



# Urban Climate Simulation in the Metropolitan Area of Buenos Aires (SUrAMBA): SENSITIVITY STUDY ON MODEL CONFIGURATION

Luis Eduardo Muñoz

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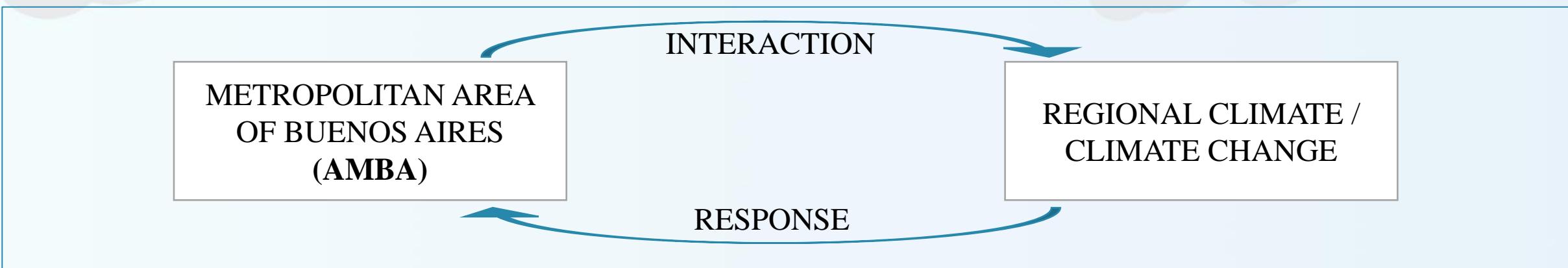
[luis.munoz.pabon@cima.fcen.uba.ar](mailto:luis.munoz.pabon@cima.fcen.uba.ar)

Thesis Advisors

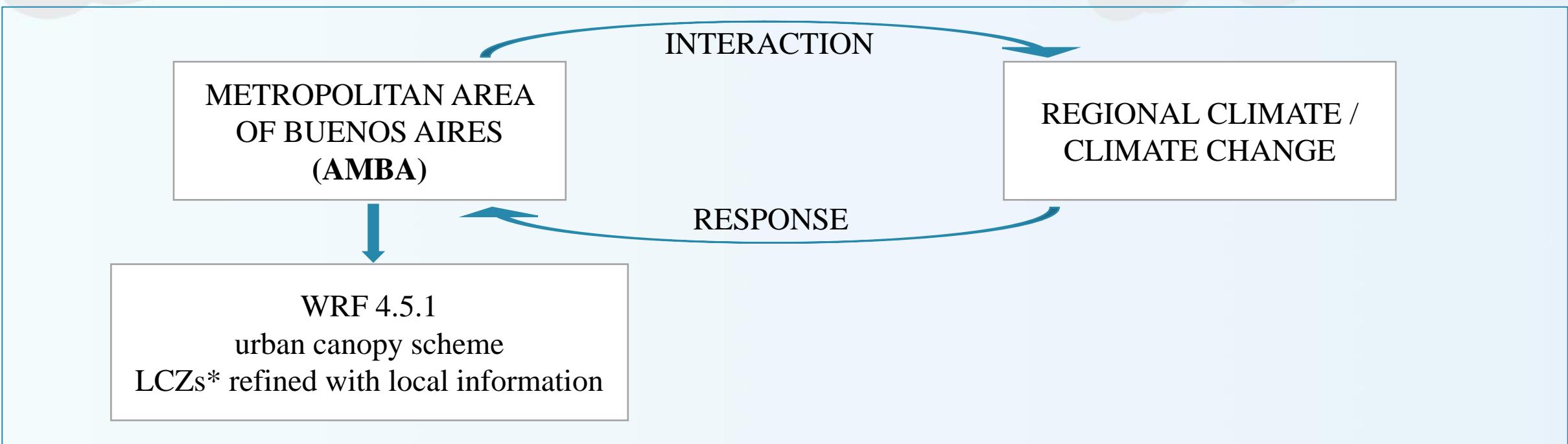
Lluís Fita, Ph.D.  
Andrea Carril, Ph.D.

Thursday, September 28<sup>th</sup>, 2023

# OVERVIEW



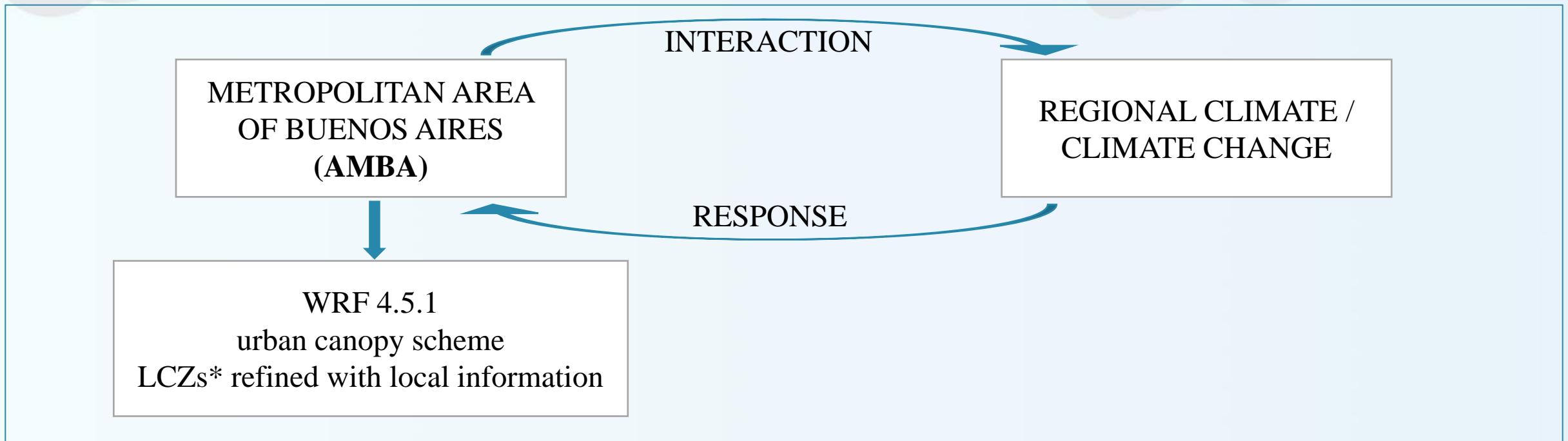
# OVERVIEW



\*Source: WUDAPT 300m



# OVERVIEW



Climate simulations 1 km resolution: current and future climate conditions, and no urban.

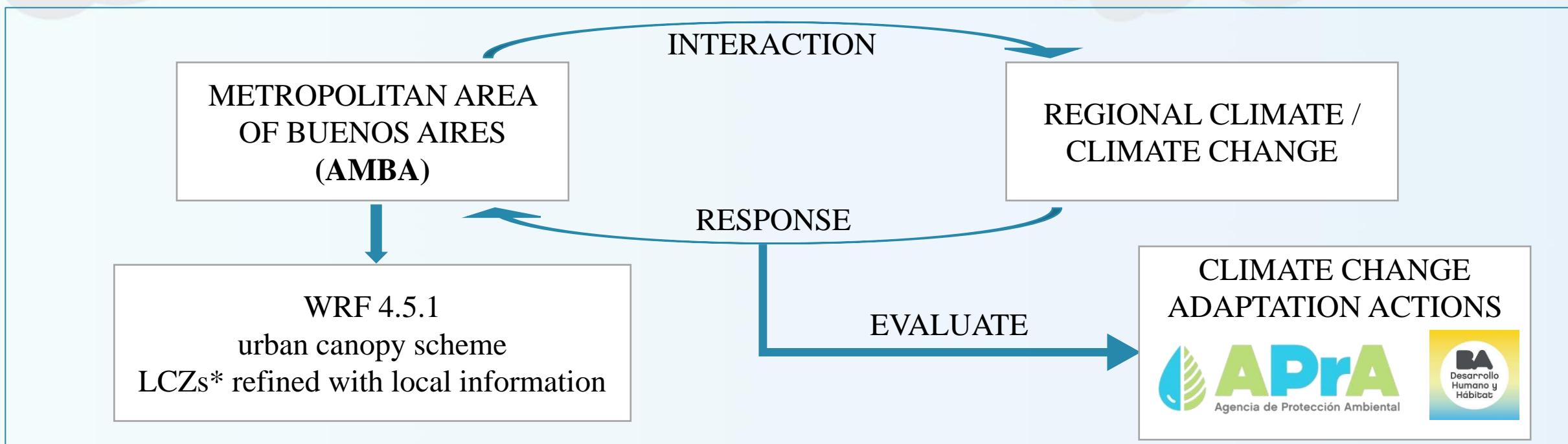


Lateral Boundary Conditions (LBC) from 4 km WRF South America Affinity Group (SAAG) simulations.

\*Source: WUDAPT 300m



# OVERVIEW



Climate simulations 1 km resolution: current and future climate conditions, and no urban.

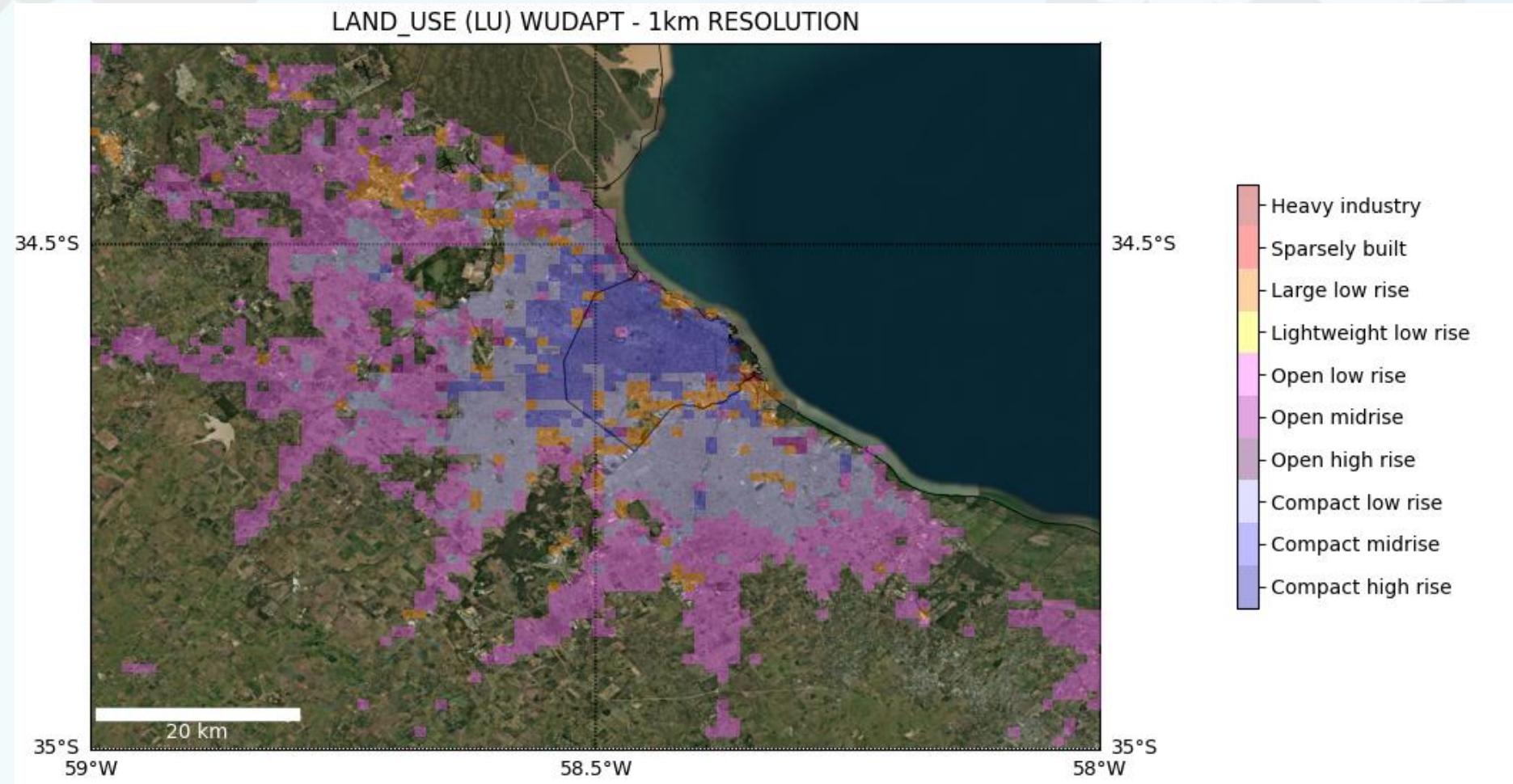


Lateral Boundary Conditions (LBC) from 4 km WRF South America Affinity Group (SAAG) simulations.

\*Source: WUDAPT 300m

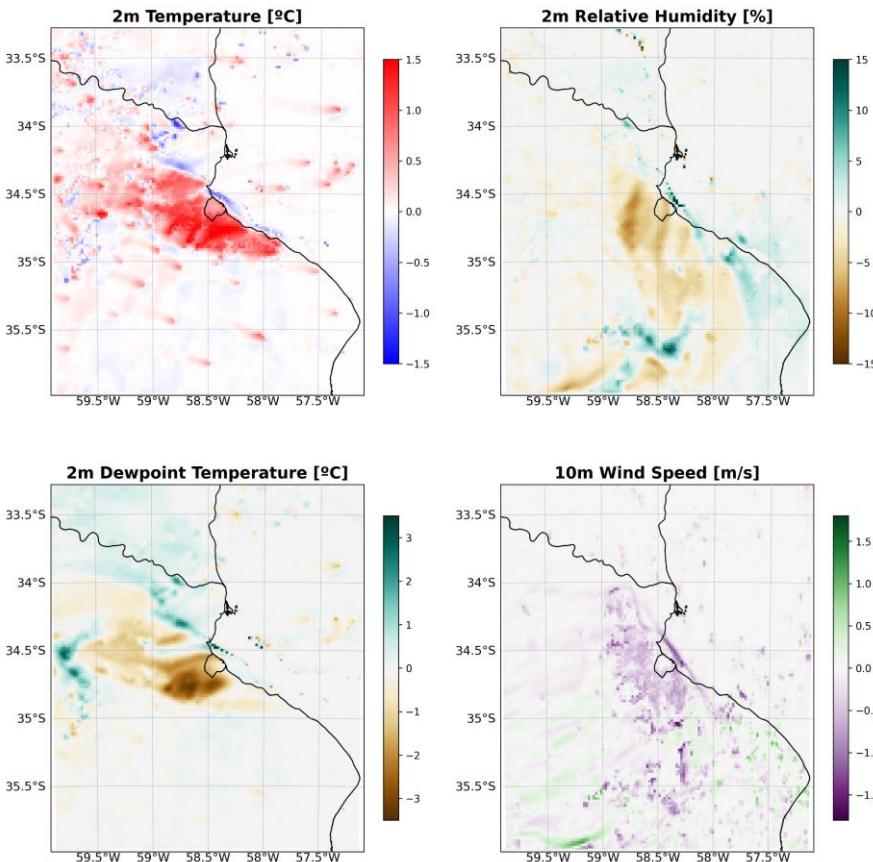


# URBAN CLASSIFICATION



# SENSITIVITY TESTS

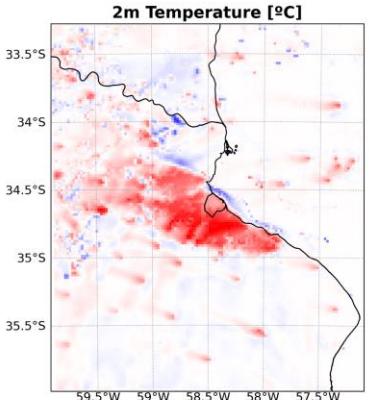
**Building Height + 5m  
3rd day output differences**



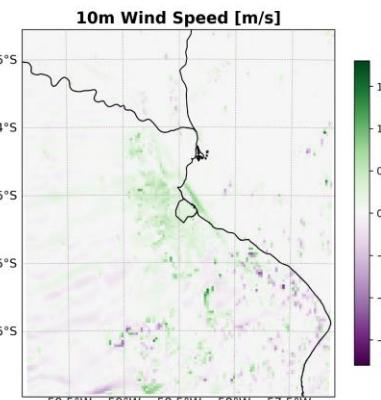
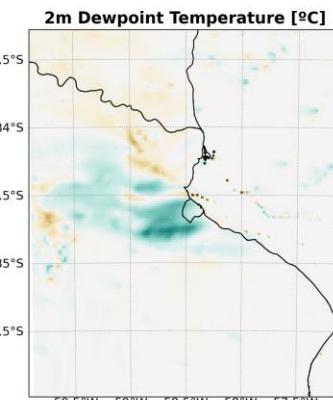
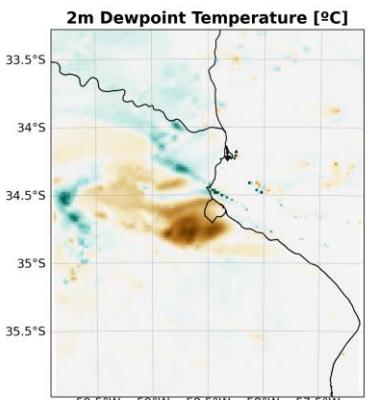
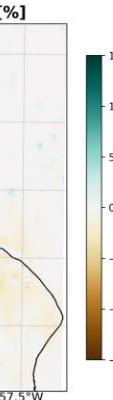
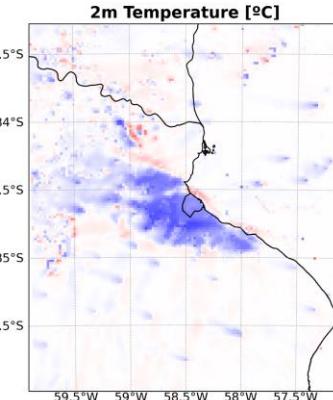
- **3-day simulations** from 09/11/2018 to 12/11/2018 (spring).
- **LCZs** from the hybrid 100-m global land cover dataset for WRF - **No changes**.
- **2 km** resolution - LBC from **ERA5**.
- Urban Canopy Scheme – **Building Effect Parametrization + Building Energy Model (BEP+BEM)**.
- MP: **Thompson graupel scheme**

# SENSITIVITY TESTS

**Building He**  
3rd day output



**Building Height - 5m**  
3rd day output differences



## Physical Parameters

Higher sensitivity, accessible information.

- Building Height **BH** → ± 5m
- Street Direction **SD** → + 45°

## Thermal Parameters

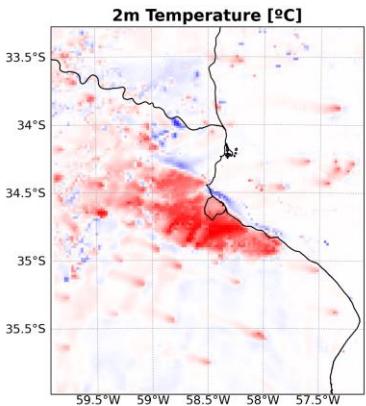
Lower sensitivity, scarce information.

- Heat Capacity **HC** → ± 10%
- Thermal Conductivity **TC** → ± 10%

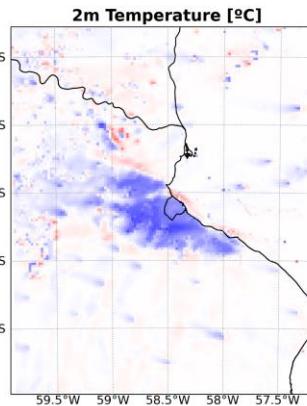


# SENSITIVITY TESTS

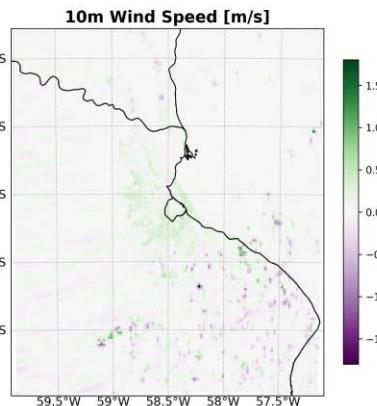
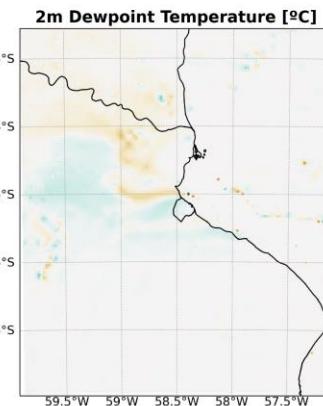
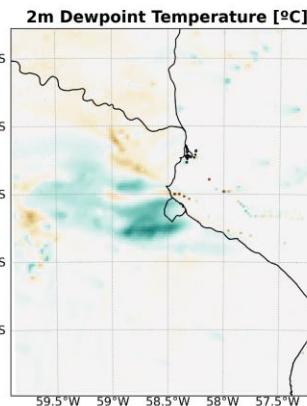
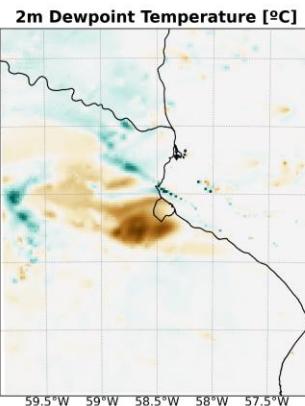
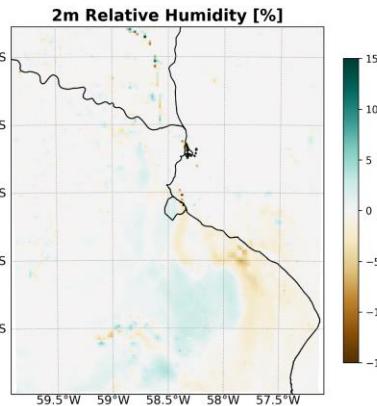
**Building He  
3rd day output**



**Building He  
3rd day output**

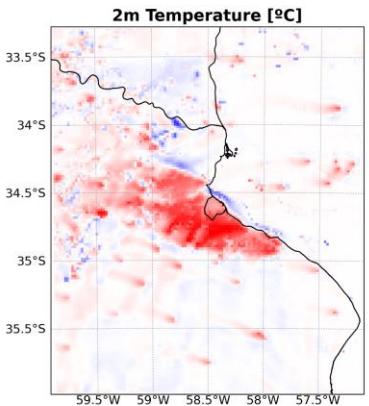


**Street Direction + 45°  
3rd day output differences**

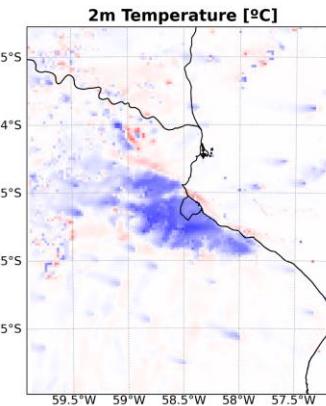


# SENSITIVITY TESTS

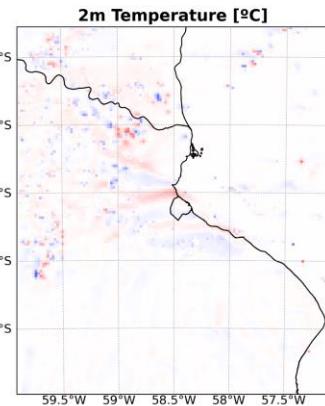
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3rd day output**



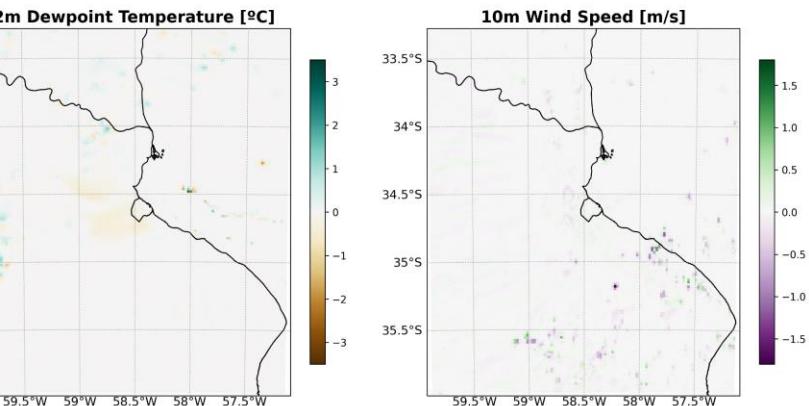
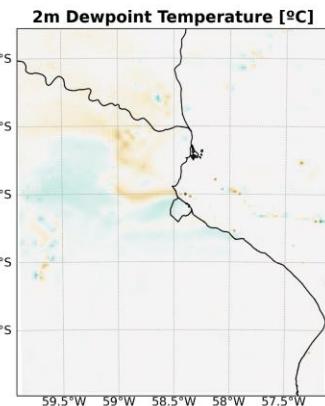
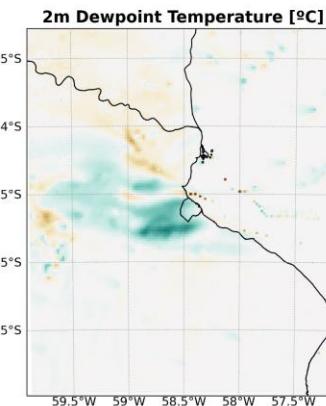
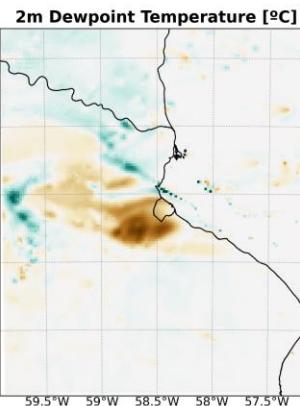
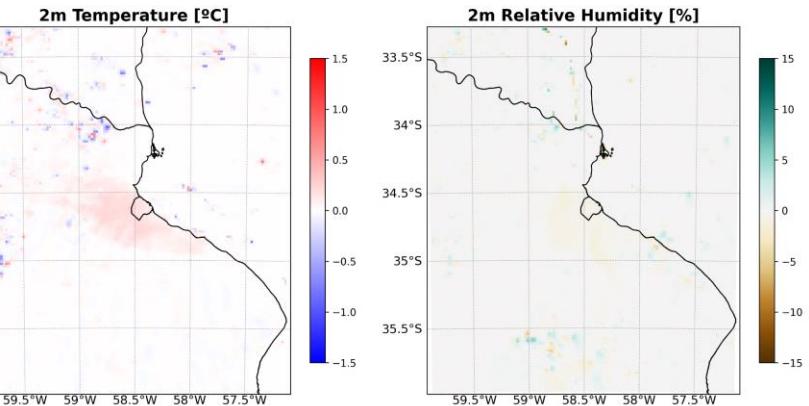
**Building He  
3rd day output**



**Street Direc  
3rd day output**

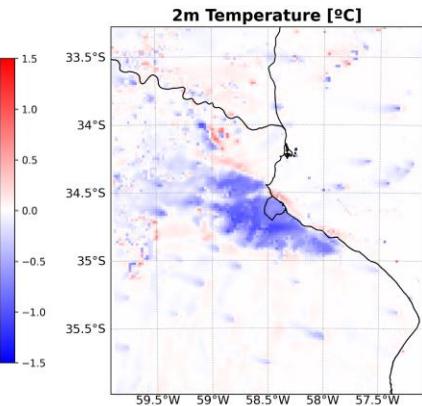
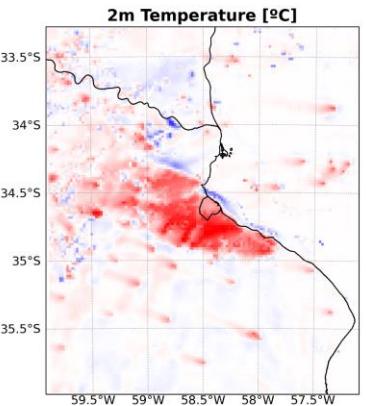


**Heat Capacity + 10%  
3rd day output differences**

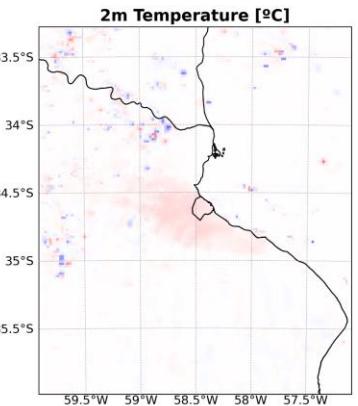
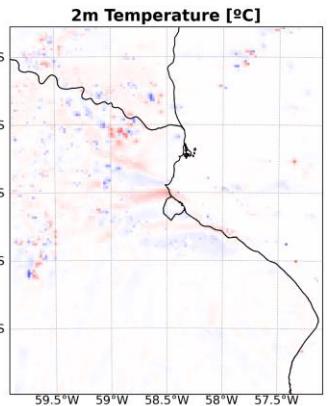


# SENSITIVITY TESTS

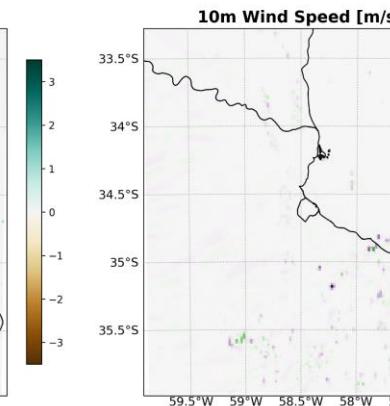
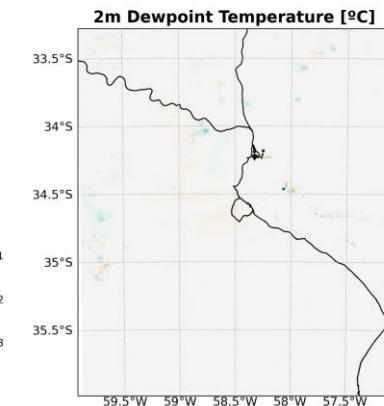
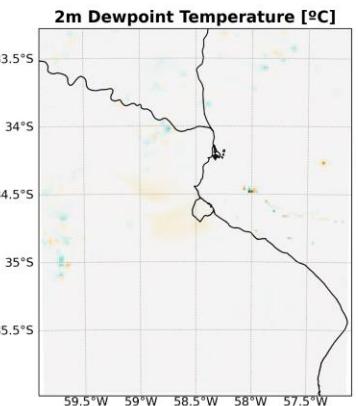
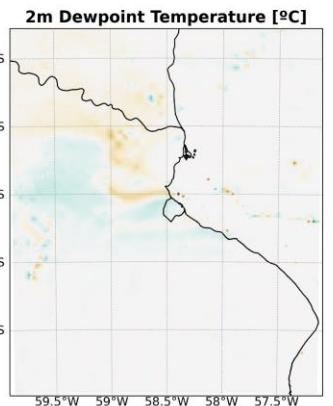
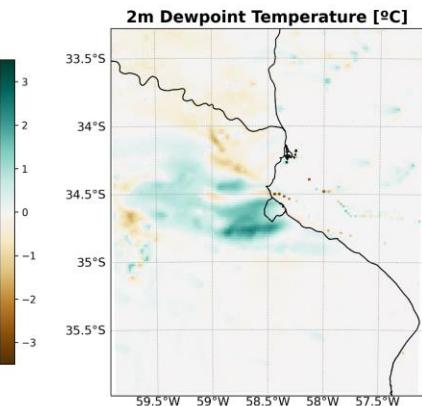
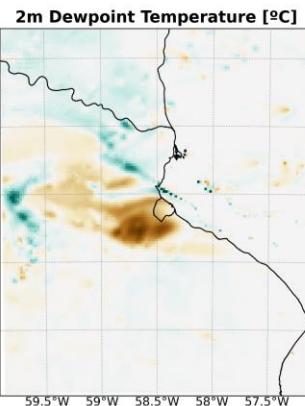
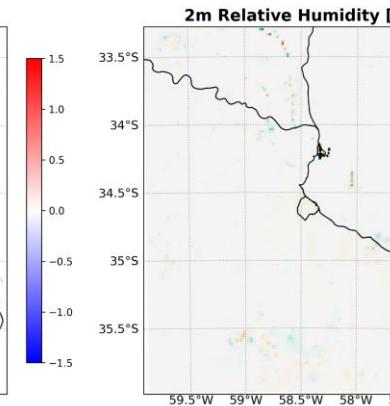
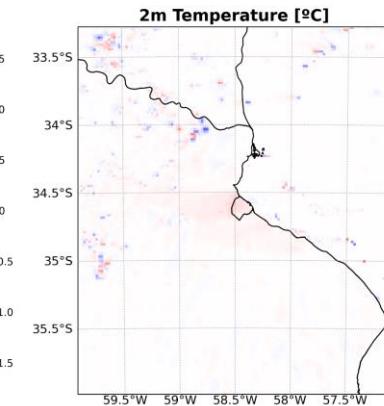
**Building He  
3rd day output**

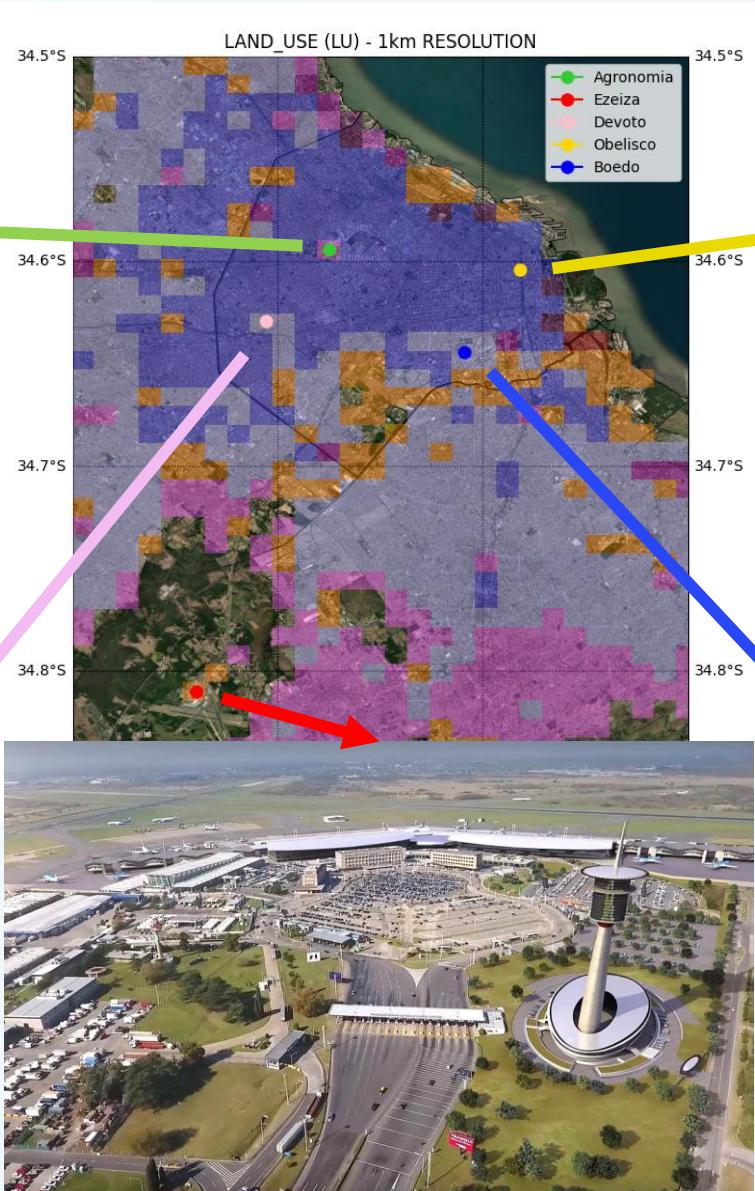


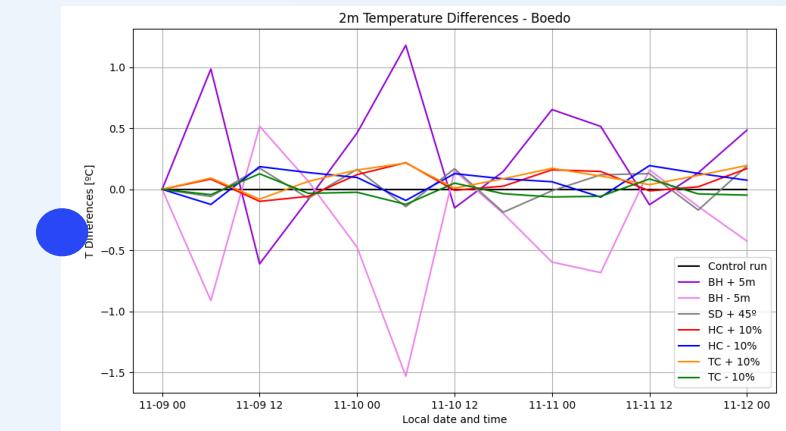
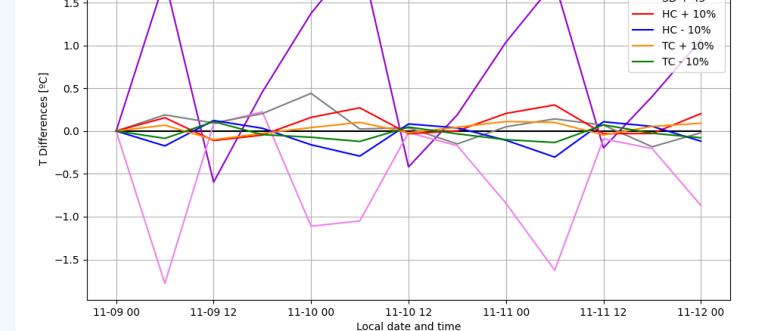
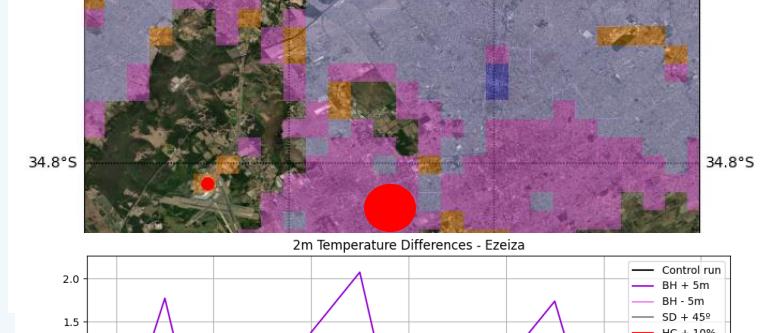
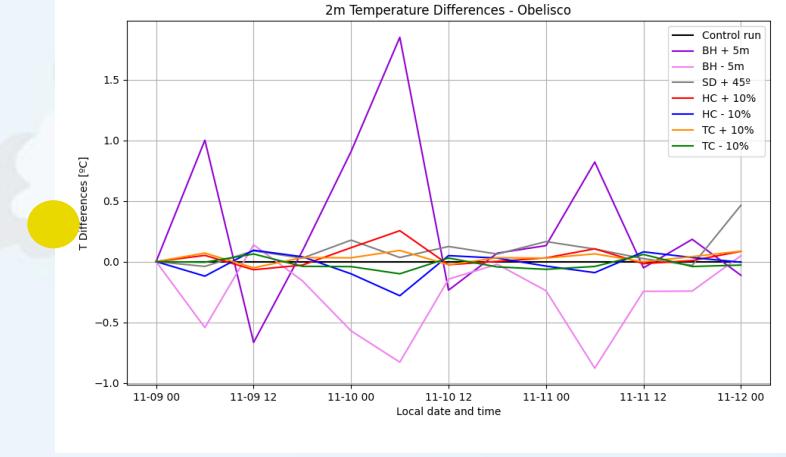
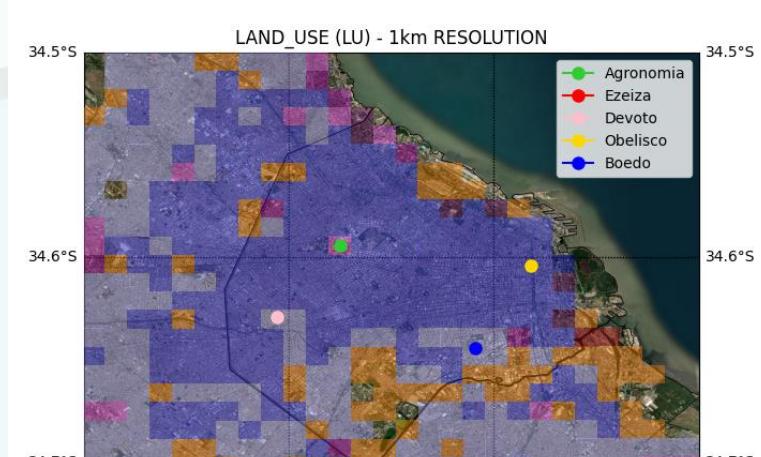
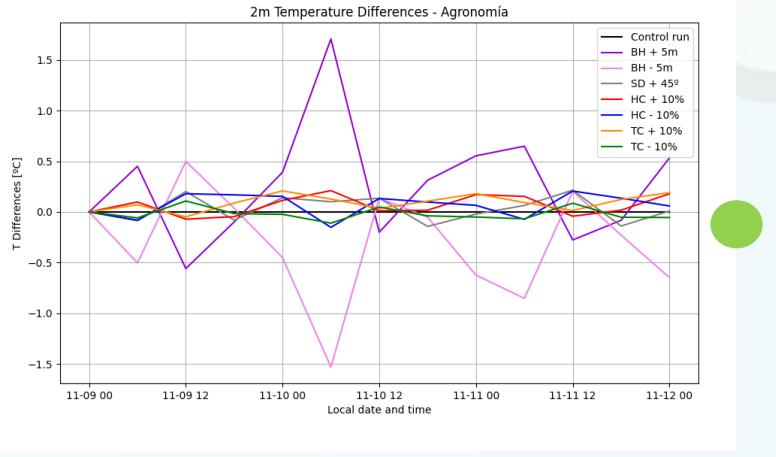
**Street Direc  
3rd day output**



**Heat Capac  
3rd day output**



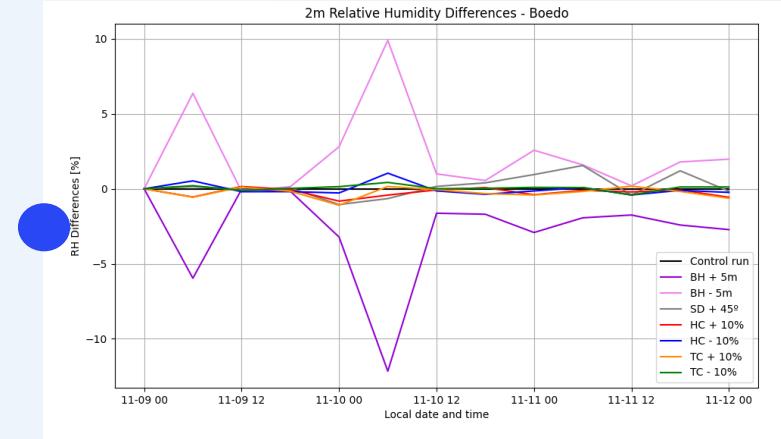
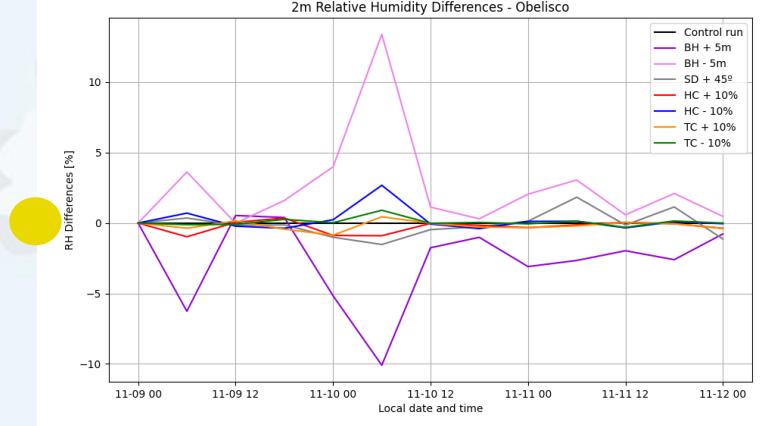
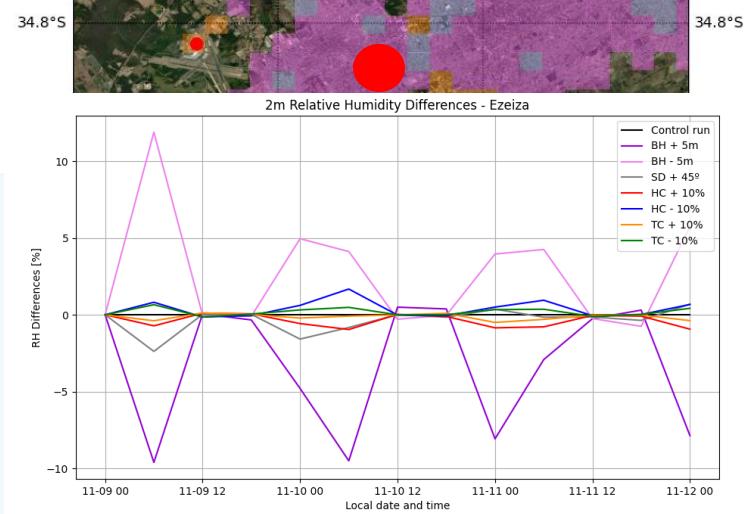
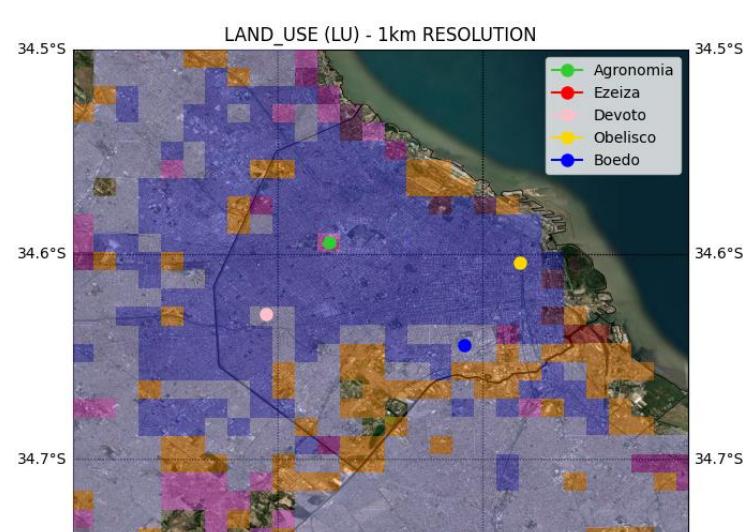
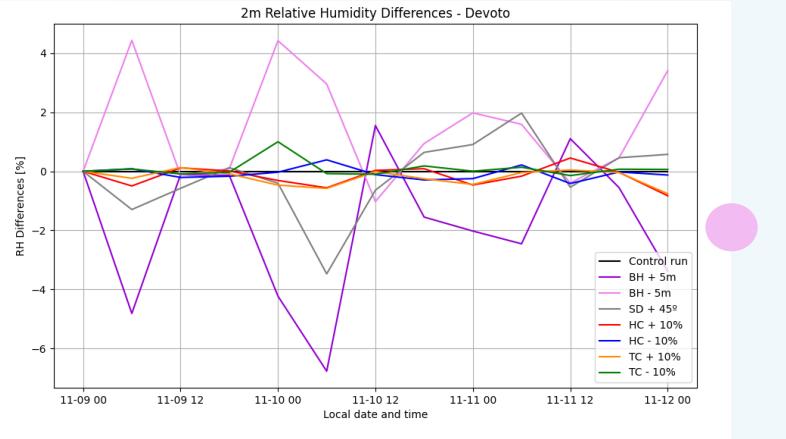
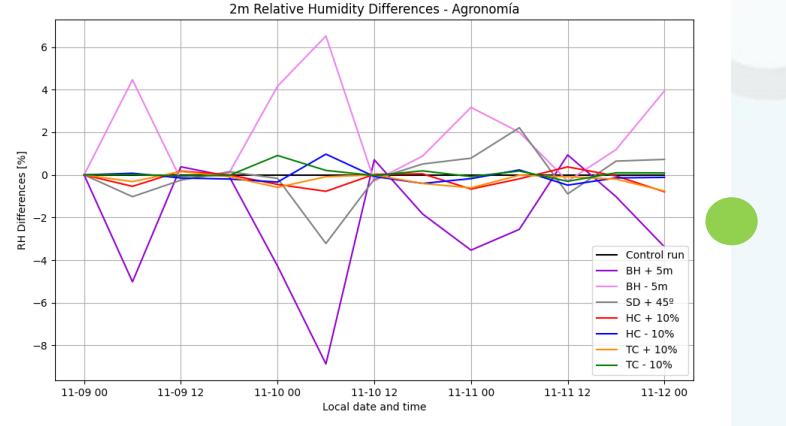




## SENSITIVITY TESTS

## 2m TEMPERATURE

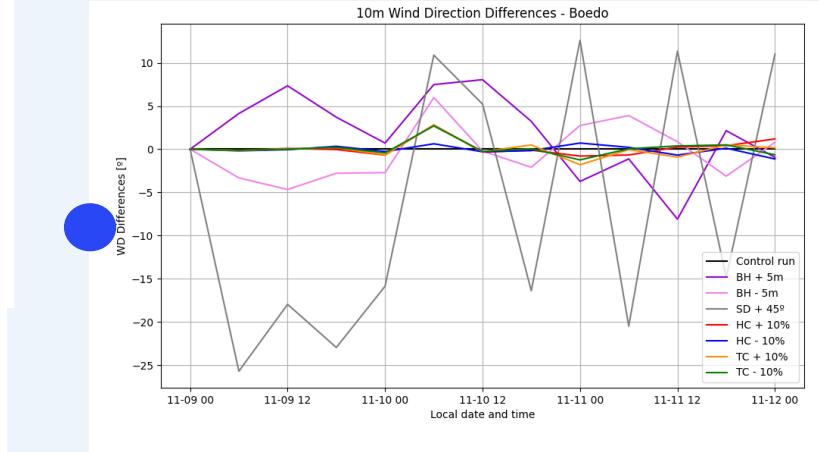
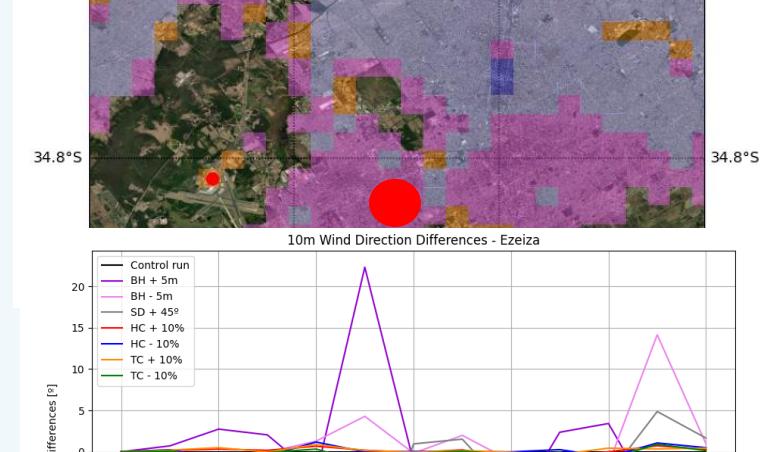
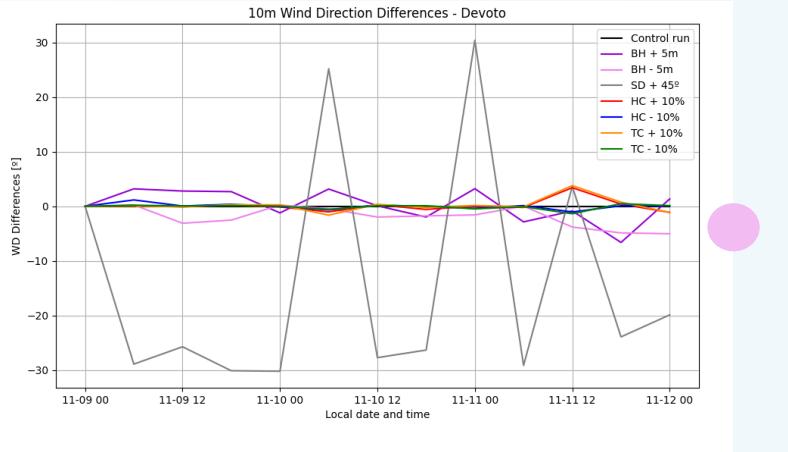
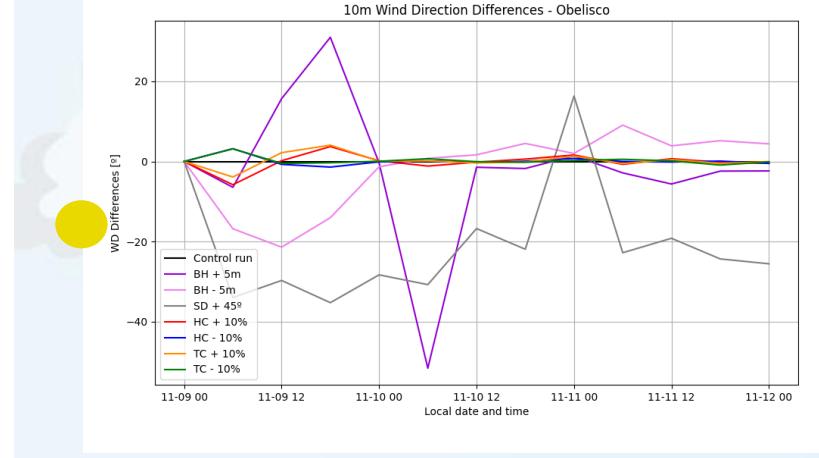
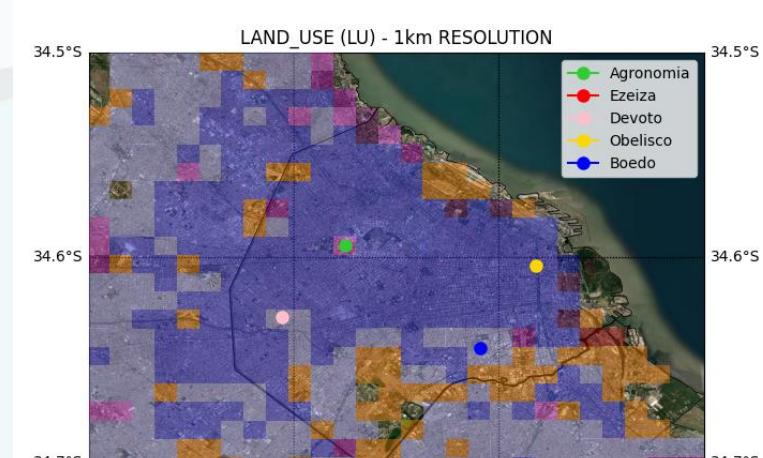
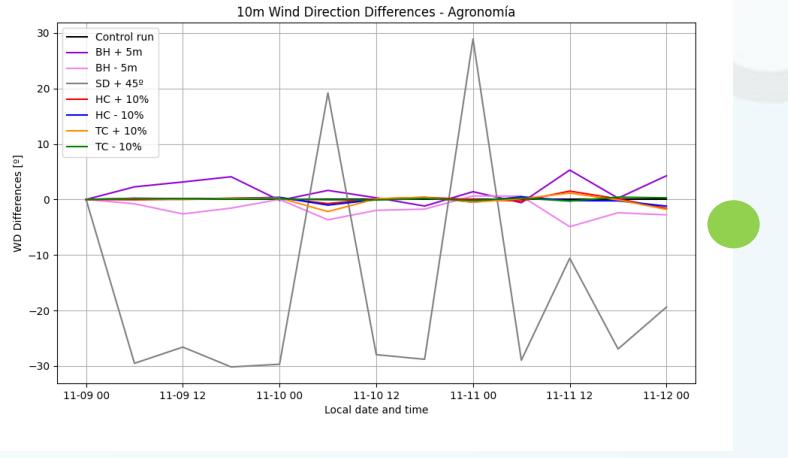




## SENSITIVITY TESTS

## 2m R.HUMIDITY





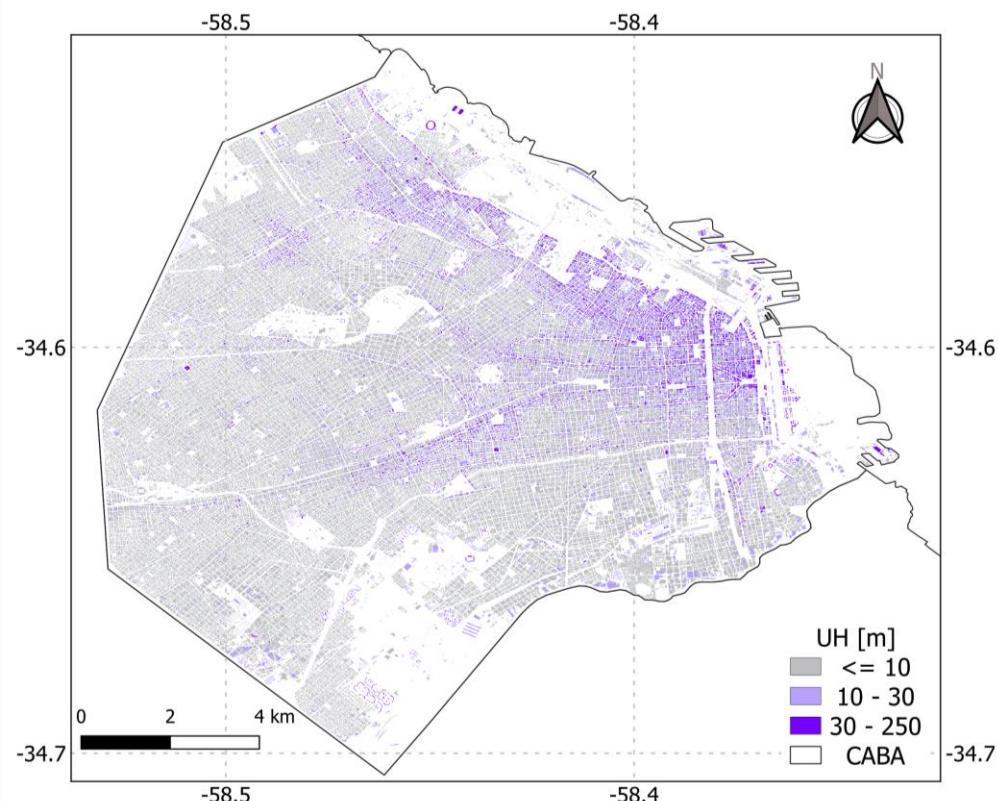
## SENSITIVITY TESTS

## 10m WIND DIR.

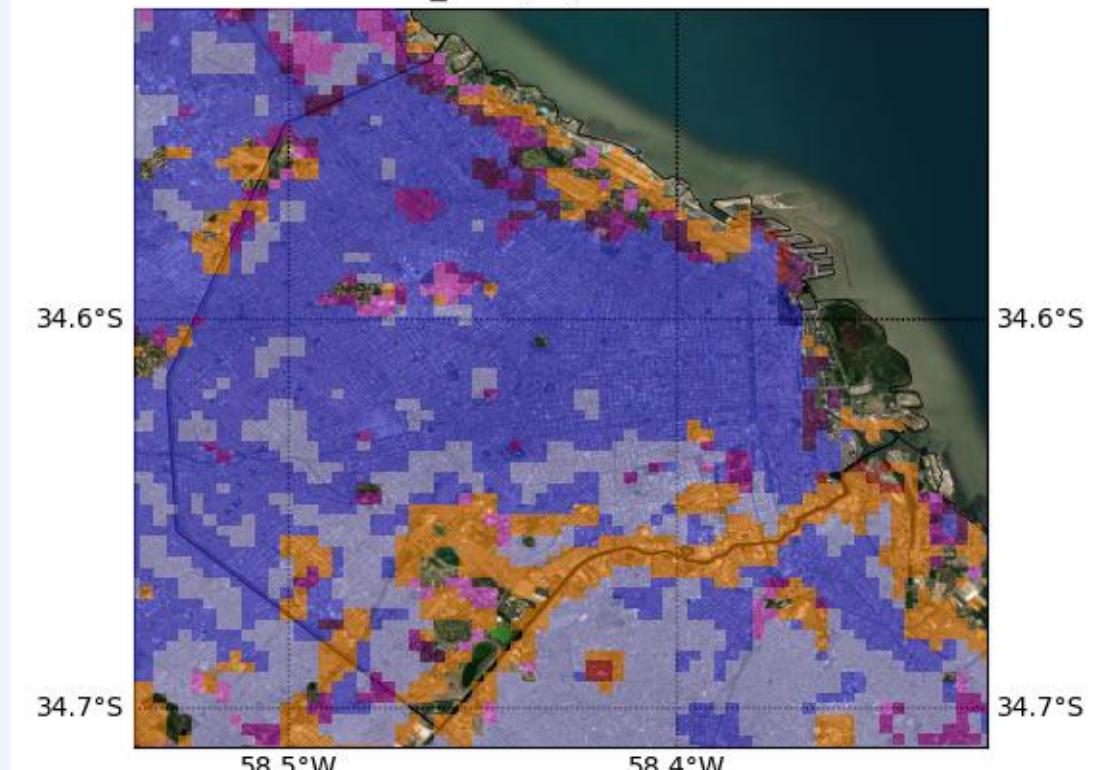


# BUILDING'S HEIGHT

CABA BUILDING'S HEIGHT - 10m RESOLUTION



LAND\_USE (LU) - 300m RES

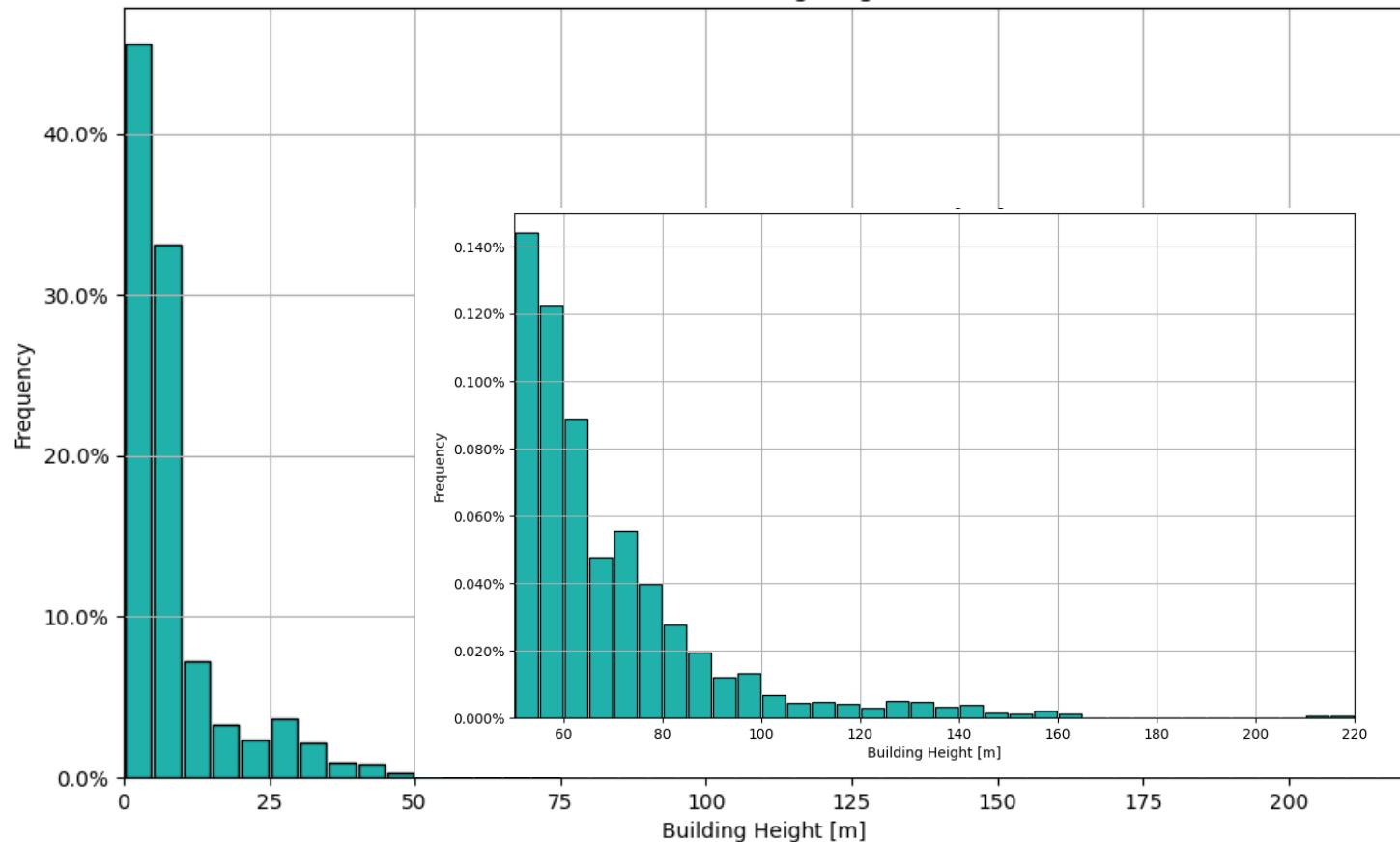


Source: APrA - SDU

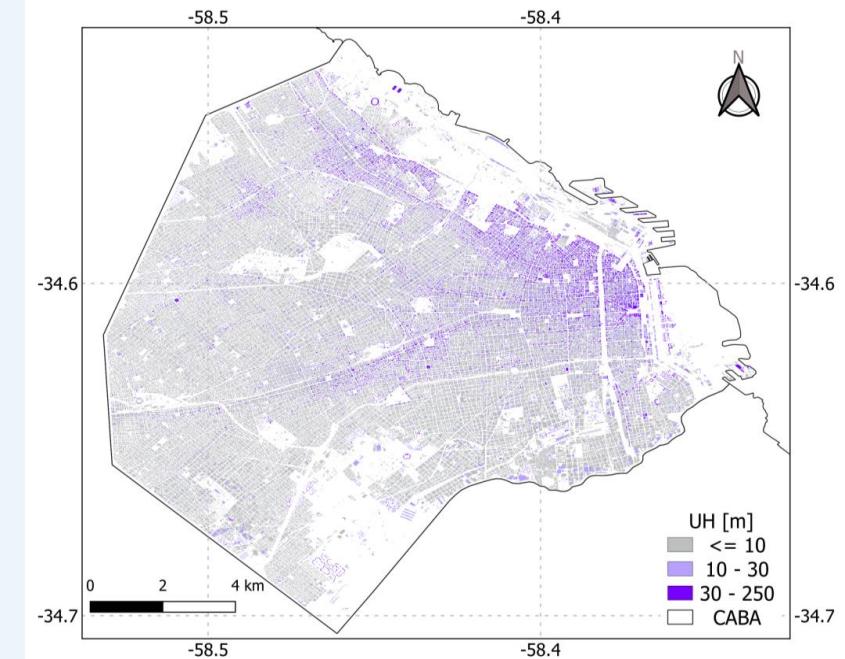


# LCZs RECLASSIFICATION

Distribution of Building Heights - CABA



CABA BUILDING'S HEIGHT - 10m RESOLUTION

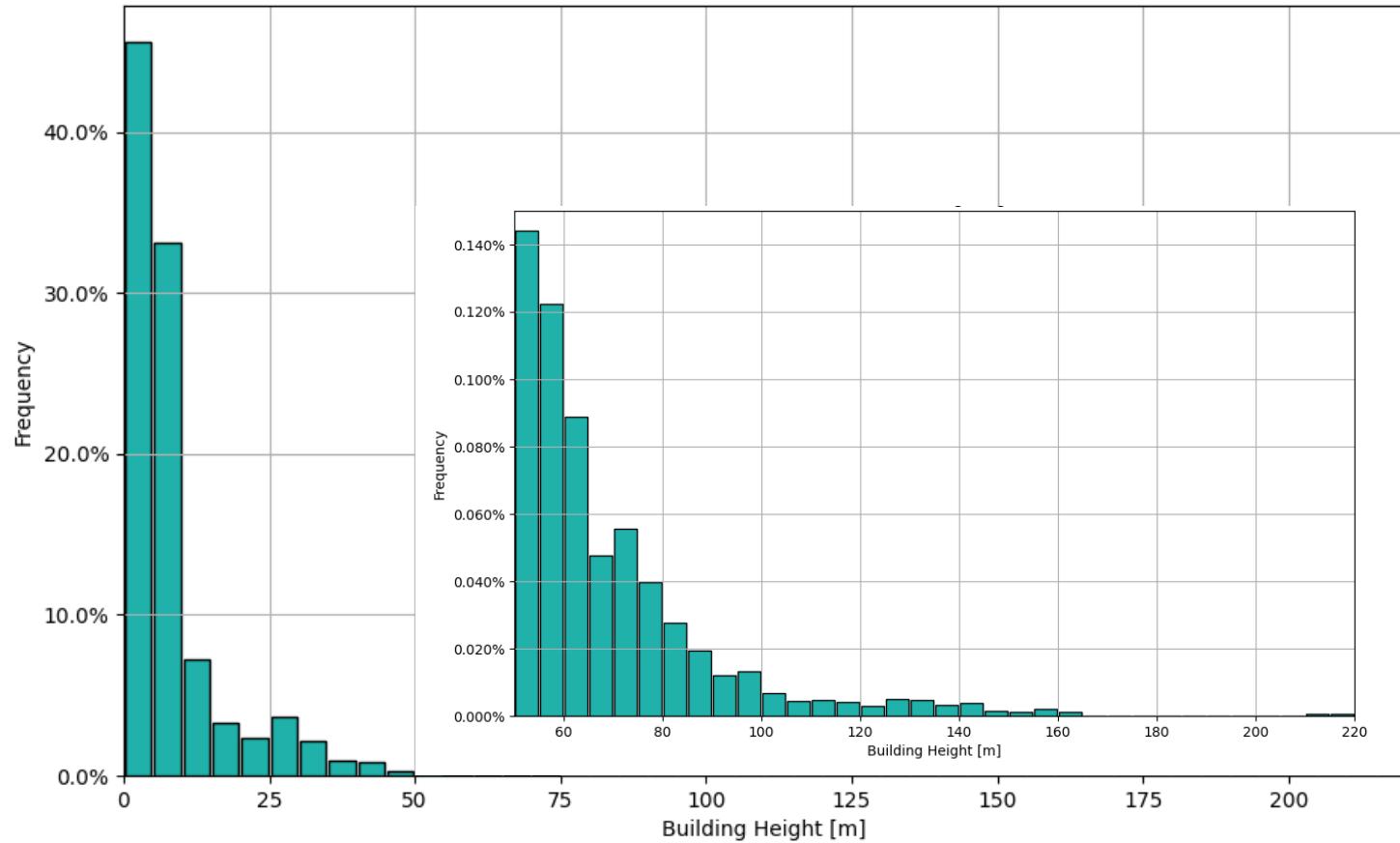


Source: APrA - SDU

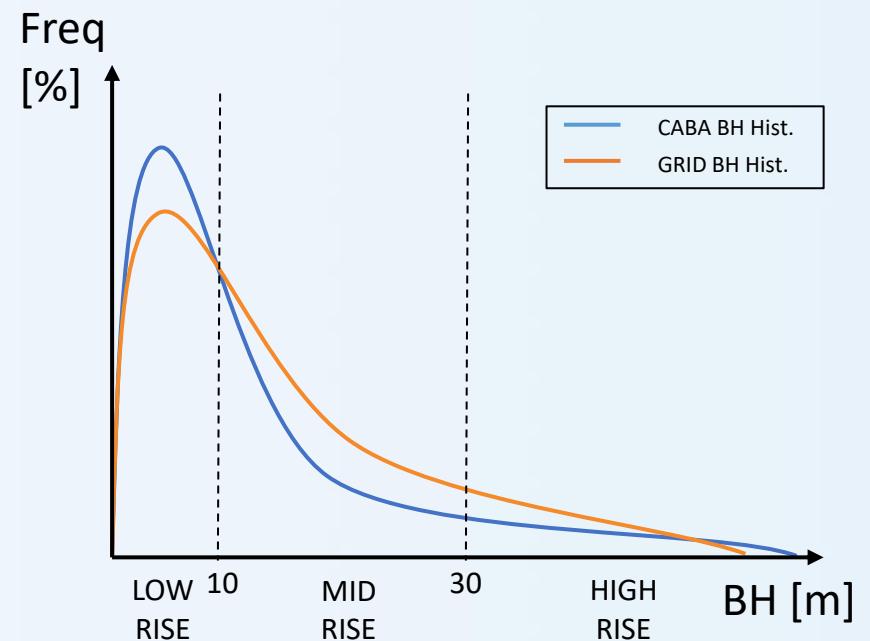


# LCZs RECLASSIFICATION

Distribution of Building Heights - CABA

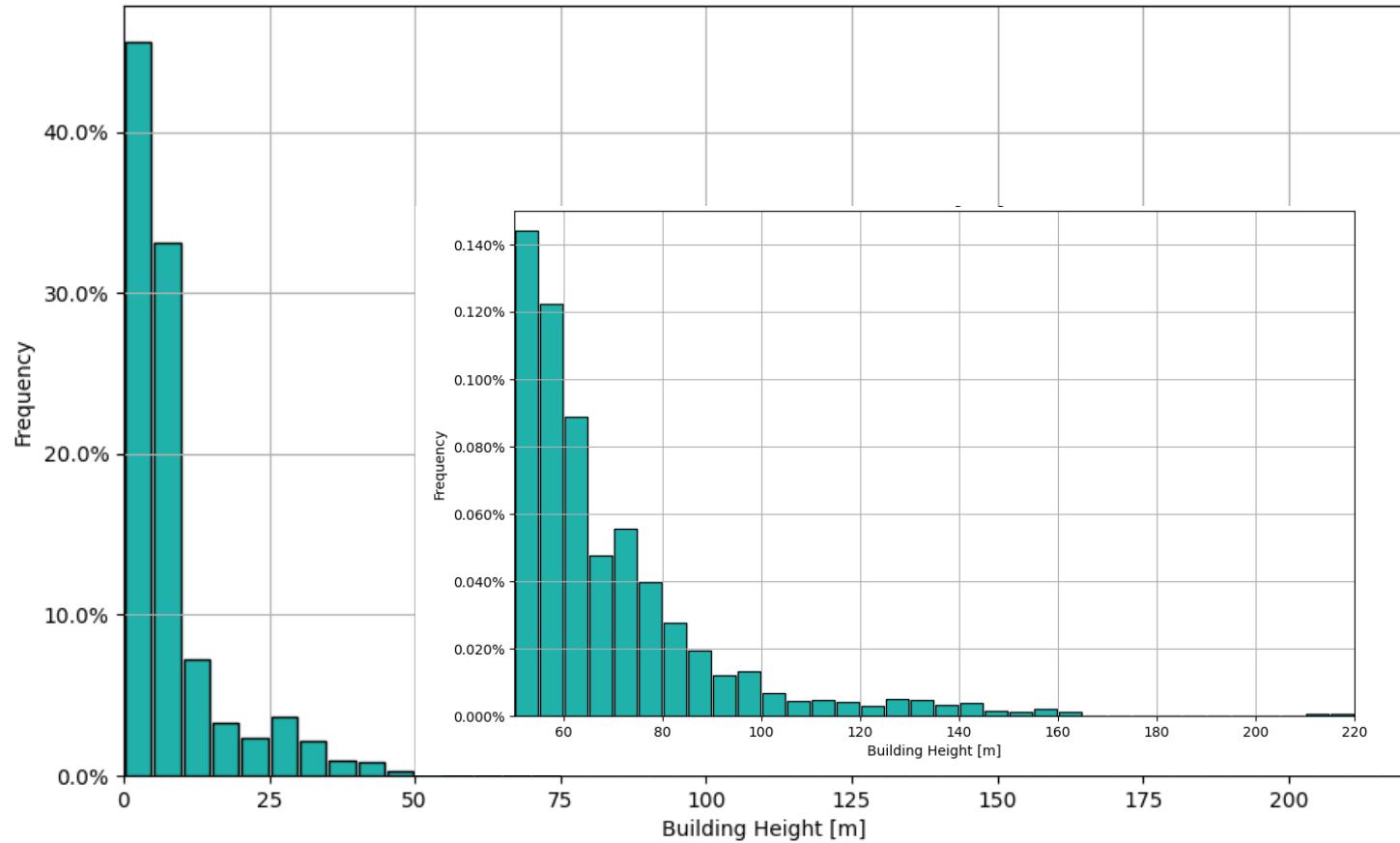


## RECLASSIFICATION CRITERIA

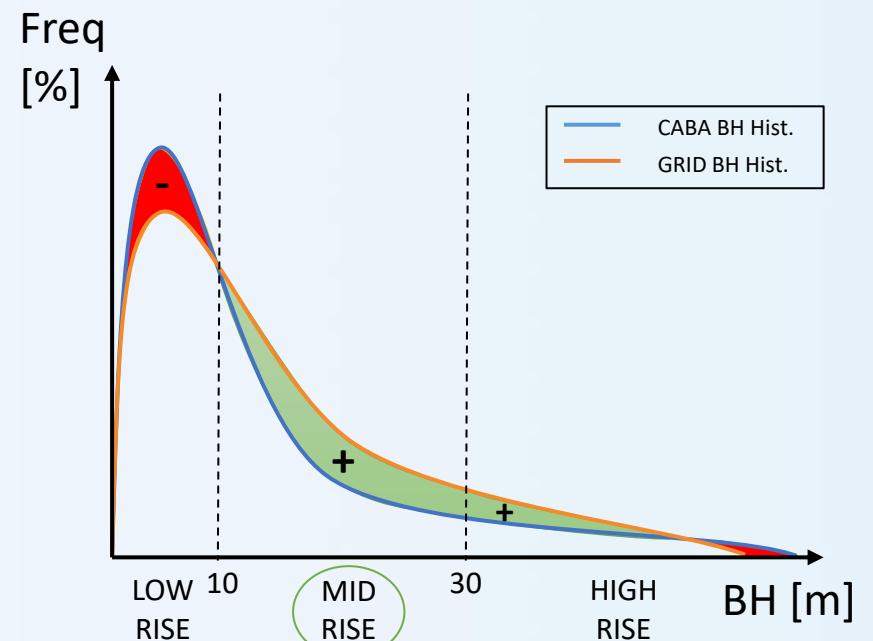


# LCZs RECLASSIFICATION

Distribution of Building Heights - CABA

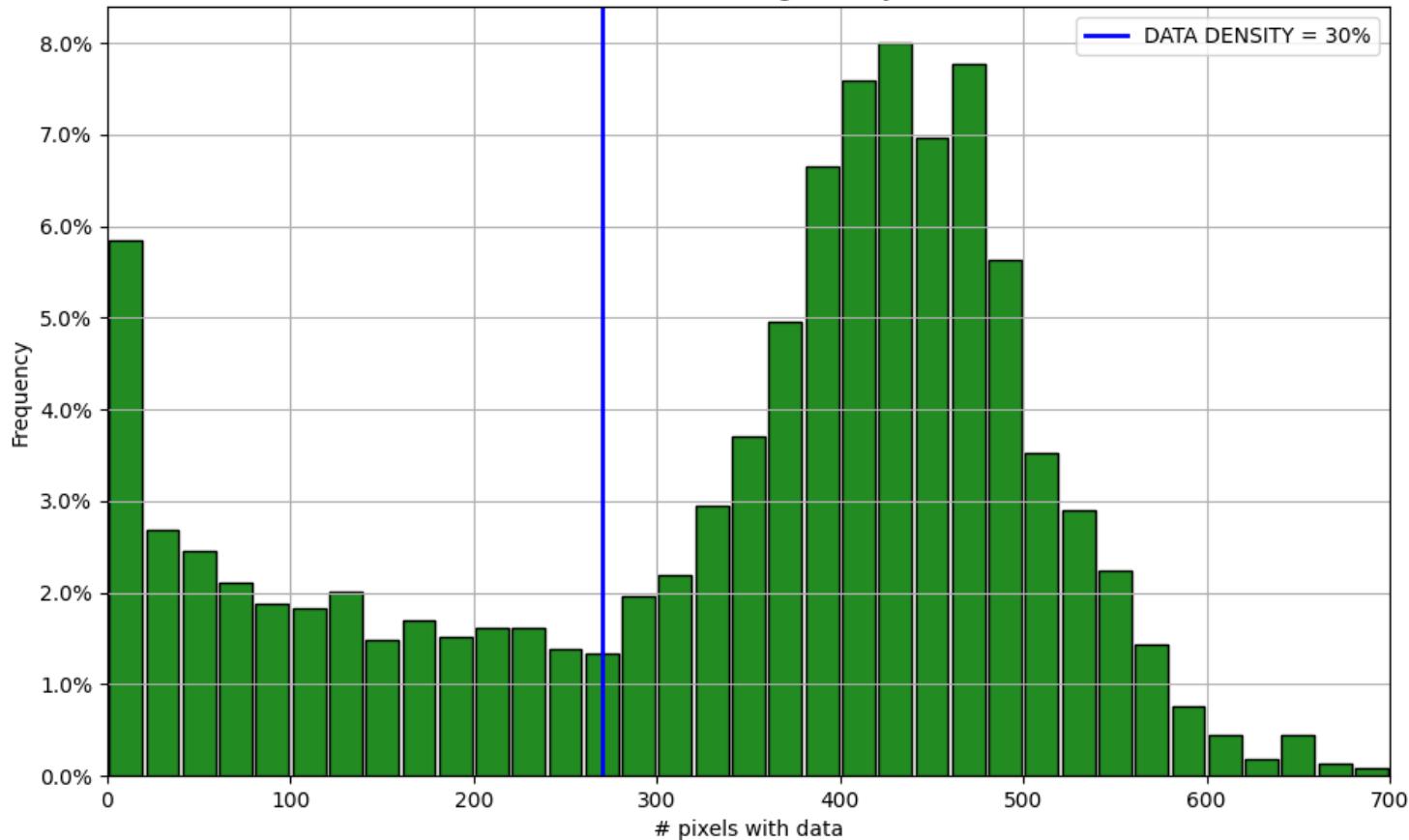


## RECLASSIFICATION CRITERIA

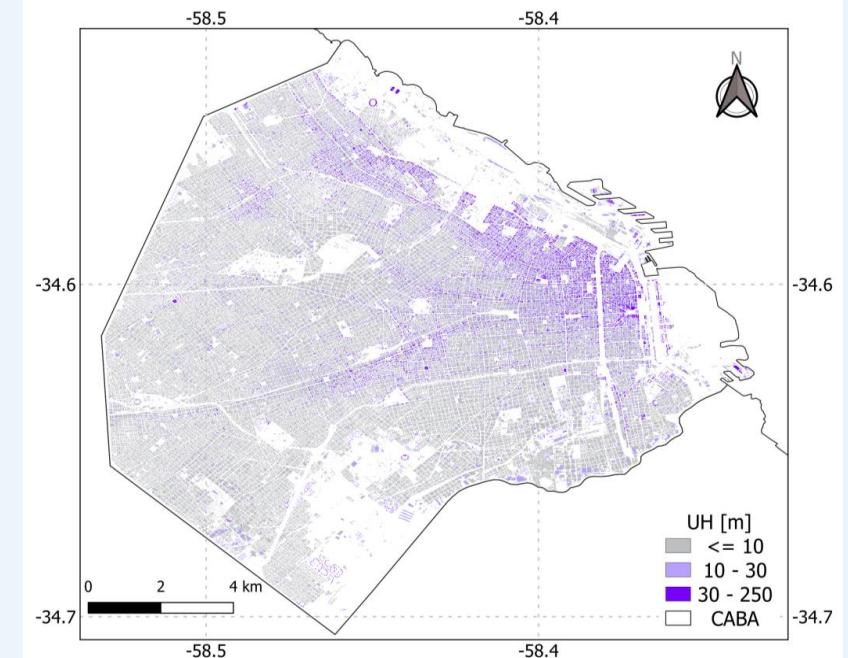


# LCZs RECLASSIFICATION

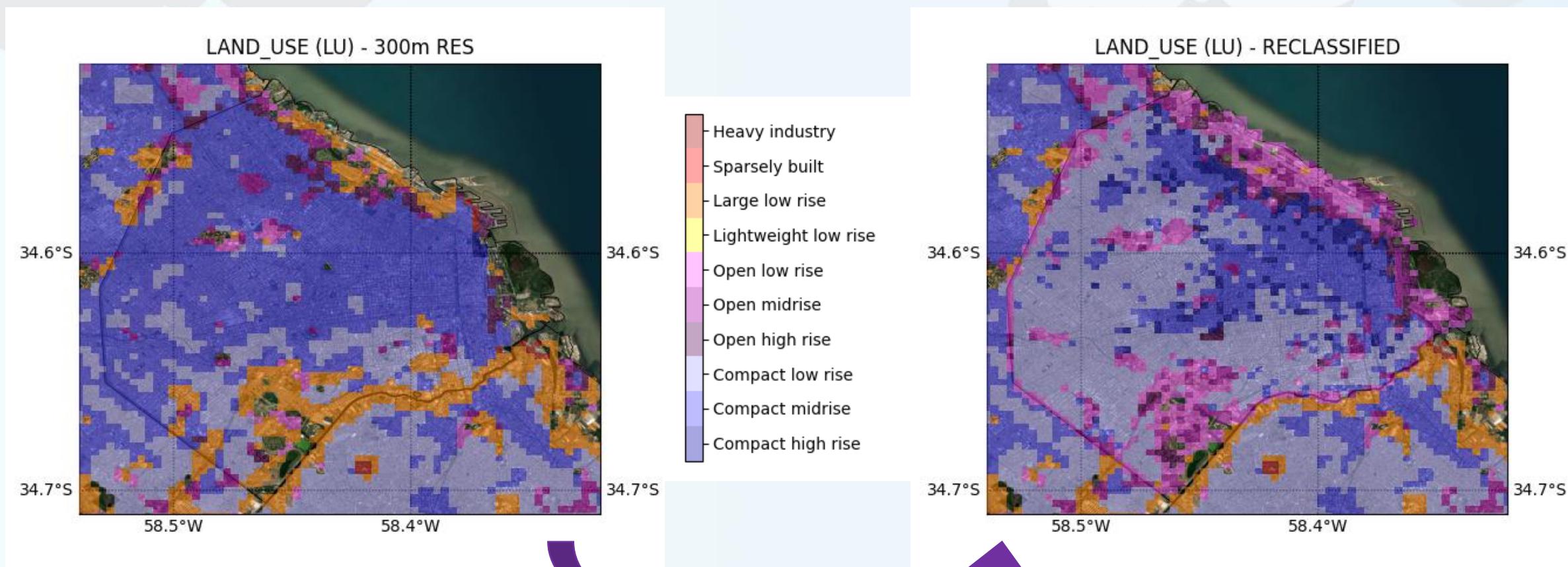
Distribution of Building Density - CABA



CABA BUILDING'S HEIGHT - 10m RESOLUTION

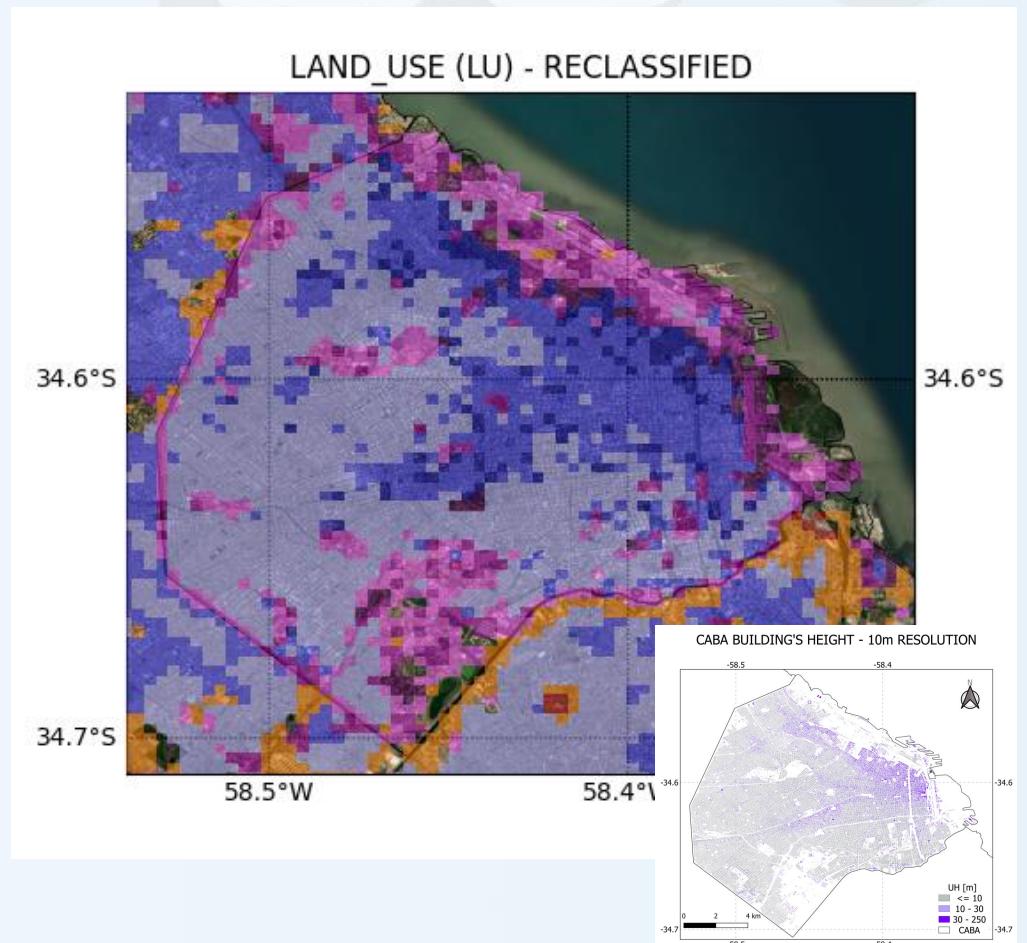


# LCZs RECLASSIFICATION



# NEXT STEPS

1. **Collect data** on building heights, parks, informal settlements (lightweight low-rise), and industries for the entire **AMBA region**.
2. **Apply the reclassification methodology** to the World Urban Data and Access Portal Tools **WUDAPT - TIFF file** and use the python tool **w2w** to change the LU Index and LU Fraction in the domain file in WRF (**geo\_em**).
3. **Thermal parameter modifications.**
4. **Simulate.**



# ACKNOWLEDGEMENTS

We thank:

CIMA – UBA/CONICET

Simulation hours and the workspace.

APrA & SECRETARÍA DE DESARROLLO URBANO

Morphological data and support.

CORDEX

Space to disseminate these results and the funding for  
my participation in the conference.

# THANKS!

Luis Eduardo Muñoz

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