The Influence of Coastal Metropolitan Areas on Meteorology (COASTAL URBAN Exercise)

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Aim

To study the influence of Bilbao metropolitan area on formation of breeze circulation

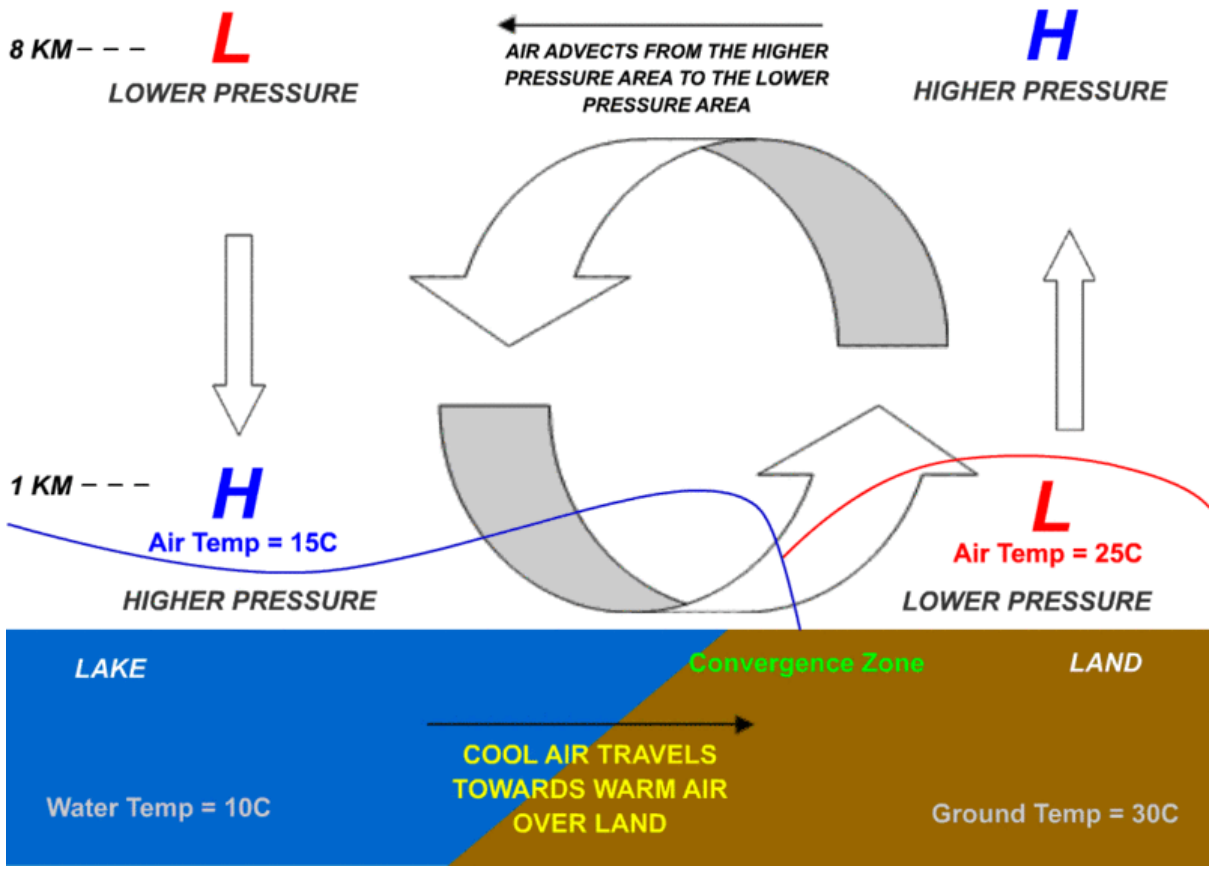
Objectives

- To perform simulations for the selected date (19 July 2009) in two modes - control run and modified run (changed AHF);
- To evaluate U and T_a diurnal cycle variability for the two types of runs.

Motivation

Breeze circulation formed in coastal areas controls:

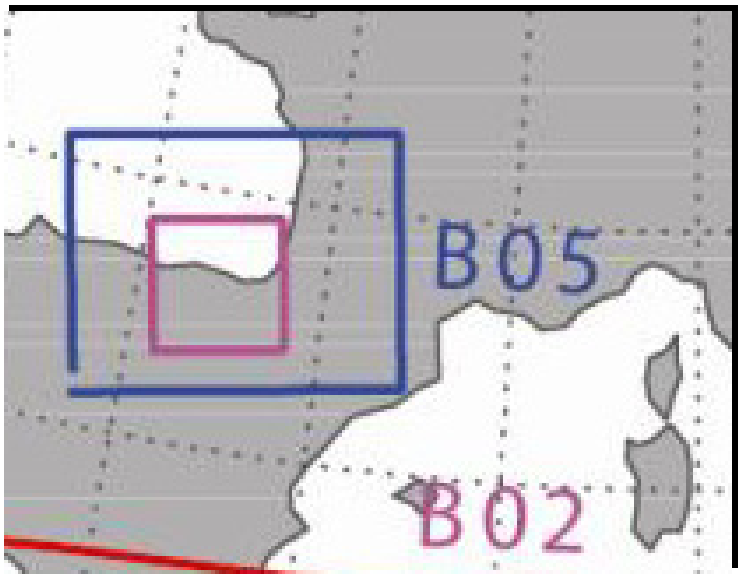
- local winds
- air quality
- convective activity and thunderstorms



Methods

Experiment setup

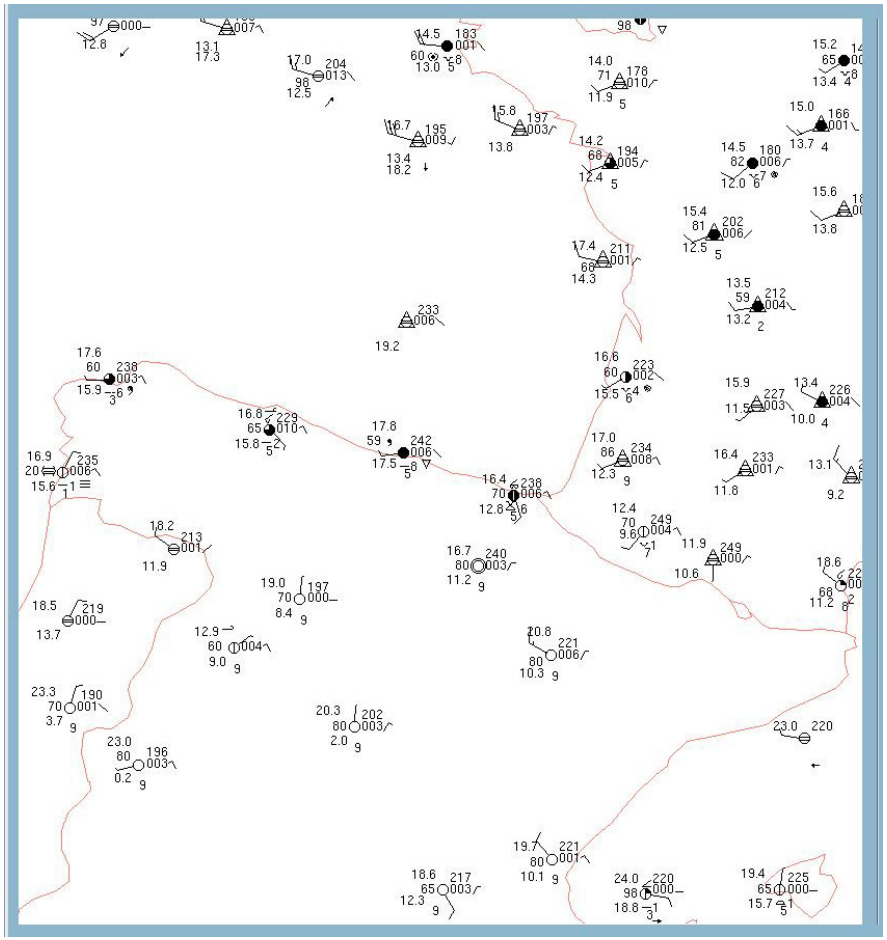
- Model: Enviro-HIRLAM
- Metropolitan area Bilbao
- B 05 Domain Resolution 5x5 km
- B 02 Domain Resolution 2.4x2.4 km
- Vertical levels 40
- Total # grid points in domain 14834
- # Urban grid points in domain 68



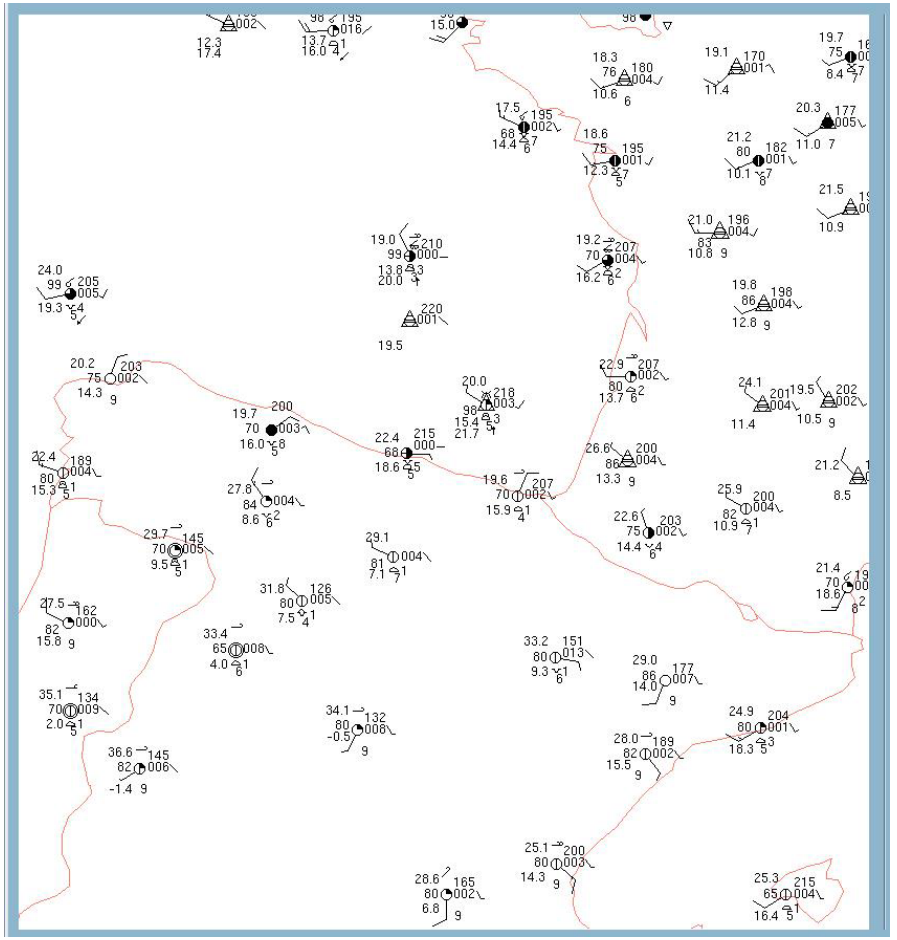
Methods

Analysis of meteorological situation

19 Jul 2009, 00 UTC

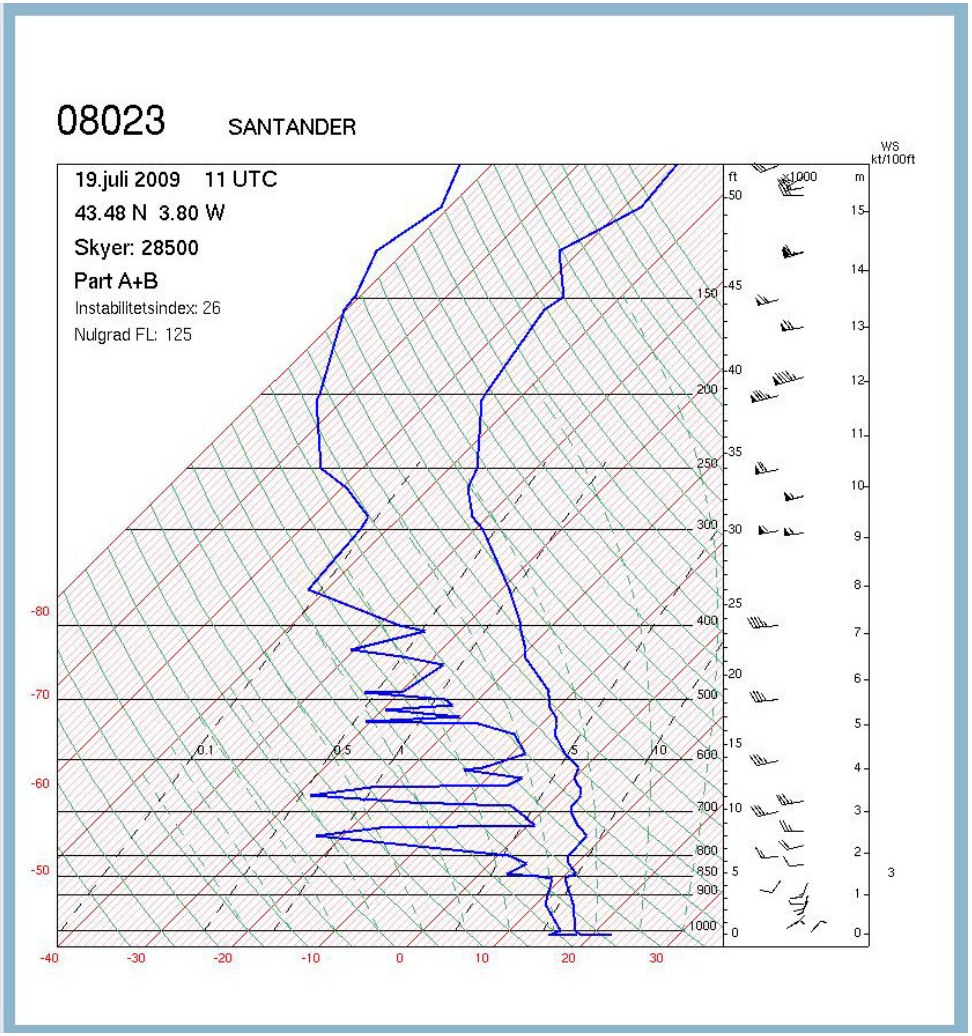


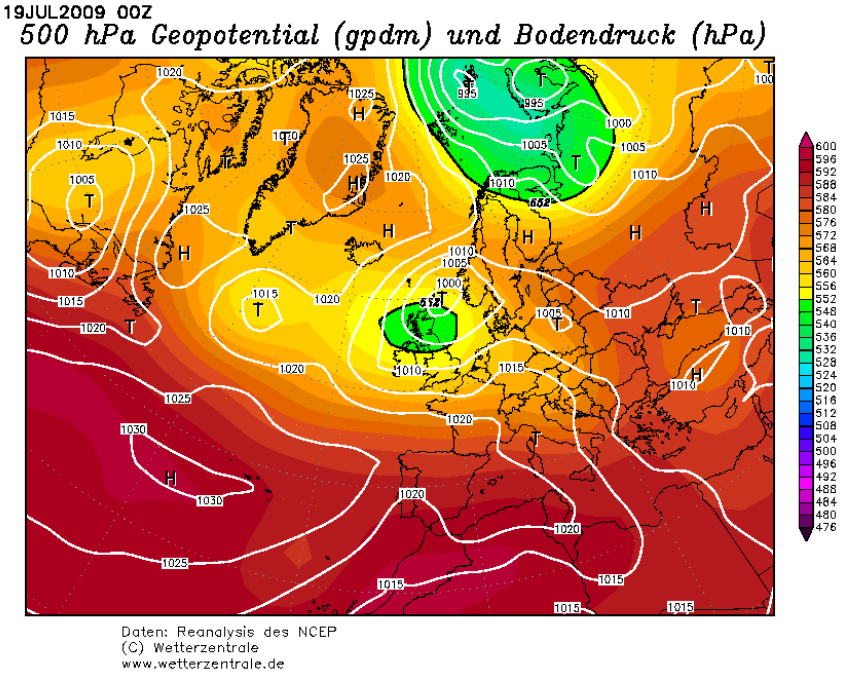
19 Jul 2009, 18 UTC



Methods:

Analysis of meteorological situation





Case date: **19 July 2009**

Forecast period: **24h**

Methods

Types of model runs

1. Reference run

Δt = 30 s, 90 s, AHF = 0

2. Modified run №1

Δt = 30 s, 90 s, AHF = 40 W m^{-2}

3. Modified run №2

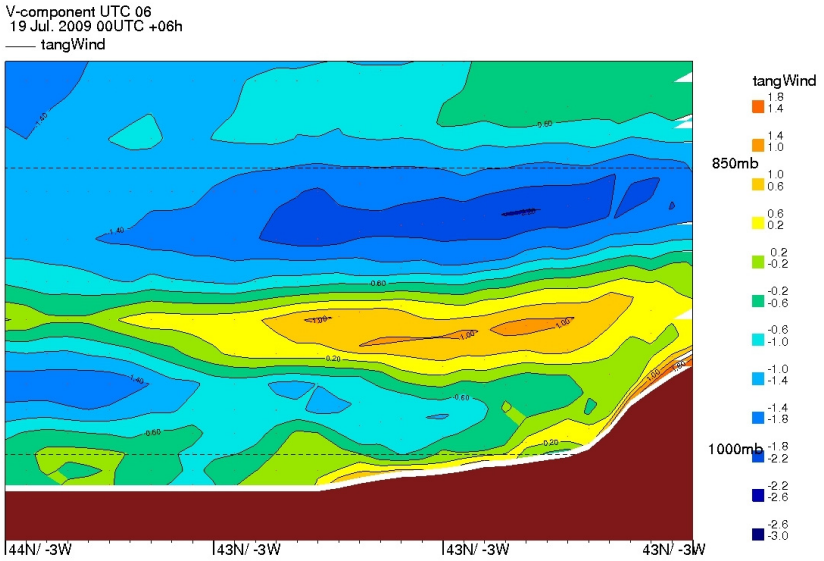
Δt = 30 s, AHF = 500 W m^{-2}

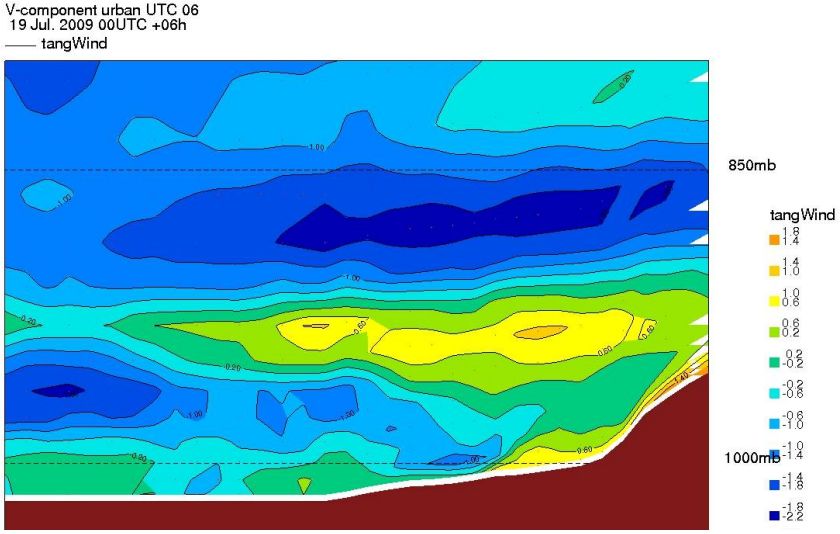
Methods

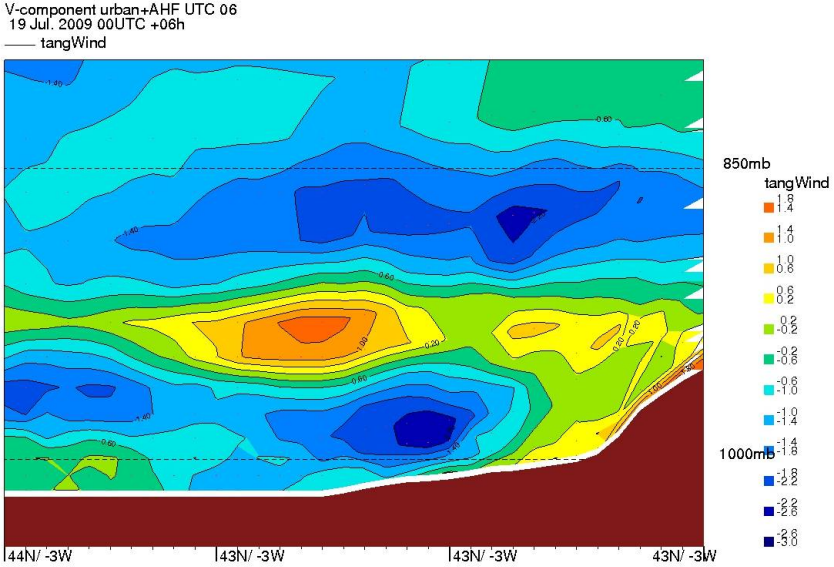
Location of the cross-sections

Results

Simulated breeze circulation
Wind *v*-component, 6 UTC

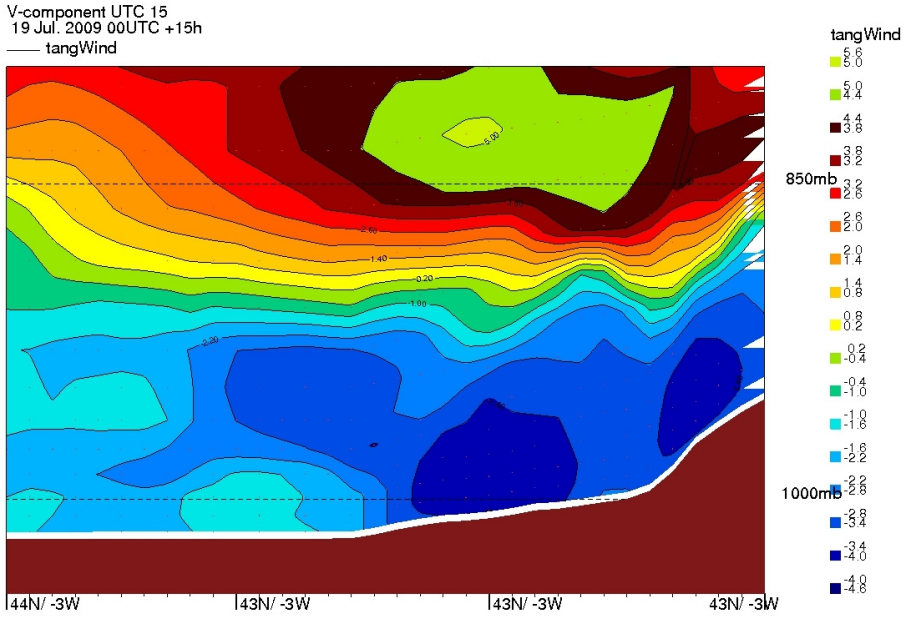


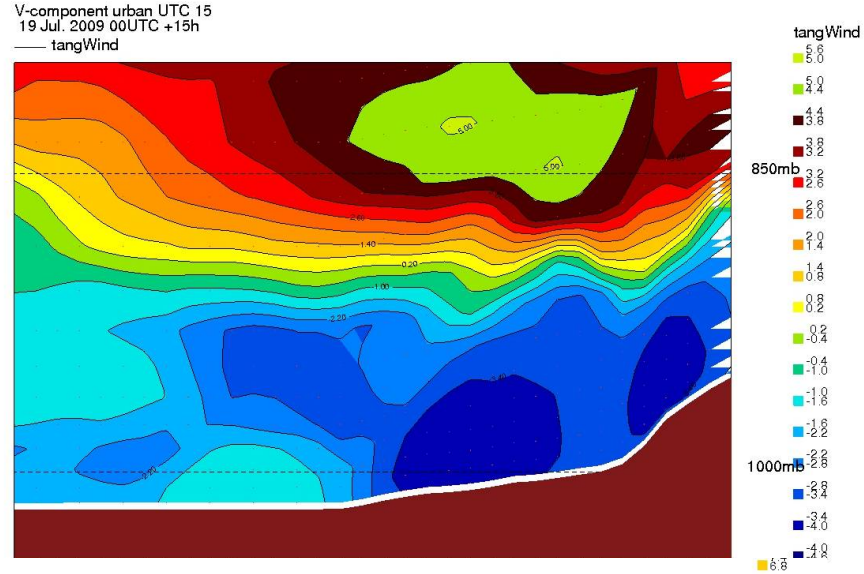


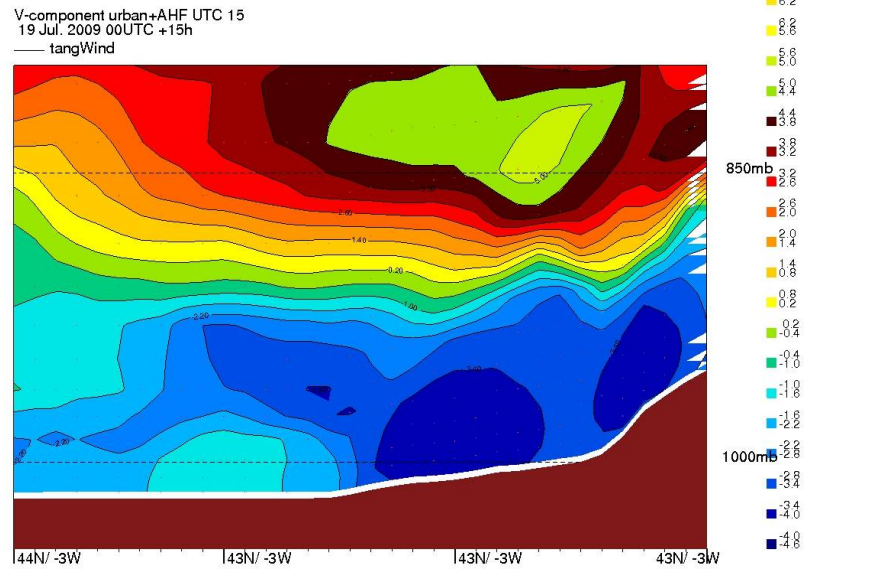


Results

Simulated breeze circulation
Wind *v*-component, 15 UTC



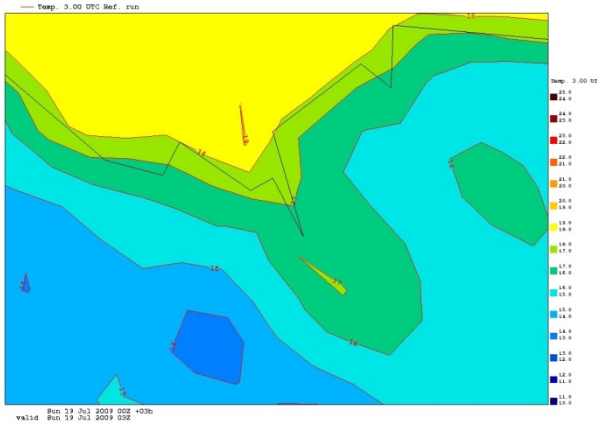




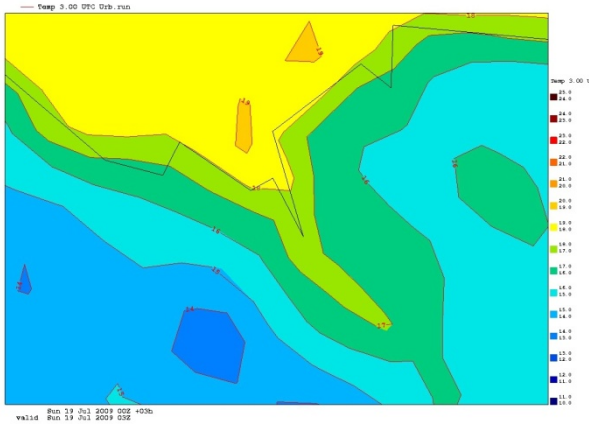
Results

Surface temperature distribution

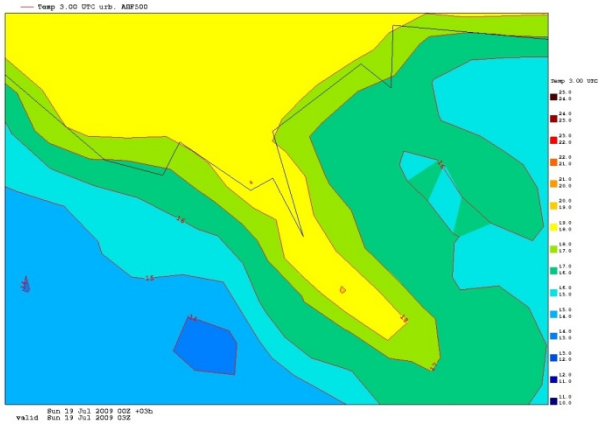
UTC 3:00, Ref.



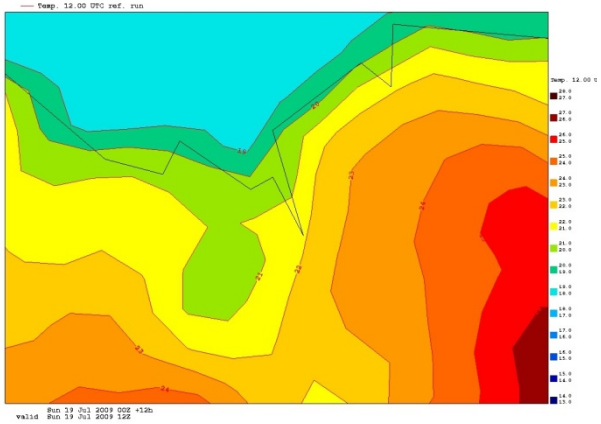
UTC 3:00, Urb. 40 W m^{-2}



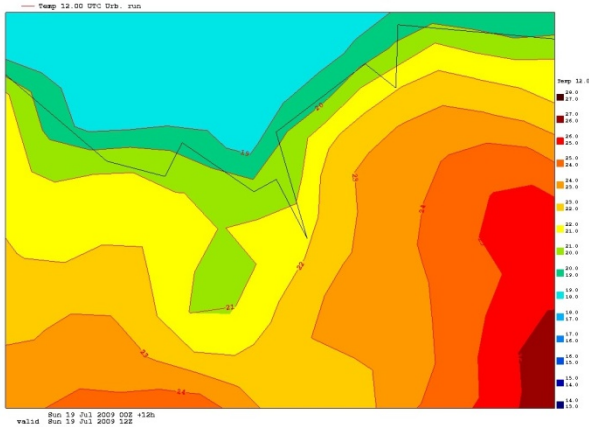
UTC 3:00, Urb. 500 W m^{-2}



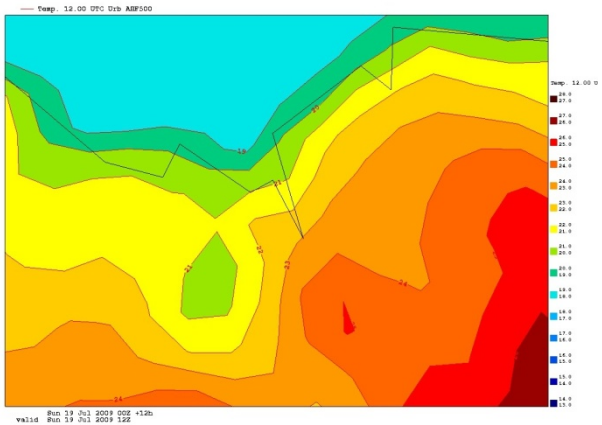
UTC 12:00, Ref.



UTC 12:00, Urb. 40 W m^{-2}

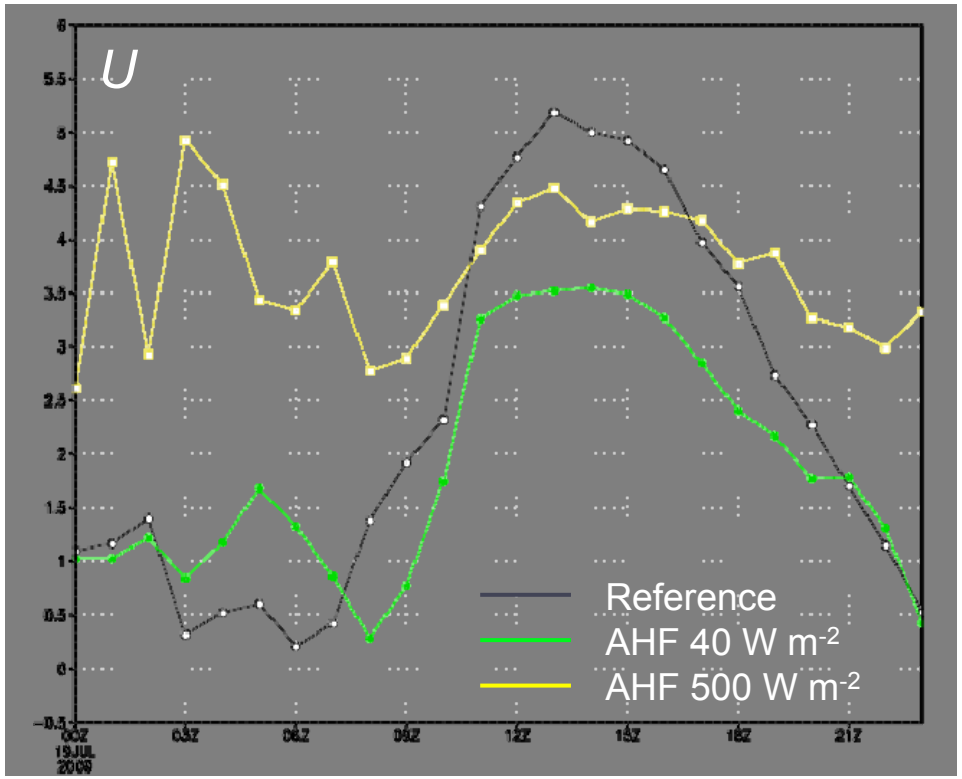


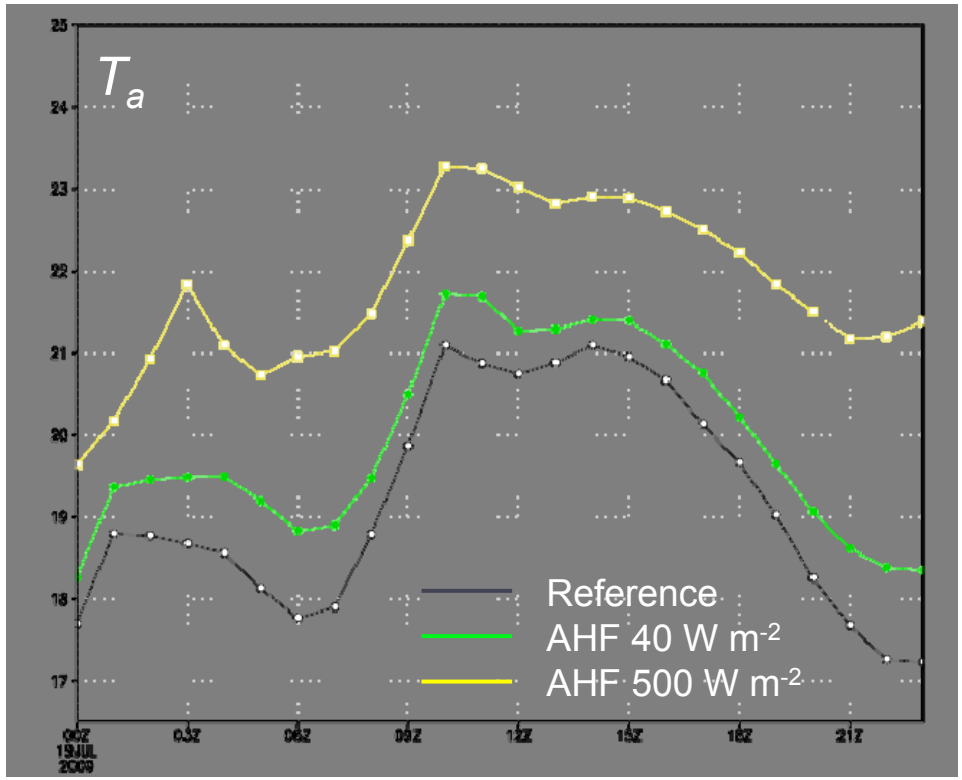
UTC 12:00, Urb. 500 W m^{-2}



Results

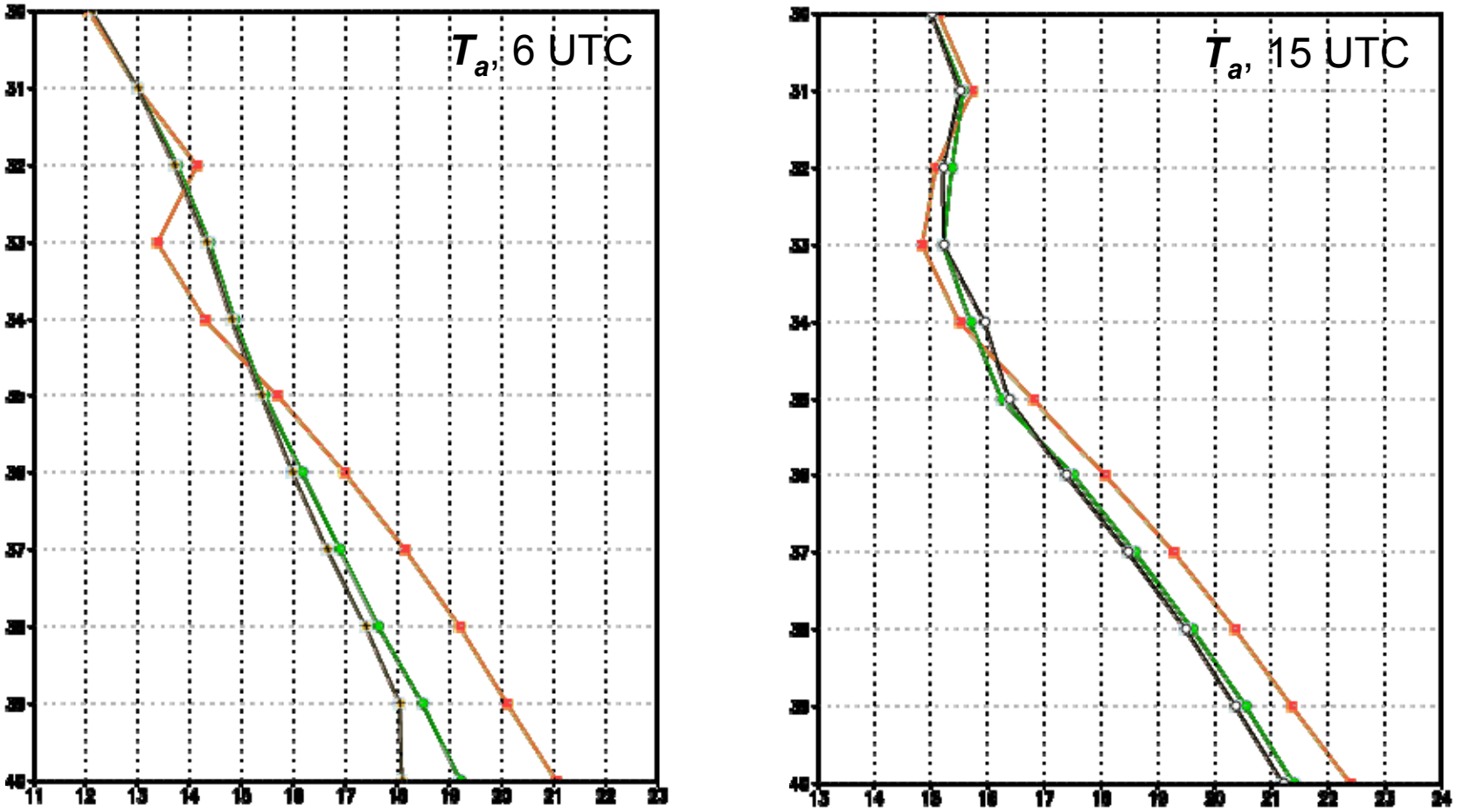
Diurnal variation of wind speed (U) and surface air temperature (T_a) in Bilbao centre





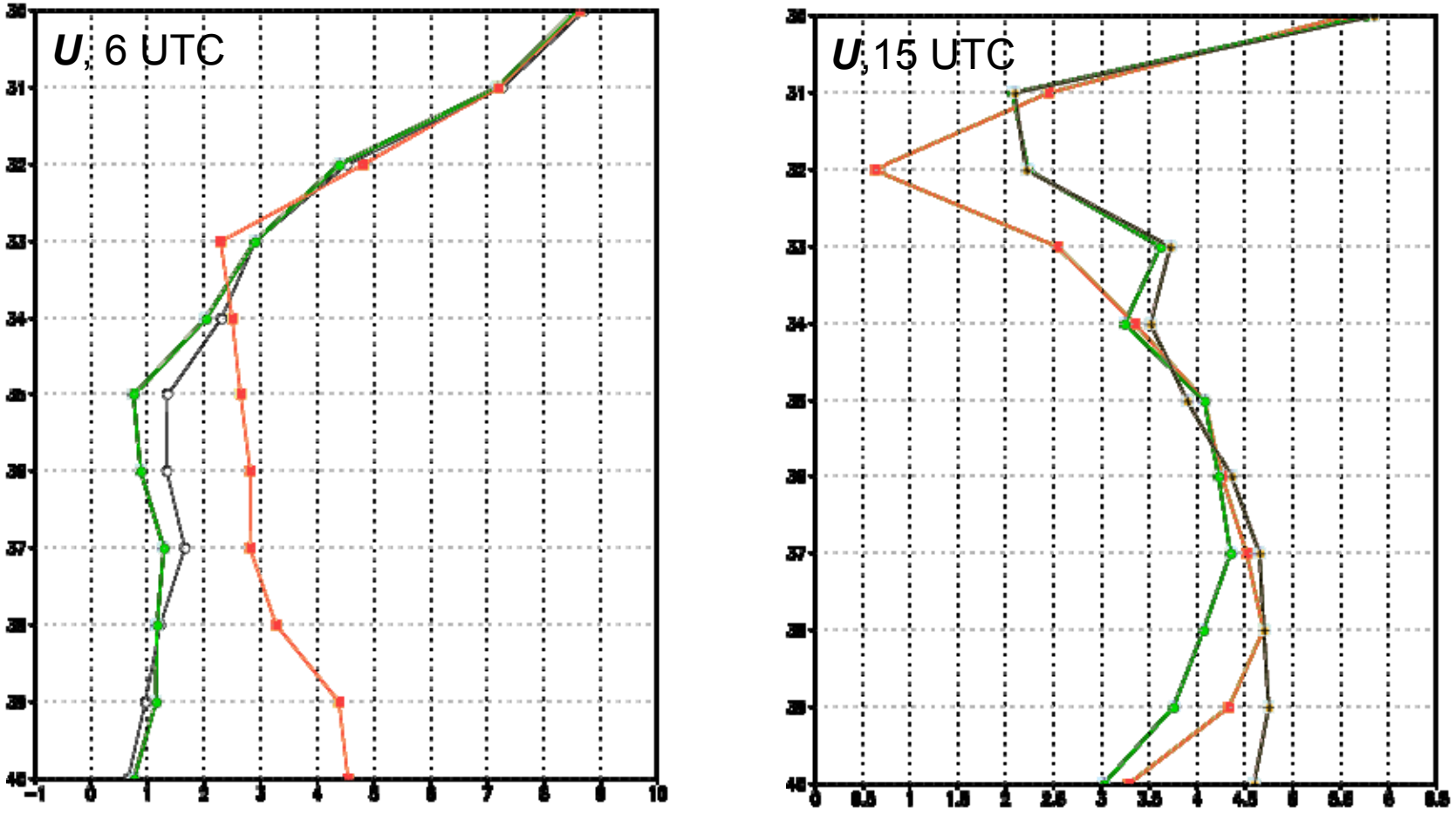
Results

Vertical profiles of temperature (Bilbao centre)



Results

Vertical profiles of wind speed (Bilbao centre)



Conclusions

- Breeze circulation is predicted by the model
- The influence of Bilbao metropolitan area on breeze circulation is demonstrated
- Metropolitan area reduces land breezes (with realistic AHF) and almost does not influence sea breezes during the daytime
- Imposed unrealistic AHF reverses circulation in the night time and unexpectedly weakens day-time circulation

THANK YOU!