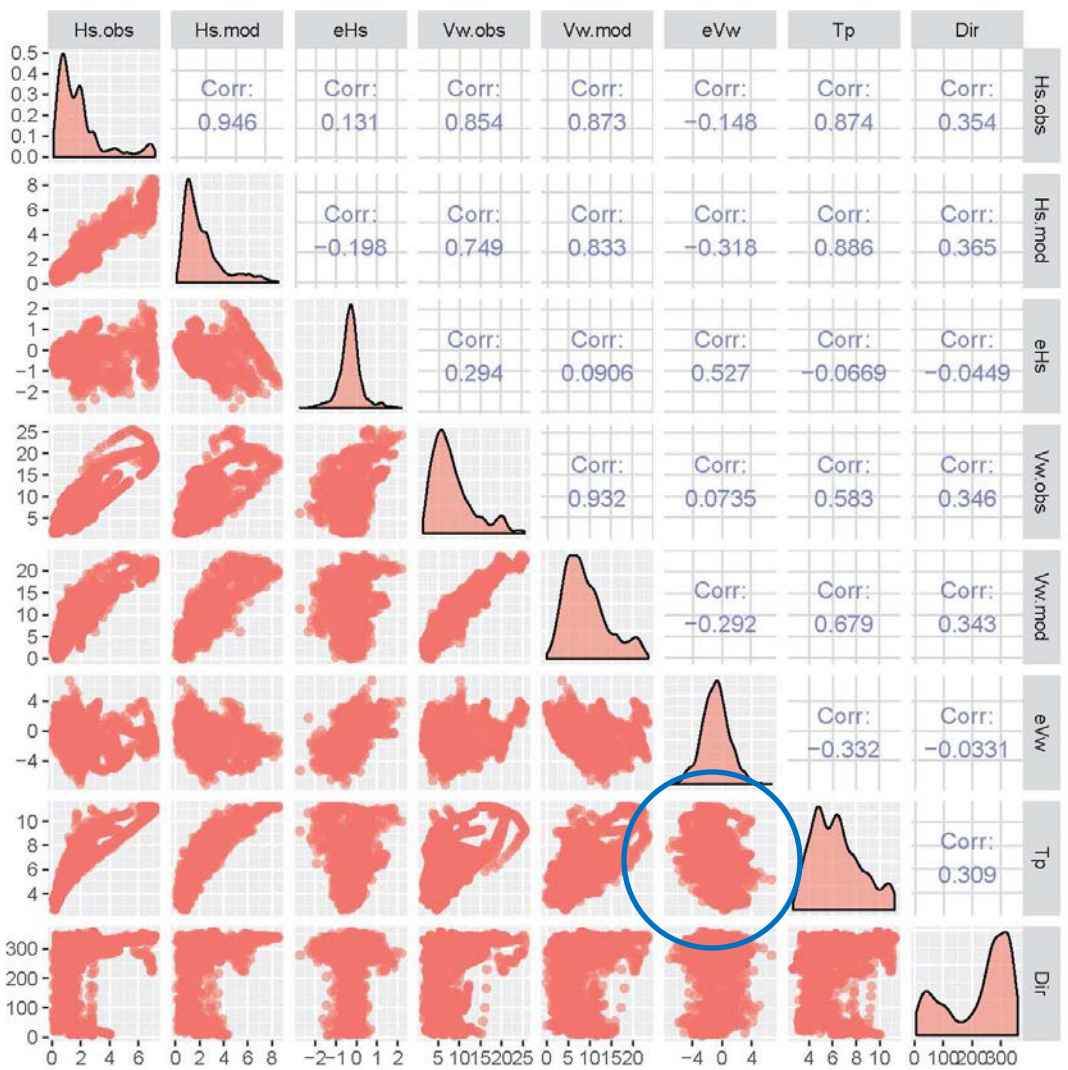


Underprediction



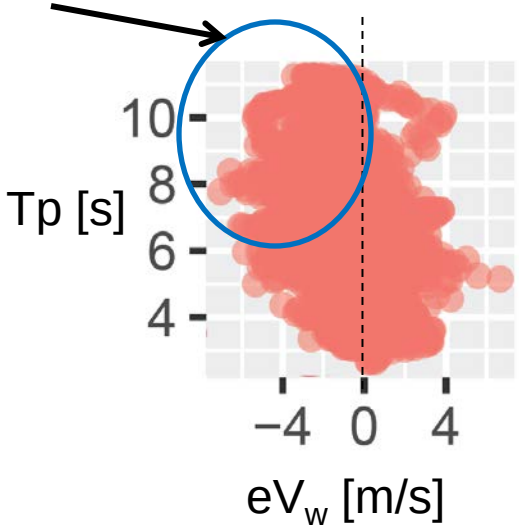
The **residuals** are almost **centred**

Results and discussion: correlation matrix



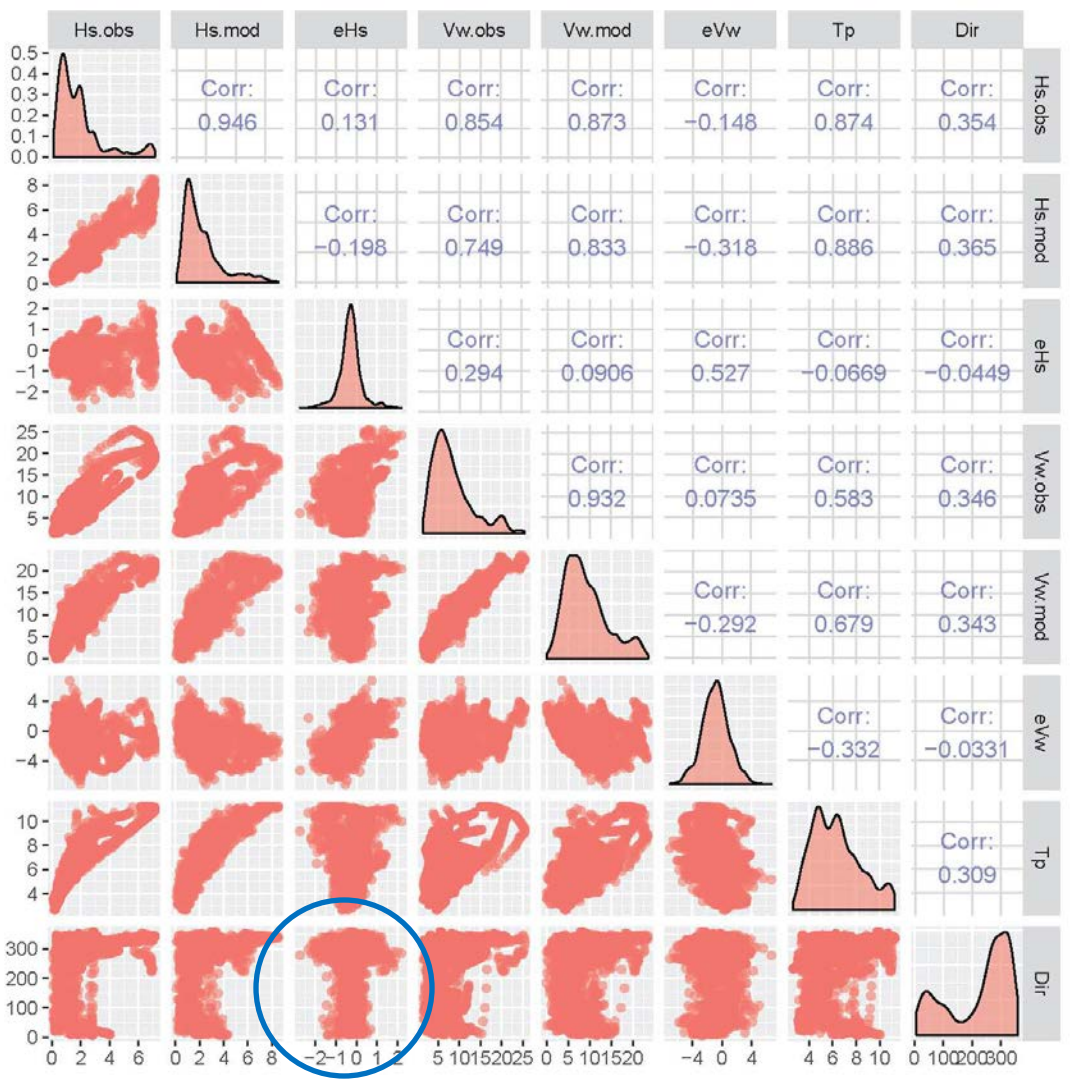
Results and discussion: correlation matrix

Underprediction of wind velocity for **high Tp** conditions



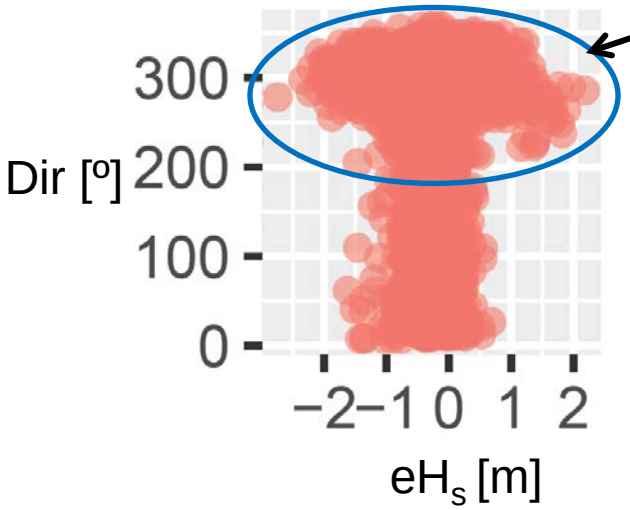
Correlation= -0.332

Results and discussion: correlation matrix



Results and discussion: correlation matrix

Higher eH_s are clustered in the S-waves



Correlation=-0.049

Conclusions

- There is more **anisotropy** on **coastal areas**
- There are equal number of overprediction and underprediction of V_w and H_s
- **eV_w** is inversely correlated with T_p
- **eH_s** is most relevant at a northerly wave direction latitudes

Acknowledgements

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