How do the sea and the land conditions affect the coastal breezes?
20 days analysed from WRF simulations in the Gulf of Cádiz (Iberian Peninsula)

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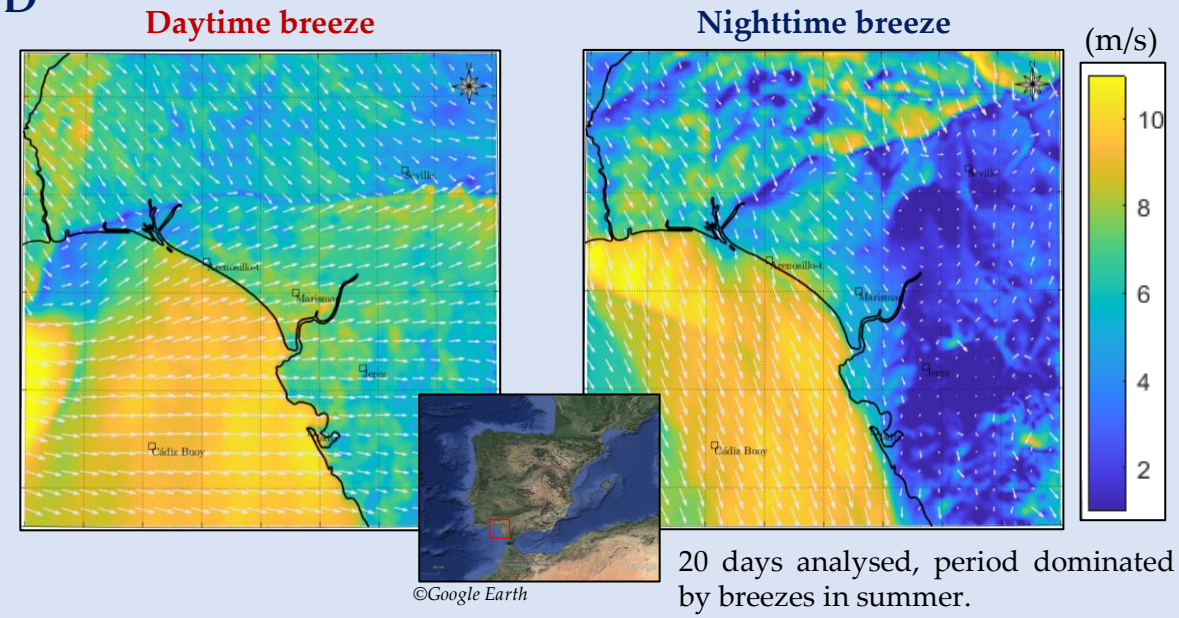
OBJECTIVE

To investigate the role of the surface conditions (sea and land) in the characteristics of the coastal breezes

METHOD

Model version	WRF v 4.2.2
Domains	9, 3, 1 km (180x180 grid points)
Initial and boundary conditions	NCEP FNL 0,25º
PBL	YSU / **MYJ**
Surface layer	Monin-Obukhov (Janjic Eta)
Land surface	Noah
Vertical levels	51
Analysed period	20 days (2020-08-01 to 2020-08-20)



20 days analysed, period dominated by breezes in summer.

WRF **overestimates** the wind speed, especially during nighttime influenced by synoptical NW.

Evaluation with:
Coastal/inland stations
Oceanic buoy
Satellite altimetry data*

WRF SENSITIVITY EXPERIMENTS (artificial)

Land cover
Soil moisture
SST

+ realistic experiments*

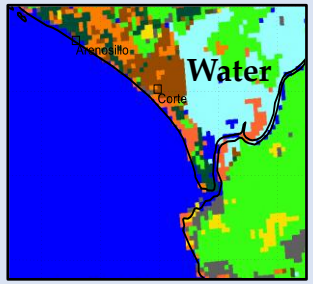
* not shown in this presentation

RESULTS – sensitivity experiments

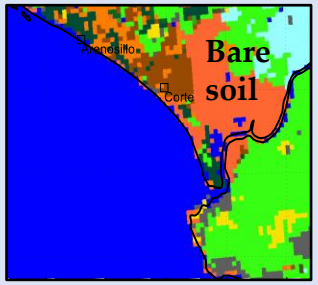
Results for 15/08/2020 at 18:00 UTC

LAND COVER

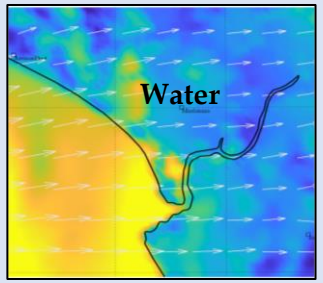
Land use 1 (L1)
Marshes as water



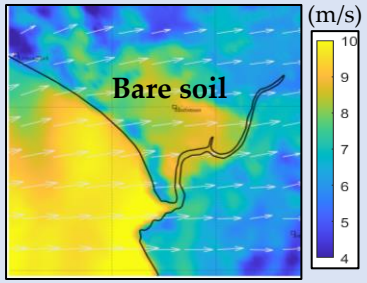
Land use 2 (L2)
Marshes as bare soil



Wind L1



Wind L2



Wind more intense (+4 m/s) at the bare-soil area

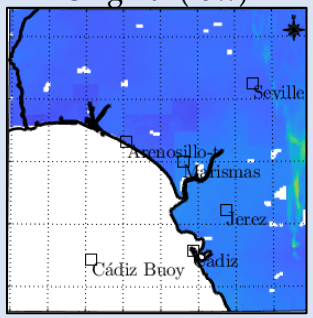
Land use can be very different depending on the season (marshes)

Important effect of land use (water *vs* bare soil) on wind speed, limited to the specific area

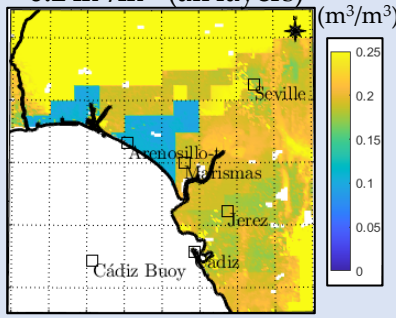
Currently analysing effects of crops and urban

SOIL MOISTURE (SM)

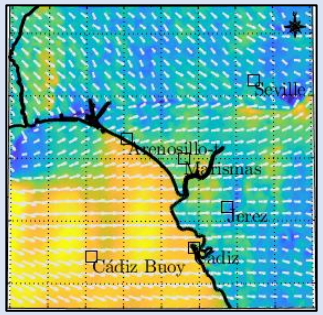
Soil moisture 1 (S1)
Original (low)



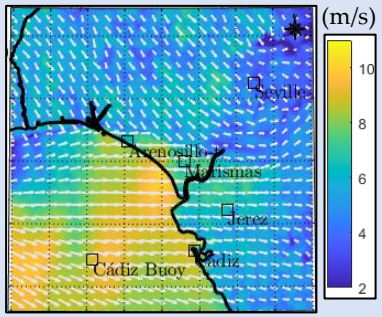
Soil moisture 2 (S2)
+0.2 m^3/m^3 (all layers)



Wind S1



Wind S2



Increased SM → Weaker winds

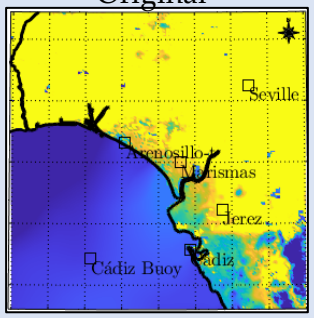
Increased SM → Less wind speed
(lower biases) (more realistic)

Irrigation not included in original SM, but important in the region!

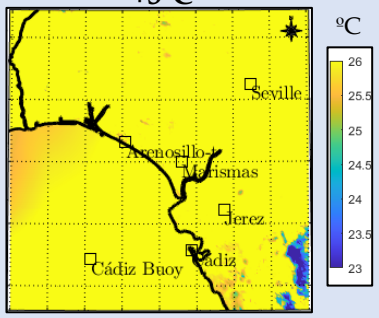
Currently including satellite SM in the model (soil moisture re-scaling needed)

SEA SURFACE TEMPERATURE (SST)

SST1
Original

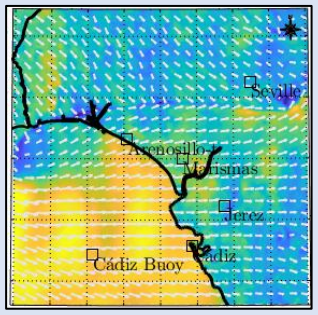


SST 2
+3ºC

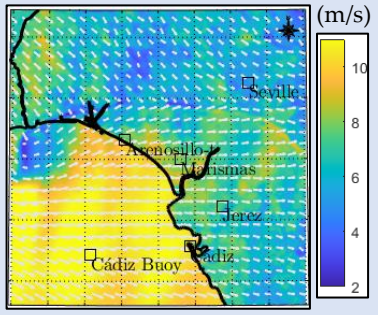


(this is skin temperature = SST)

Wind SST1



Wind SST2



Increased SST → Stronger winds

Model SST constant and almost homogeneous, but observations indicate SST decreasing from 24,5ºC to 20,5ºC in the 20 analysed days

Increased SST → More wind speed
(larger biases) (less realistic)

Currently using high-resolution and updated SST to initialise WRF, better results!

CONCLUSIONS