URBAN EXERCISE The Influence of Metropolitan Areas on Meteorology using Enviro-HIRLAM model for Paris

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## Introduction

In the cities the natural weather conditions are considered to be influenced by its urban cover. Buildings, roads and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist generally become impermeable and dry. This development leads to the formation of urban heat islands (UHI) — the phenomenon whereby urban regions experience warmer temperatures than their rural surroundings.

## Main Goal

Study the influence of the Paris metropolitan area on a formation of meteorological fields using the Enviro-HIRLAM model with modification of land surface scheme.

#### **Methods**

A)Model: Enviro-Hirlam

#### **B)** Approaches:

1) Select specific cases for meteorological conditions

2) Perform control run without modification (CTRL)

3) Modify the land surface scheme of the Enviro-HIRLAM model by changing anthropogenic heat flux for urban area (AHF150)

4) Analysis of the two runs (CTRL, AHF150)

# Meteorological situations for selected case

11JUL2009 00Z

850 hPa Temperatur (Grad C)



Daten: Reanalysis des NCEP (C) Wetterzentrale www.wetterzentrale.de



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## Characteristics and choosing a day for calculation

Parameters	11 July	25 July	Grade %
Wind speed	-	+	20
Wind direction	+	+	10
Inversion	+	-	20
Air temperature	+	-	10
Precipitation	+	-	10
Clouds	+	-	10
Vertical motion	+	-	10
Pressure	-	-	10
Result	+	-	

## URBAN FEATURES

- Location: in the north-bending arc of the river Seine (the city is relatively flat)
- Area of city: 86.928 km2
- Population: 11,6 million (in 2006)



Figure: Urban reclassification into districts based on CORINE 2000 for the Paris metropolitan area.

#### **MODEL DOMAIN**

Metropolitan area: Paris

Domain: P01

Horizontal resolution (km): 2.5x2.5

Total number grid points in domain : 10148

Number urban grid points in domain : 580

Number metropolitan grids in domain : 220

Area covered by metropolitan grids : 1267.2 km<sup>2</sup>







#### **Diurnal variations for the air temperature**





Sat 111J60 2009 002 +24h2.00 Sat 11 Jul 2020550002 +24h valid Sun 12 Jul 2009 002

4.00





#### Sensible heat flux (AHF150-CTRL)

![](_page_14_Figure_1.jpeg)

Sat 111J60 2009 002 +21h2.00 Sat 11 Jul 202950002 +21h valid Sat 11 Jul 2009 21z

Sat 111J50 2009 002 +24h2.00 Sat 11 Jul 202950002 +24h valid Sun 12 Jul 2009 002

## Conclusions

- The urban heat island (UHI) is observed from the difference between the AHF150 and the CTRL runs
- Temperature:

higher temperature for the AHF150 run for the urban area before sunrise (4UTC) and after sunset (20UTC)

#### Wind:

The wind increases for the periods when the UHI is observed

- Relative humidity
  The relative humidity decreases over the city area
- Sensible heat flux
  The sensible heat flux increases over the city area

## attenfion 1

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