

**BC workshop
Cali 28-30 November 2018**



Centro Mario Molina - Chile

SMHI

**Impact assessment of PM and BC
emissions from residential wood
combustión in Osorno, Chile**

report elaborated by

Swedish Meteorological and Hydrological Institute
&

Centro Mario Molina Chile

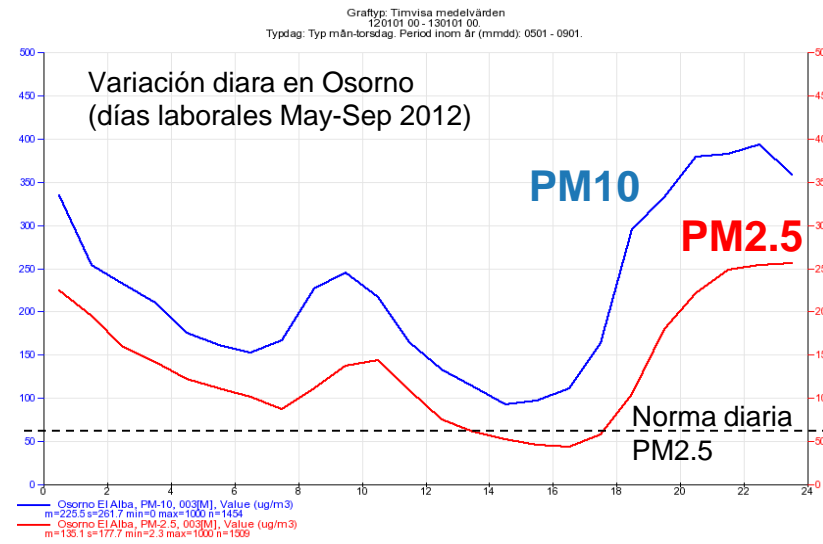
30/04/2014

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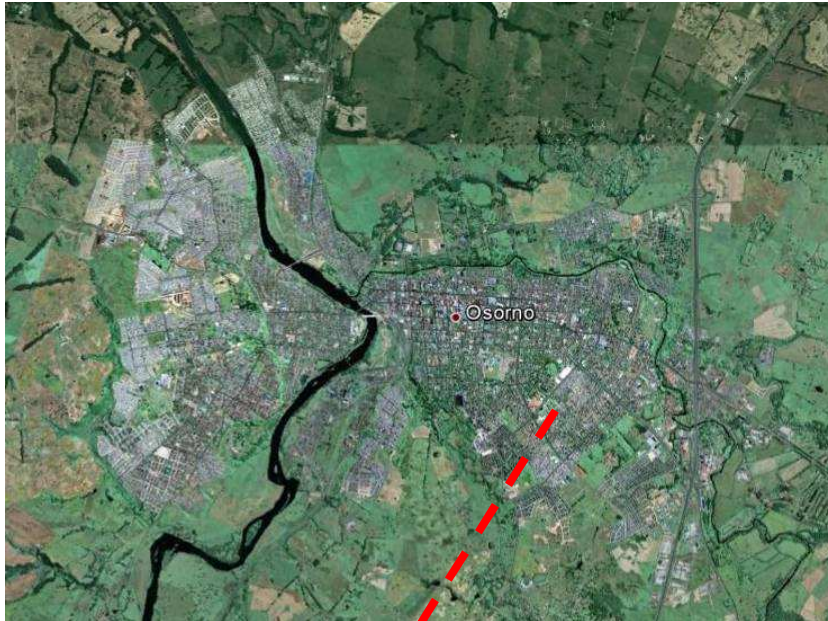


The problem: high PM levels during winter season

Osorno has ~ 130 000 inhabitants



El Alba – automatic monitoring station in Osorno

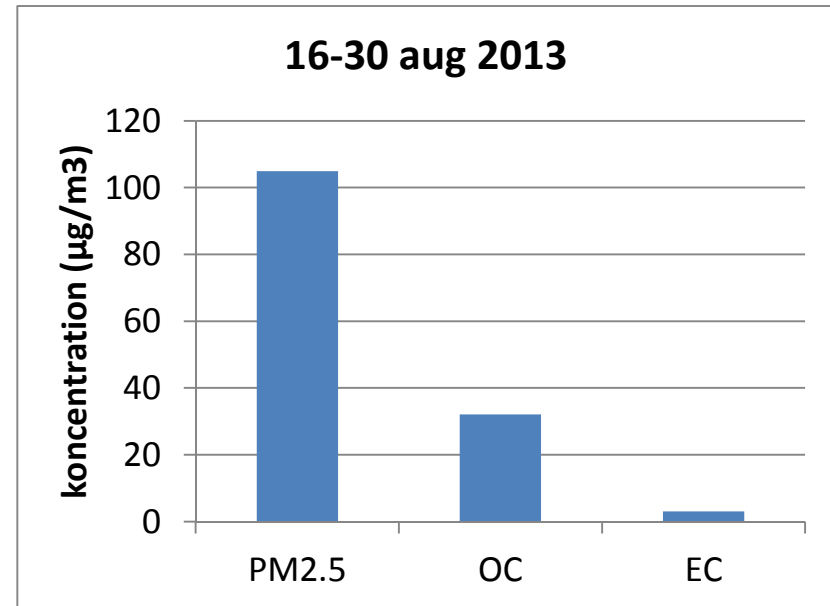


Hourly data:

- PM10
- PM2.5
- Wind speed/dir
- Temperature

Daily filter data:

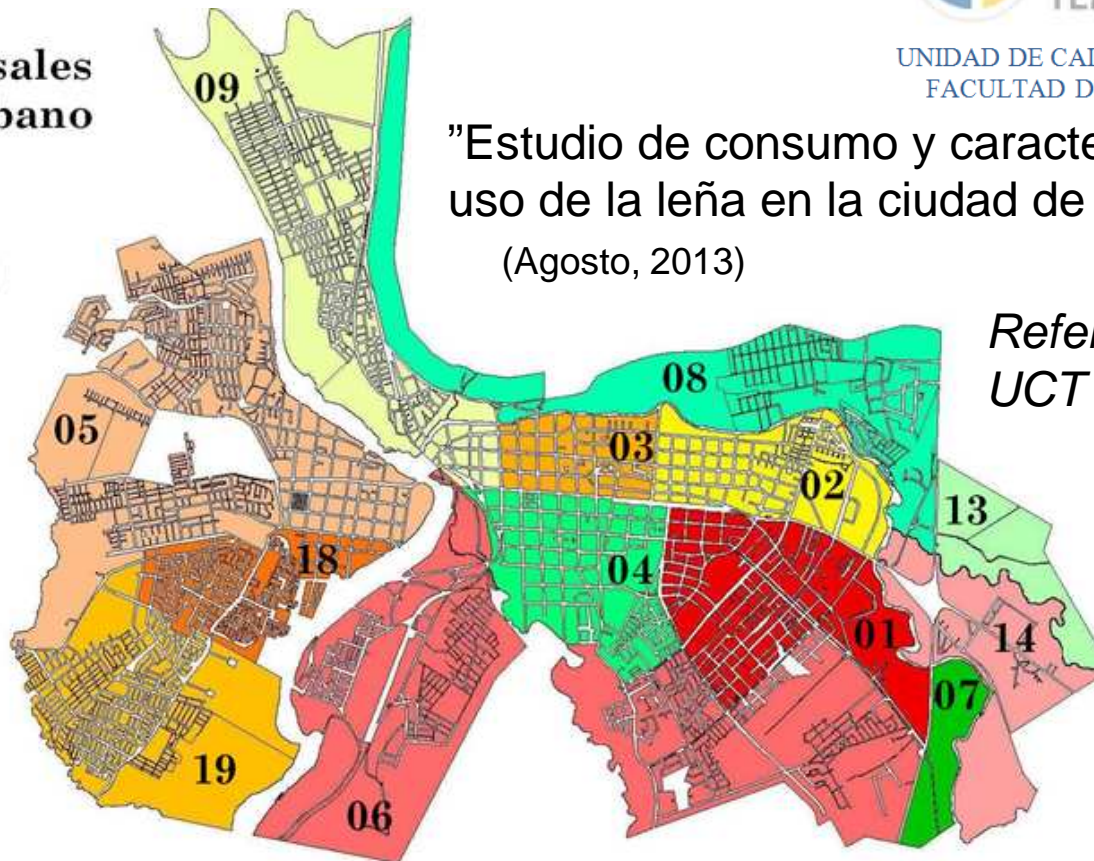
- PM2.5
- OC
- EC



Conclusion:
- OC ~30% of PM2.5
- EC ~ 3% of PM2.5

Distritos Censales de Osorno Urbano

- 01. Amador Barrientos
- 02. Cementerio Municipal
- 03. Plaza
- 04. Municipal
- 05. Rahue
- 06. Ovejería
- 07. Las Quemadas
- 08. Pílauco
- 09. Misión de Cuinco
- 13. Polloico
- 14. Chuyaca
- 18. Concepción
- 19. Cementerio



”Estudio de consumo y caracterización del uso de la leña en la ciudad de Osorno.”

(Agosto, 2013)

Referred to as UCT Report, 2013

Fuente: Elaboración propia (a partir de información del INE).

About 1000 questionnaires on wood consumption obtained from 19 districts. In total 36 465 houses in Osorno, many have various fireplaces.

- Wood combustion used in 94.7% of the homes.

Tabla 15. Artefactos que usan leña utilizados en la ciudad de Osorno

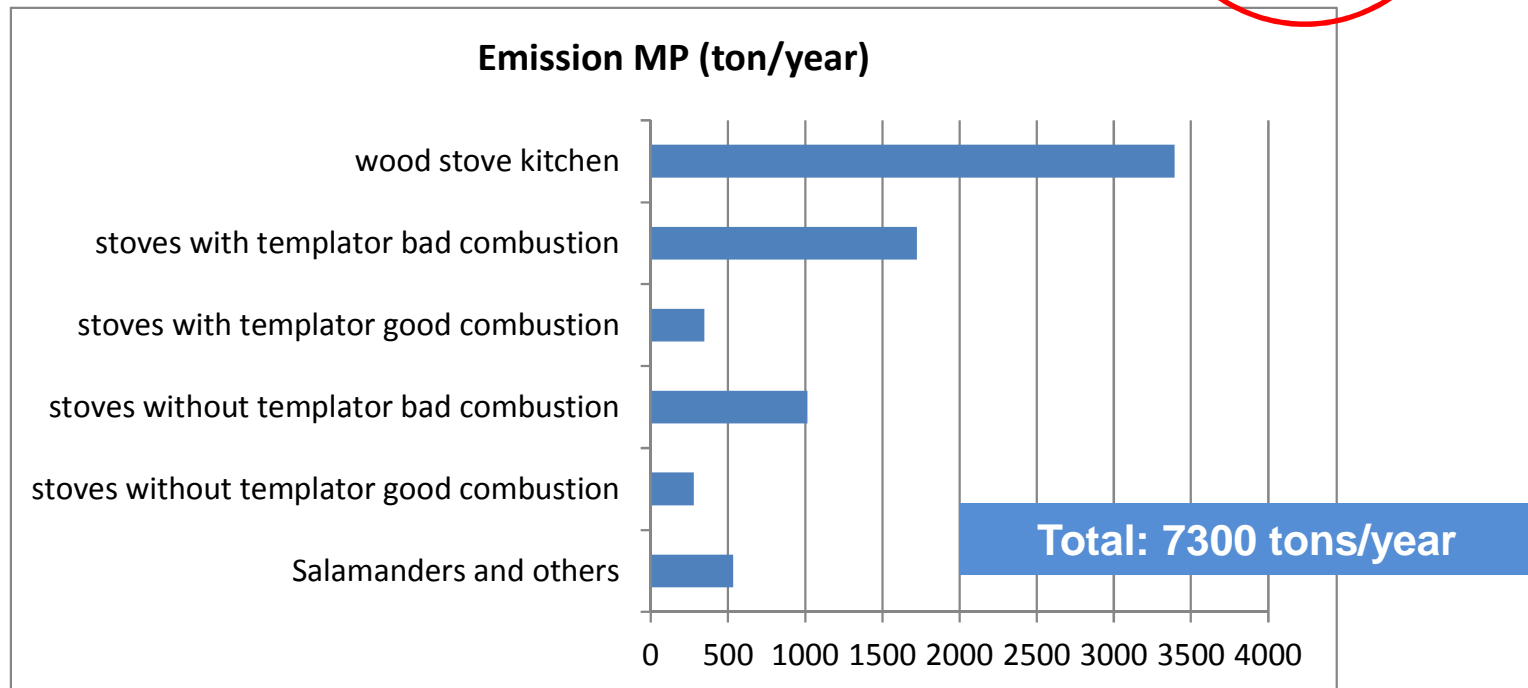
TIPO DE ARTEFACTO	FRECUENCIA	PORCENTAJE
COCINA A LEÑA	641	50,0
SALAMANDRA	47	3,7
COMBUSTIÓN LENTA SIN TEMPLADOR	136	10,6
COMBUSTIÓN LENTA CON TEMPLADOR	391	30,5
CHIMENEA DE HOGAR ABIERTO	27	2,1
OTROS ARTEFACTOS	39	3,0
TOTAL	1.281	100,00

(this type of statistics obtained from all 19 districts)

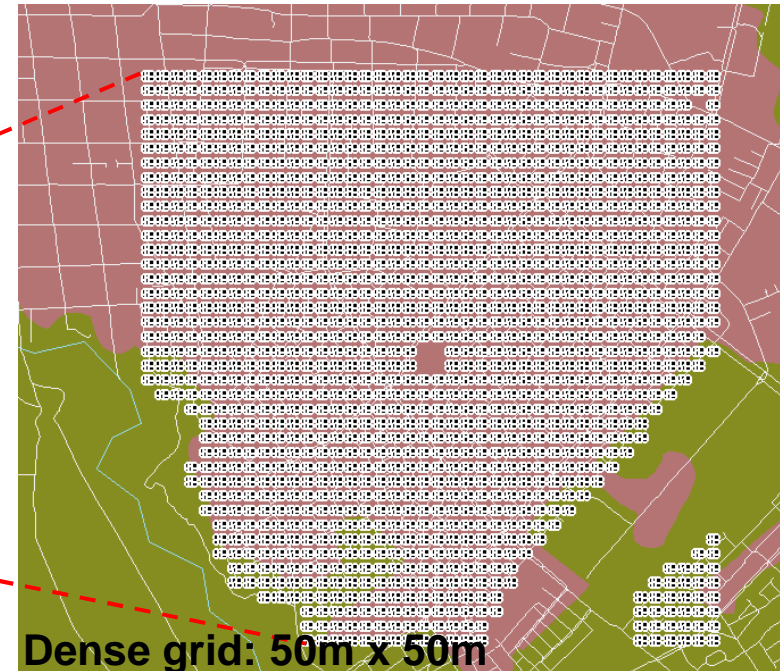
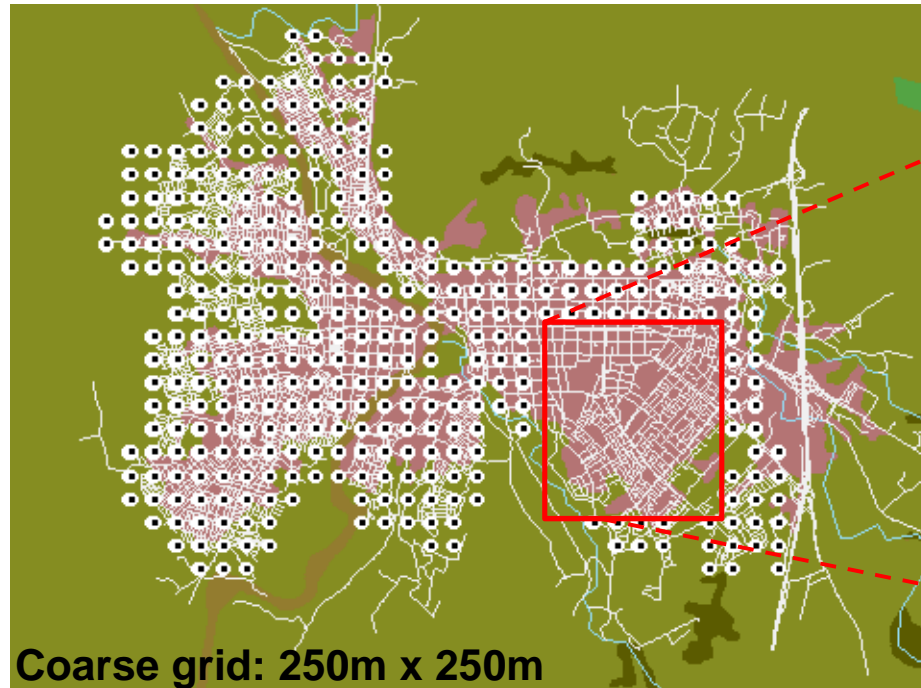
UCT Report, 2013

Emission factors:

Type	Emissionfactor (g/kg)		
	dry wood	wet wood	90% wet wood
wood stove kitchen	19.2	30.9	29.7
stoves with <u>templator</u> bad combustion	40.5	40.5	40.5
stoves with <u>templator</u> good combustion	8.0	12.9	12.4
stoves without <u>templator</u> bad combustion	76.0	76.0	76.0
stoves without <u>templator</u> good combustion	15.0	24.2	23.3
Salamanders and others	17.3	27.9	26.8



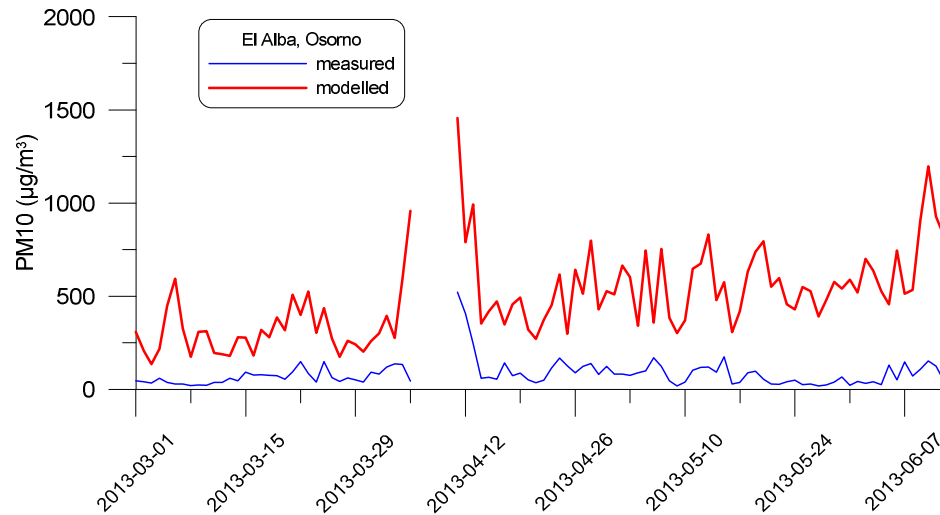
Results: Comparison monitored - simulated PM10 at El Alba (1)



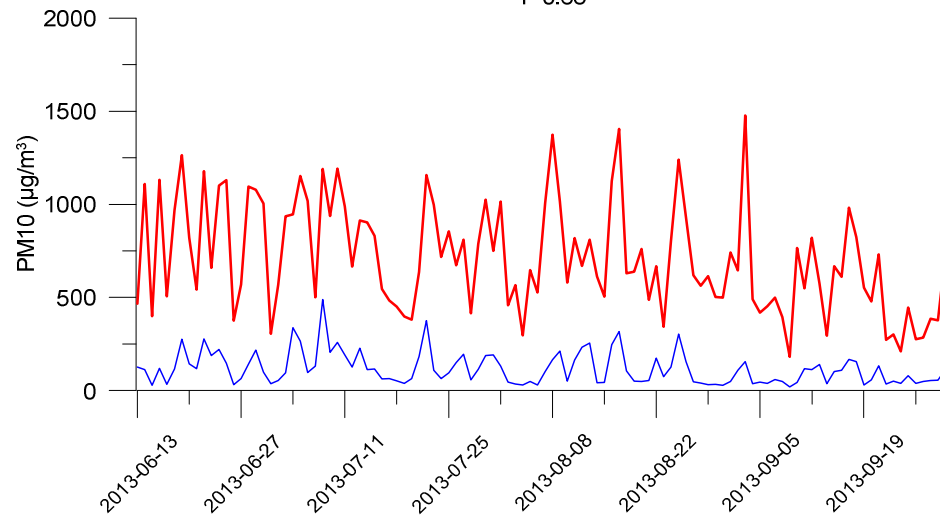
Emissions, as given by UCT Report, 2013, distributed homogeneously as point sources over each district. All point sources splitted in 6 types of emissions according to the classification and emission factors given for each district.

In order to increase the precision of the model simulation close to the monitor station El Alba, a more dense calculation grid was used around the monitor (>4000 point sources).

Results: Comparison monitored - simulated PM10 at El Alba (2)



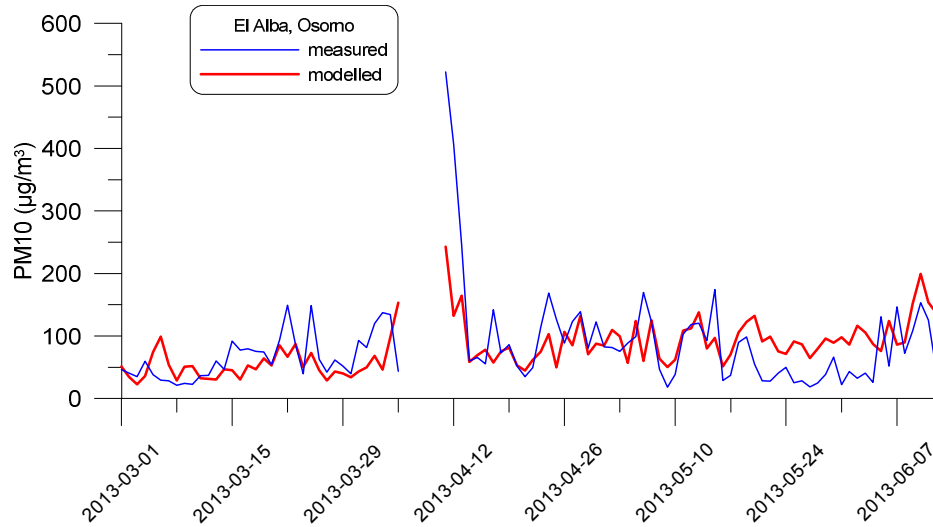
Statistics whole period
 Number of data points= 209
 Average X= 101.0
 Average Y= 606.5
 r=0.68



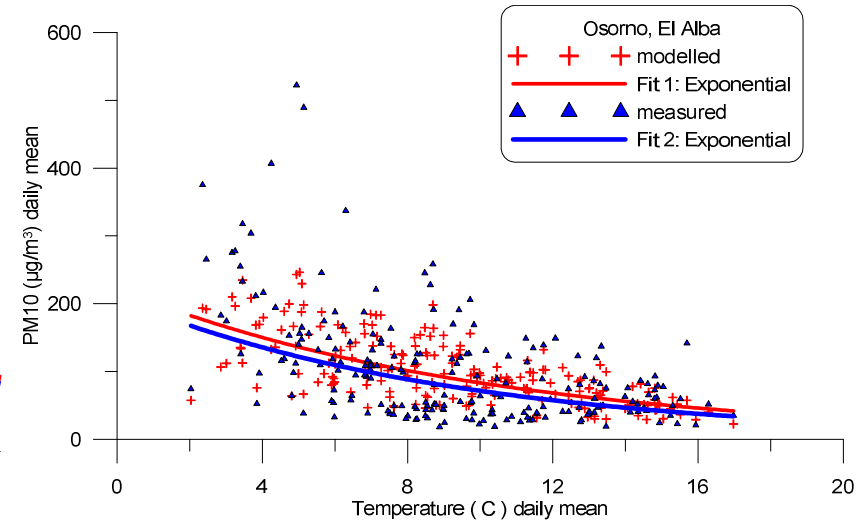
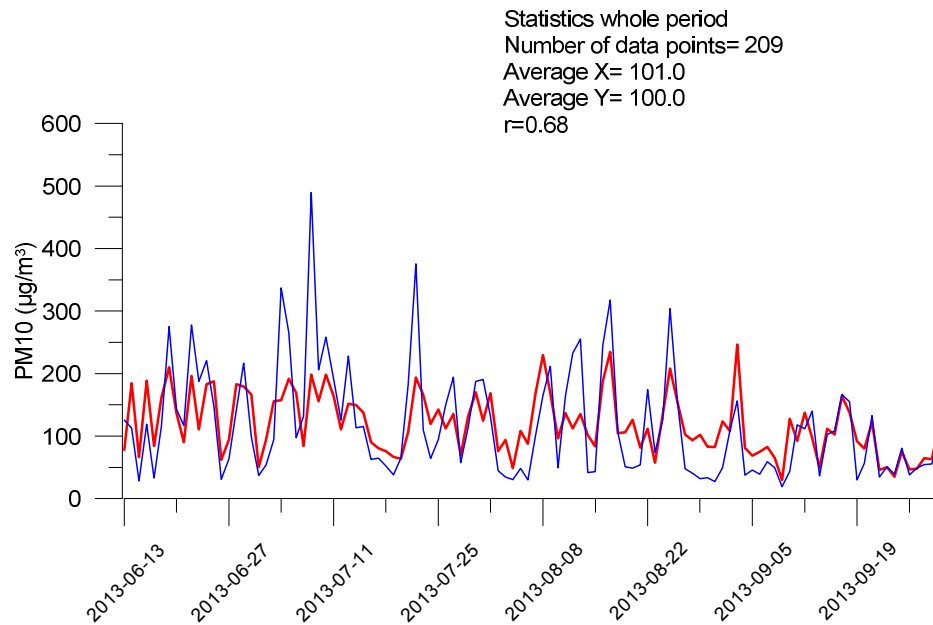
Simulated emissions have a temporal variation depending on
 a) hour of the day / weekday
 b) ambient temperature

Using the emissions as given in *UCT Report, 2013*, the simulated PM10 levels were 6-7 times higher than the monitored levels

Results: Comparison monitored - simulated PM10 at El Alba (3)



After applying a reduction factor of 0.17 over the model output, a good agreement was obtained.



Results: Comparison monitored – simulated PM over Osorno

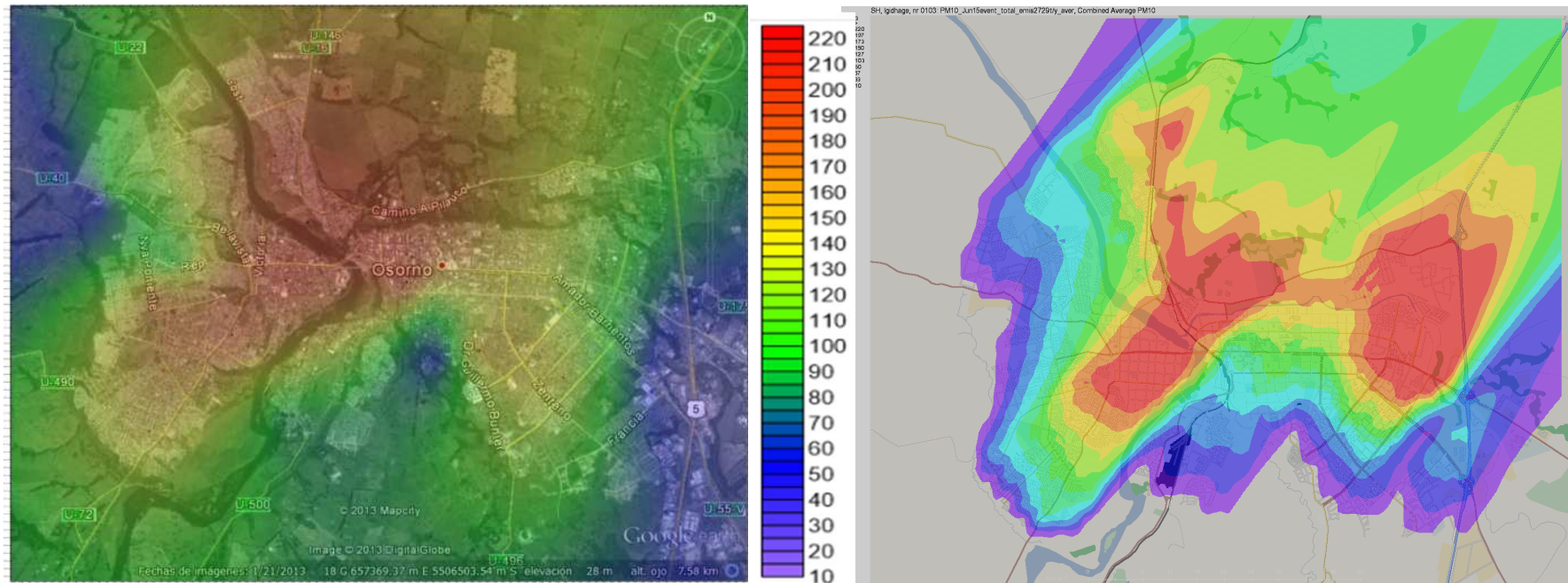


Figure 4.2.11. Monitored PM_{2.5} concentrations (left) and simulated PM₁₀ (right) during the June 23 21-24 hour event (model results with emission factors 17% of Table 3.3.4, emission during these hours 2 729 tons/year)

Conclusion:

This independent comparison shows similar PM levels and distribution over Osorno between monitored and simulated particle concentrations. However:

- the PM emissions in the eastern part of the city seems to be over-estimated in the inventory

Results: PM emission from wood combustion in Osorno

According to *UCT Report, 2013*
and emission factors from *CENMA, 2009*:

7300 tons PM/year

According to integrated model assessment
(this study, reduction factor 0.17):

1275 tons PM10/year
1020 tons PM2.5/year
31 tons BC/year

How can this difference be explained?

- Model results **Impossible an error of 600-700%**
- Emission factors **Probably an important part of the explanation**
- Wood consumption: **Probably part of the explanation**

If the reduction factor is applied to the original emission factors (EFs):

Range EF PM2.5 corr:	1.7 to	10.3 g/kg
Range EF BC corr:	0.04 to	0.25 g/kg

Thank you for your attention!

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Acknowledgement

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