Winter INFO-SMOG Program Forecast for the Greater Montréal Area

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and
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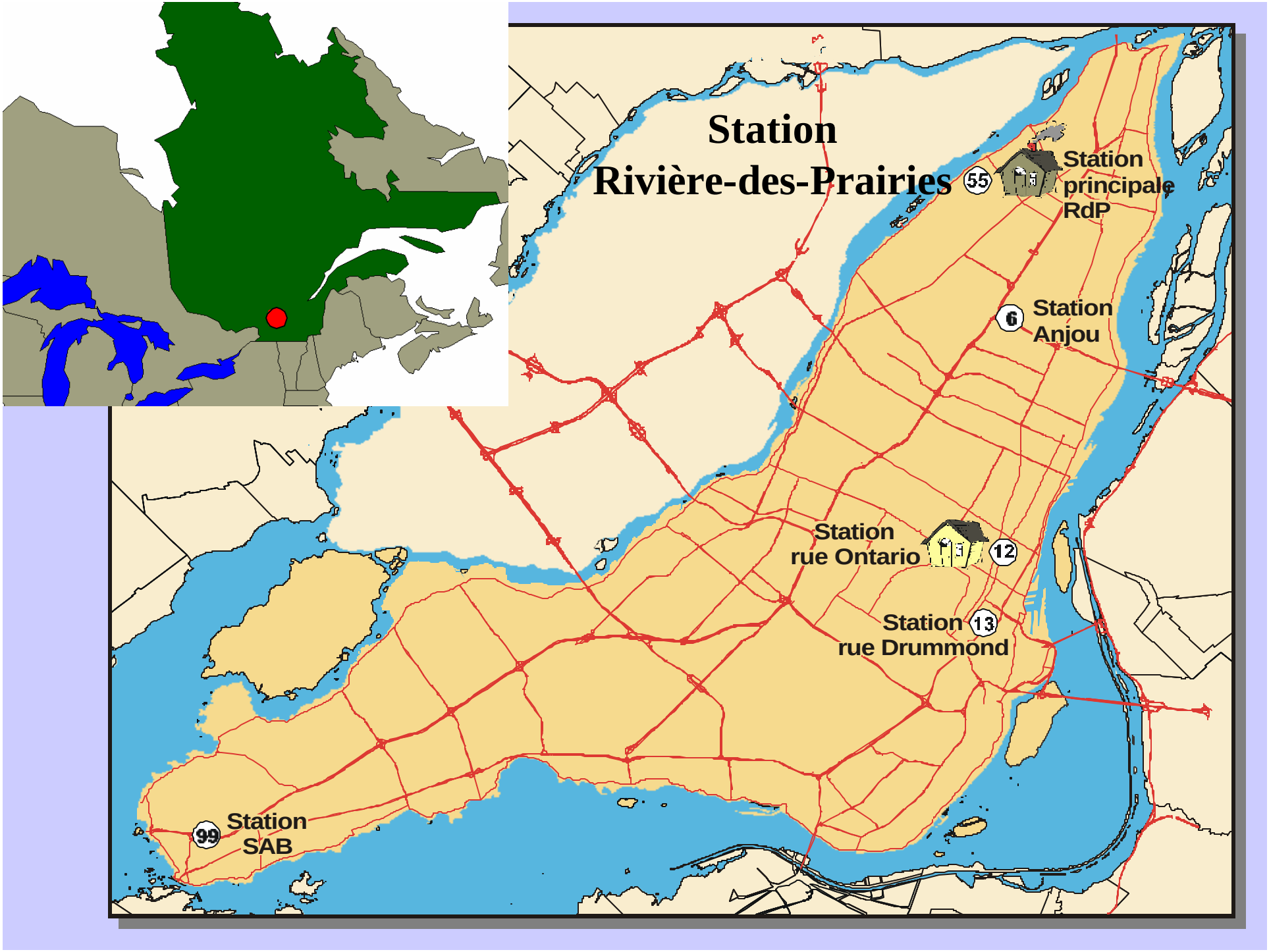
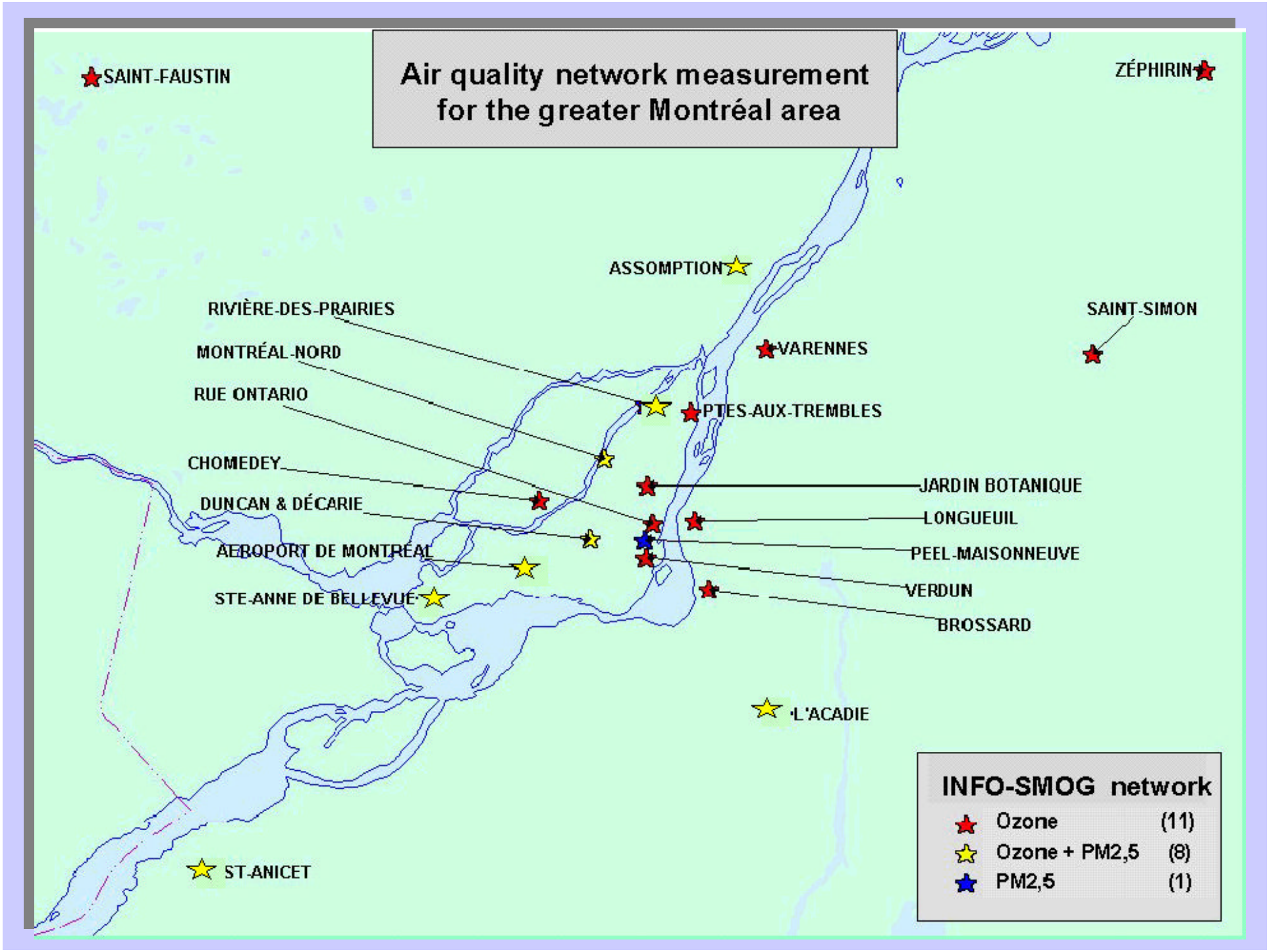
Environment Canada - Québec region

02/02/04

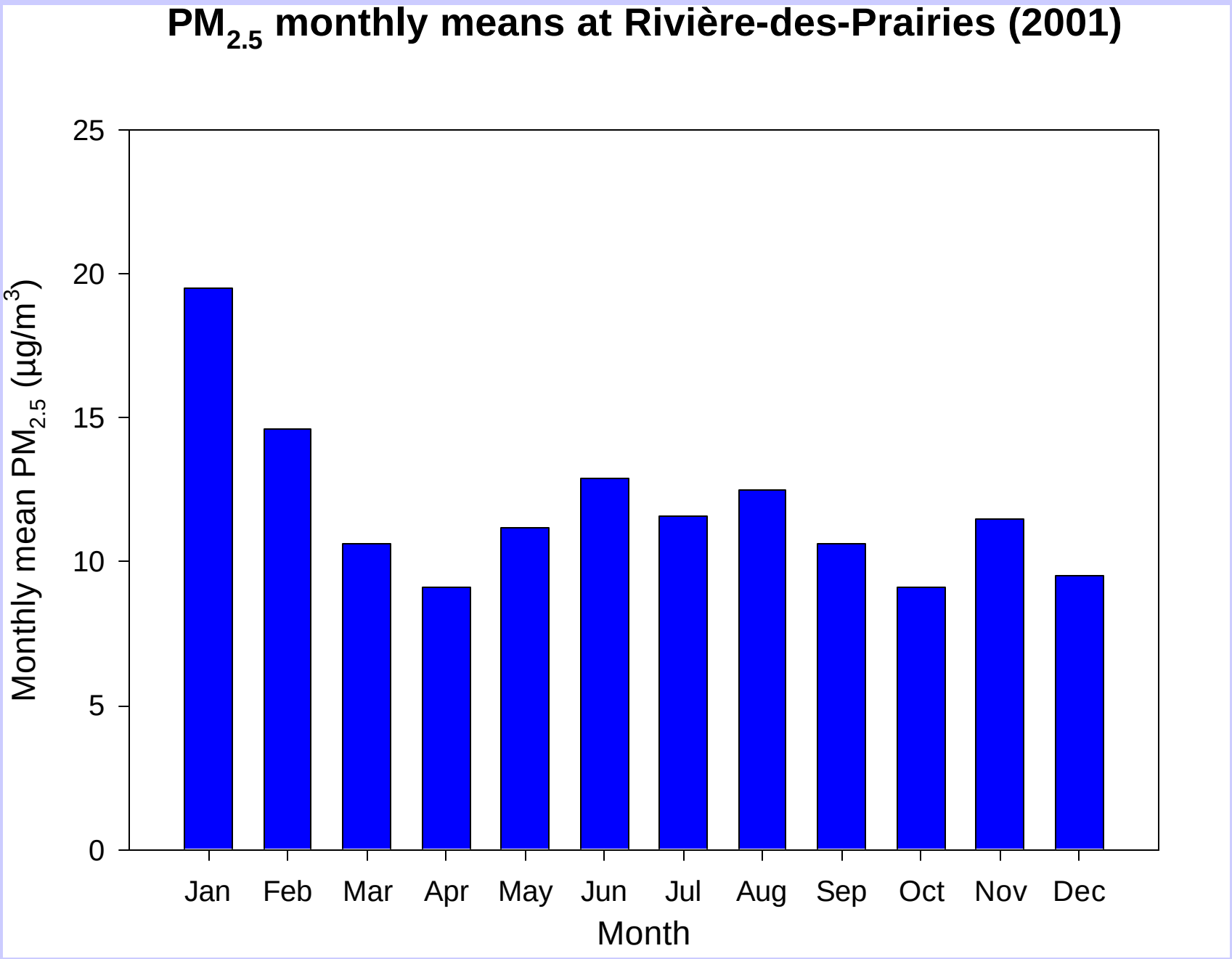
Canada


Station
Rivière-des-Prairies
55
Station
principale
RdP
6
Station
Anjou
Station
rue Ontario
12
Station
rue Drummond
13
99
Station
SAB

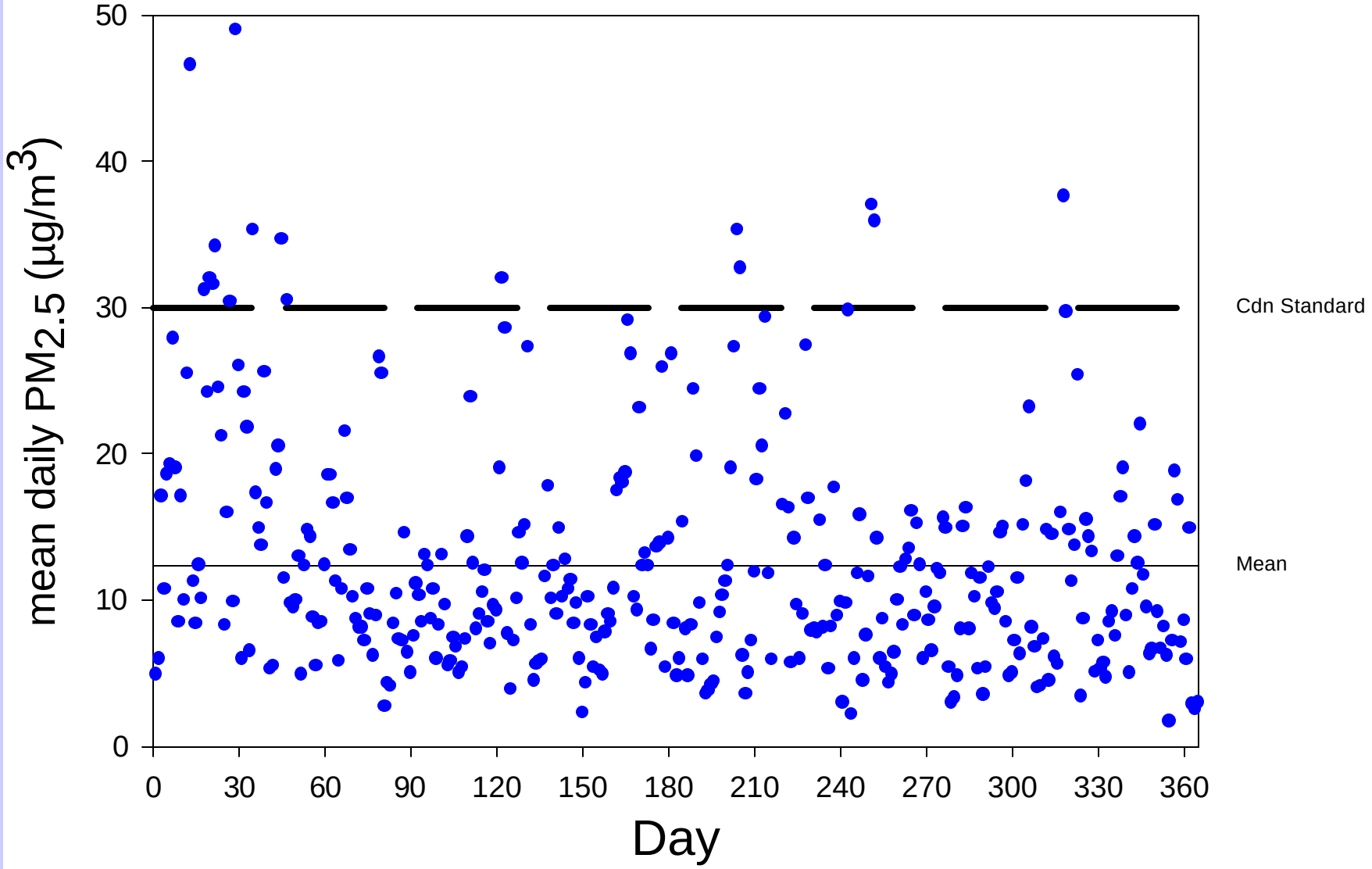

Air quality network measurement
for the greater Montréal area
SAINT-FAUSTIN
ZÉPHIRIN
ASSOMPTION
RIVIÈRE-DES-PRAIRIES
SAINT-SIMON
MONTRÉAL-NORD
VARENNES
RUE ONTARIO
PTES-AUX-TREMBLES
CHOMEDEY
JARDIN BOTANIQUE
DUNCAN & DÉCARIE
LONGUEUIL
AEROPORT DE MONTRÉAL
PEEL-MAISONNEUVE
VERDUN
STE-ANNE DE BELLEVUE
BROSSARD
L'ACADIE
ST-ANICET
INFO-SMOG network
Ozone (11)
Ozone + PM2,5 (8)
PM2,5 (1)

Sources of $PM_{2.5}$ (Québec)

- Transportations (9.2 %)
- Industries (12.6 %)
- Combustions (not industrial)
  - mainly wood burning (21.9 %)
- Open sources (55 %) (including forest fire (14.5 %))
- Others (1.3 %)

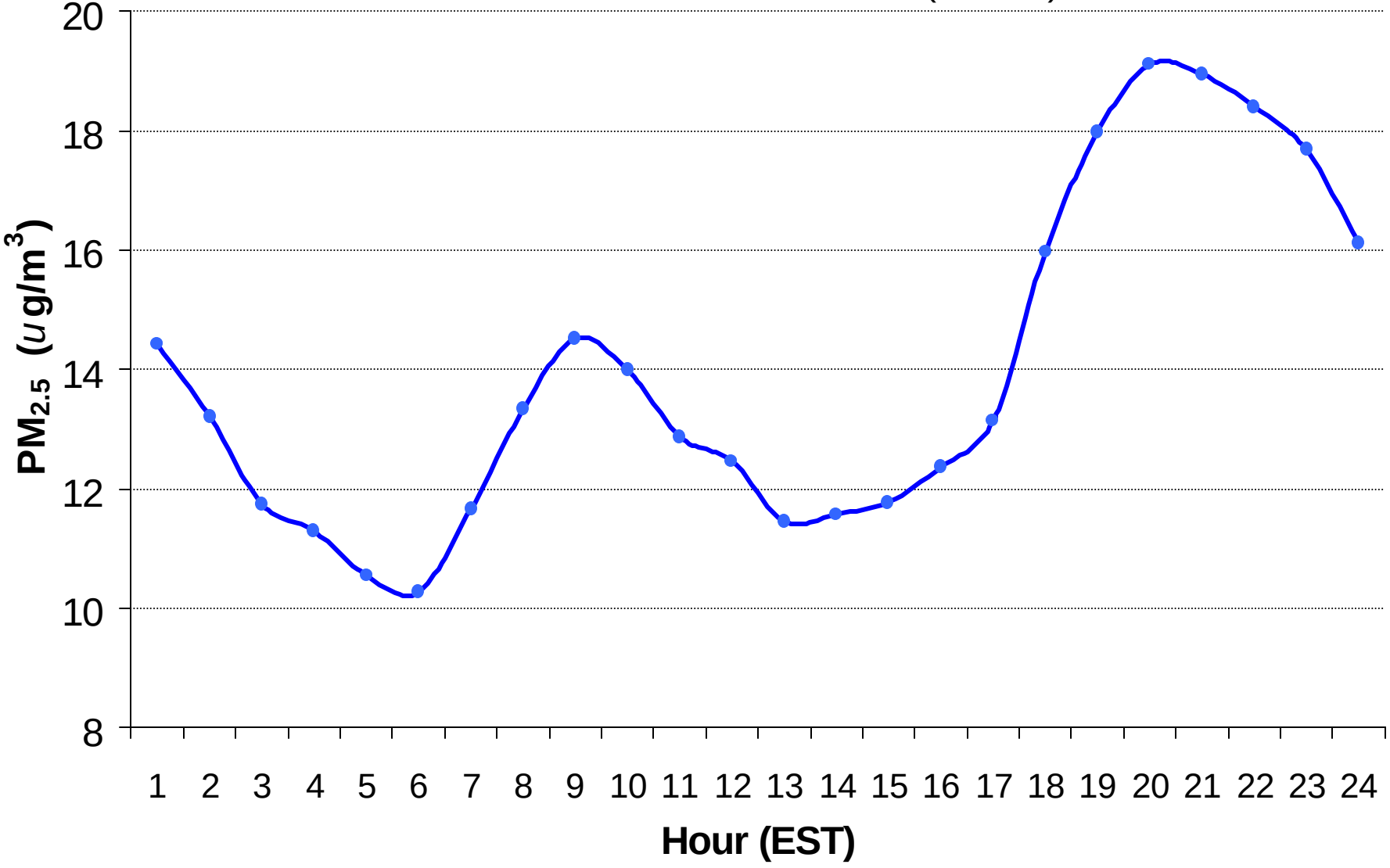

PM2.5 monthly means at Rivière-des-Prairies (2001)
Monthly mean PM2.5 (µg/m3)
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

$PM_{2.5}$ daily means at Rivière-des-Prairies (2001)



Hourly variation $PM_{2.5}$ Rivière-des-Prairies

WINTER 98-99, 99-00 and 00-01 (n = 341)



Hourly variation $PM_{2.5}$ Rivière-des-Prairies

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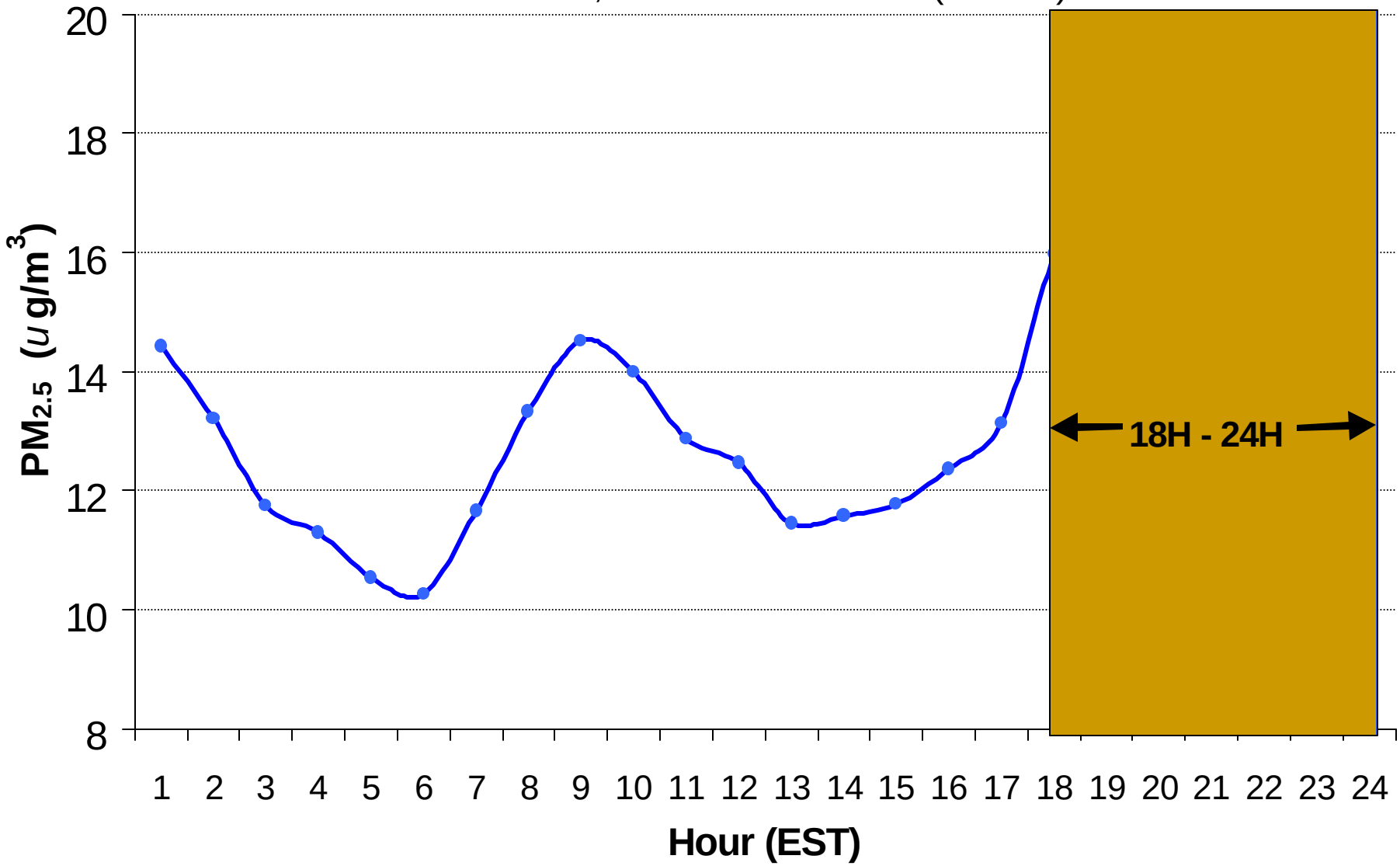
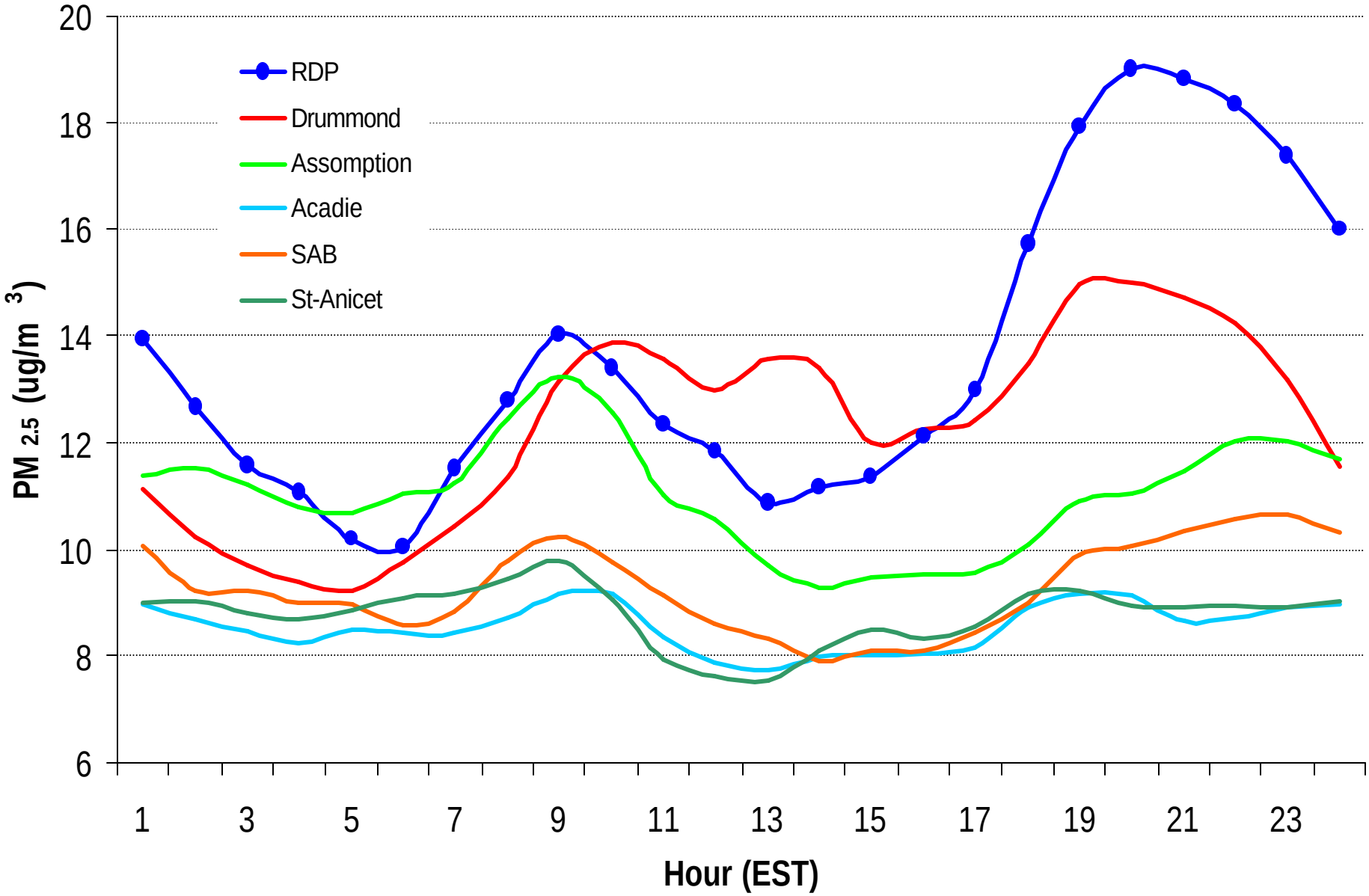
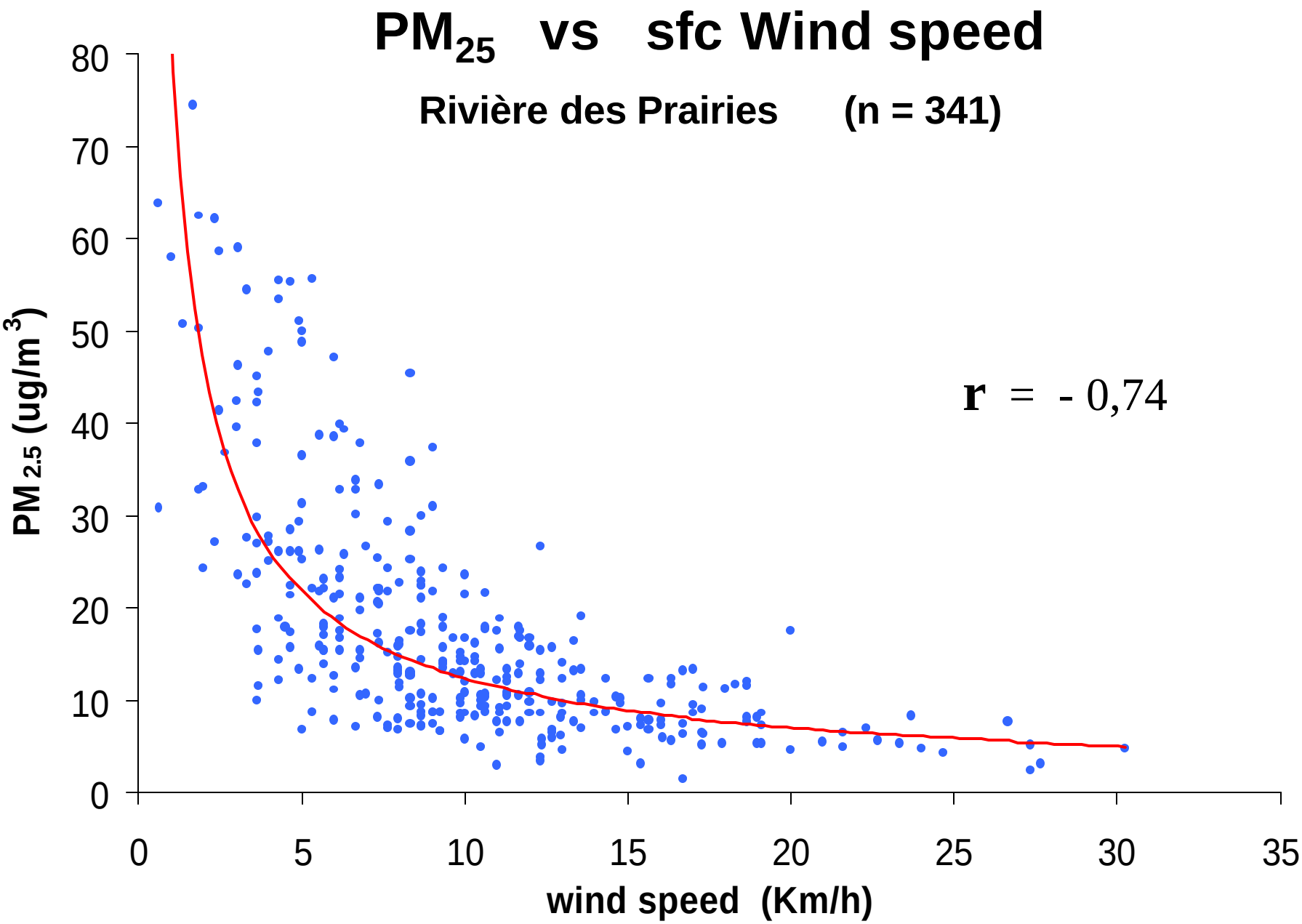
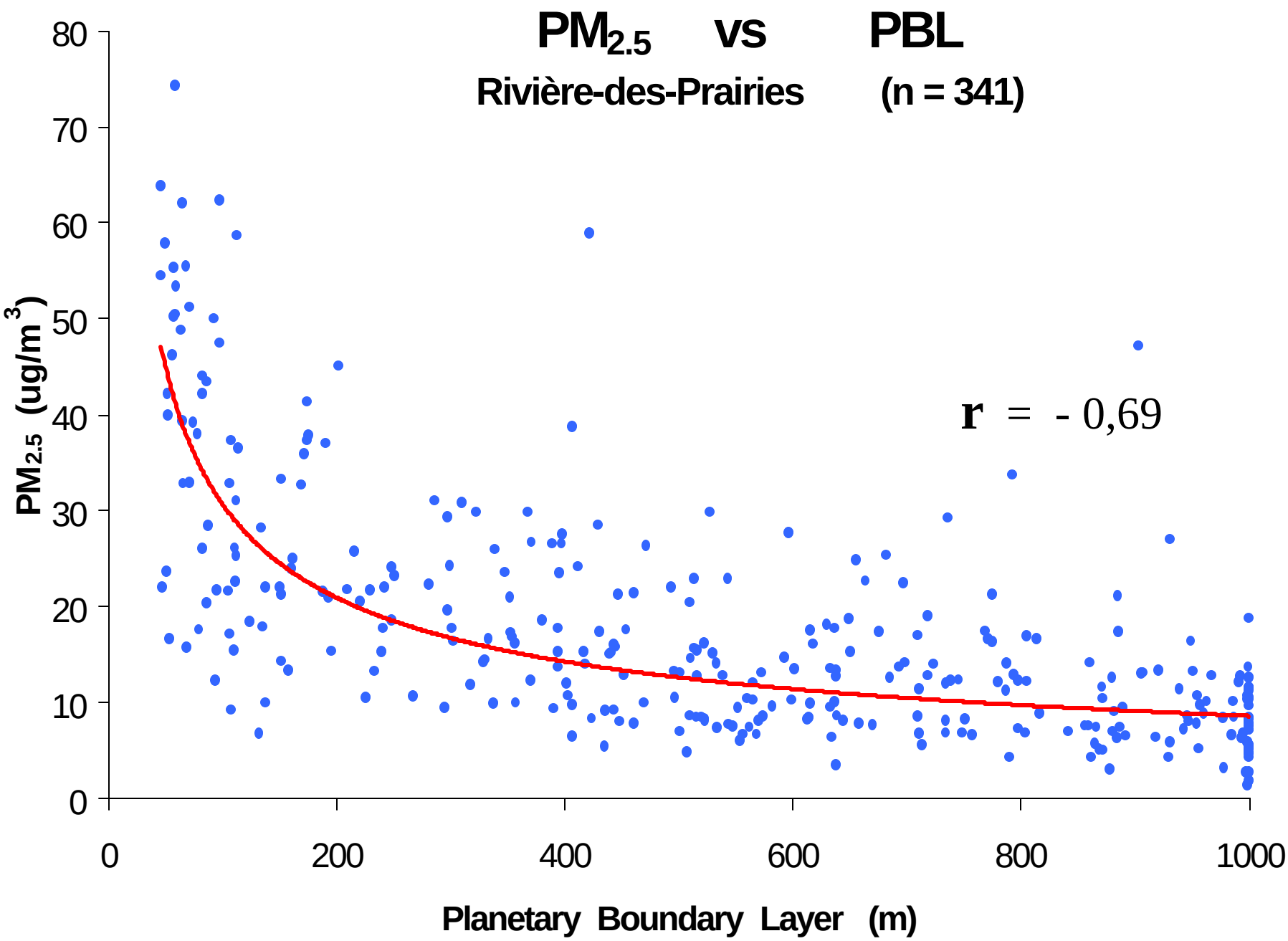
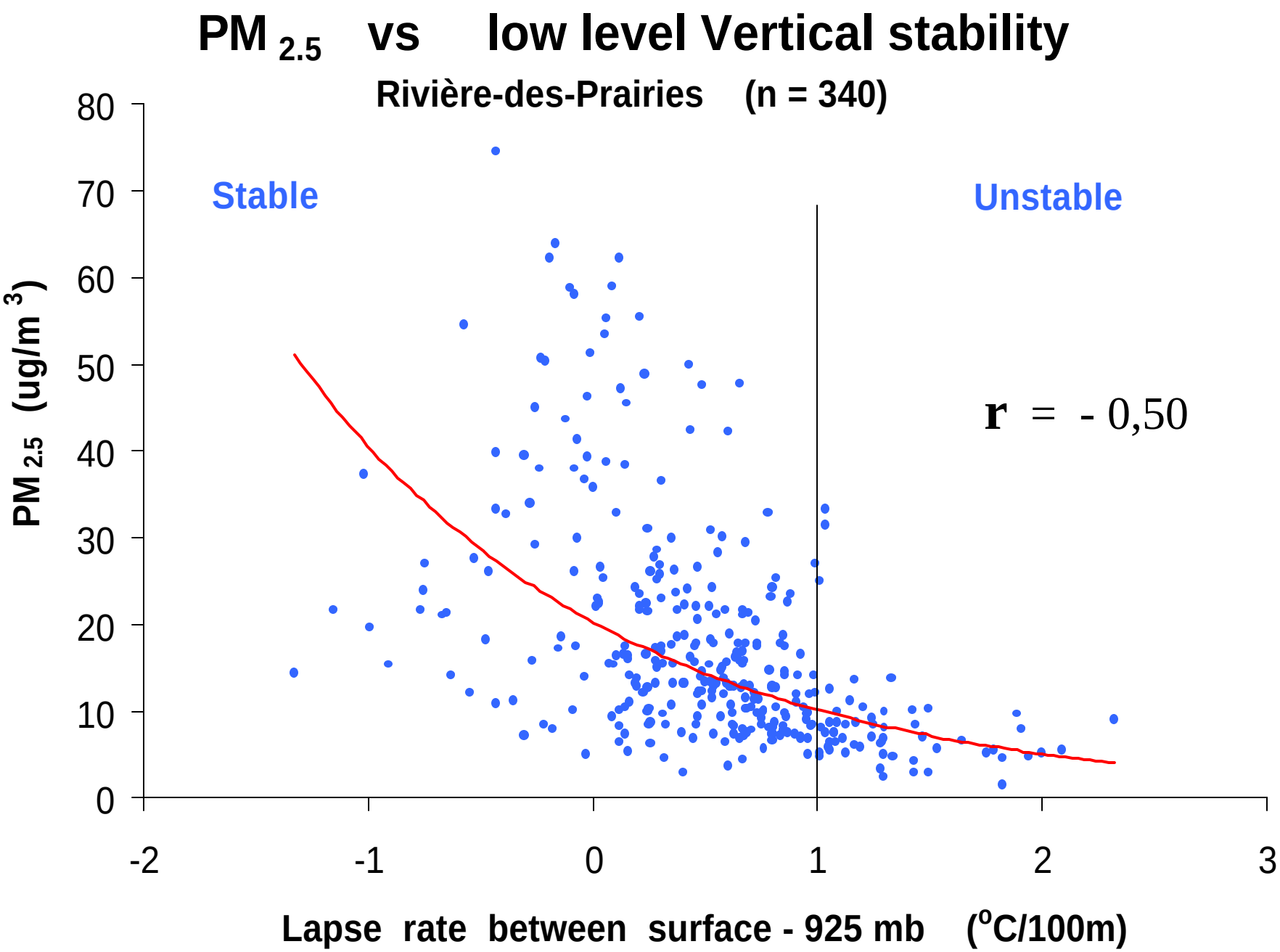


Hourly Variation $PM_{2.5}$ all stations




PM25 vs sfc Wind speed
Rivière des Prairies (n = 341)
r = - 0,74
PM 2.5 (ug/m3)
wind speed (Km/h)
0
10
20
30
40
50
60
70
80
0
5
10
15
20
25
30
35


PM2.5 vs PBL
Rivière-des-Prairies (n = 341)
r = - 0,69
PM2.5 (ug/m3)
Planetary Boundary Layer (m)
0
10
20
30
40
50
60
70
80
0
200
400
600
800
1000


PM 2.5 vs low level Vertical stability
Rivière-des-Prairies (n = 340)
Stable
Unstable
r = - 0,50
PM 2.5 (ug/m 3)
80
70
60
50
40
30
20
10
0
-2
-1
0
1
2
3
Lapse rate between surface - 925 mb (°C/100m)

Statistical forecast model based on :

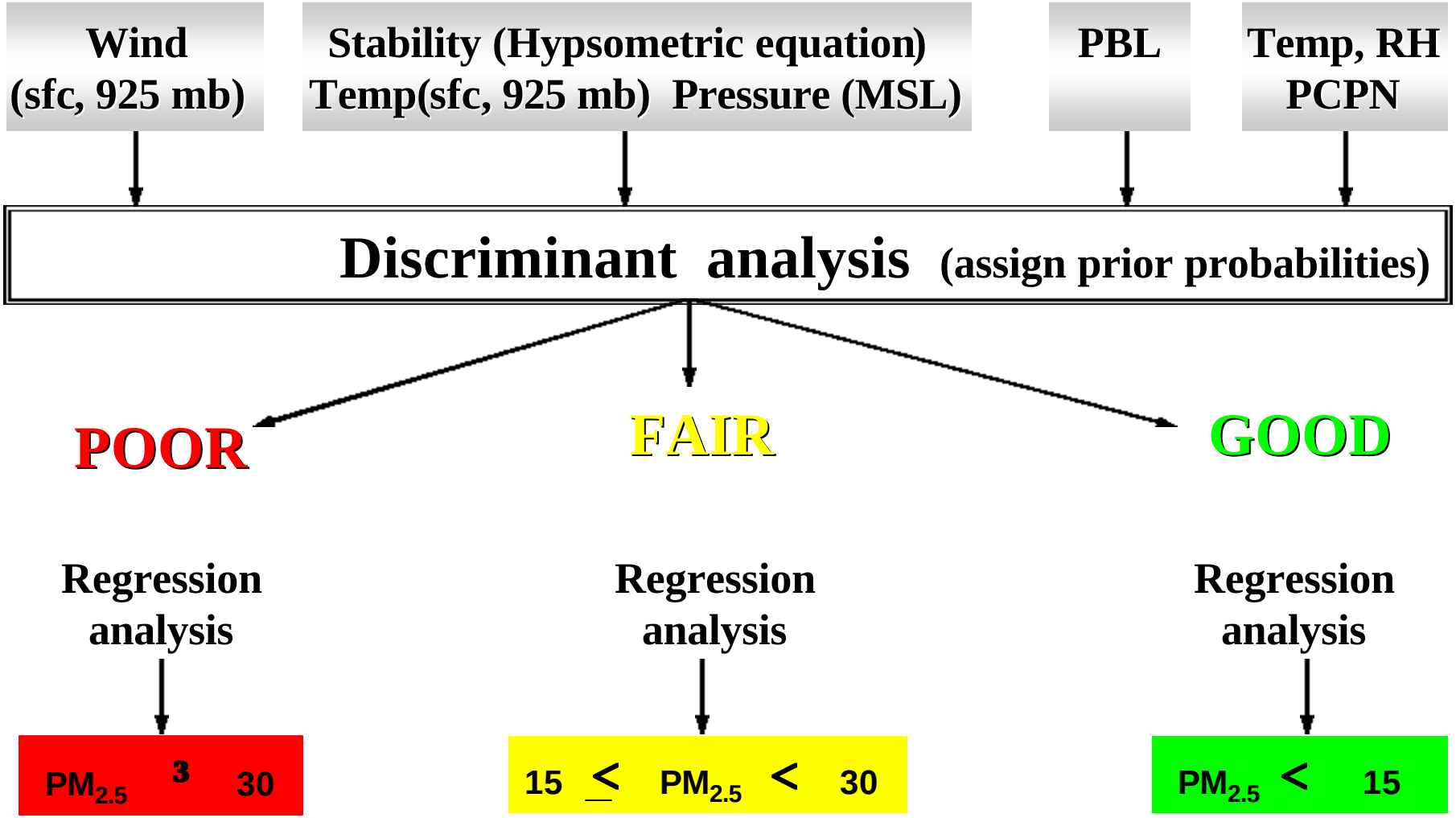
Meteorological Parameter	Time period	Correlation **r**
Surface wind speed (Km/h)	Evening average	**-0,74**
PBL (m)	00Z	**-0,69**
Low level Vertical stability (^{o}C/m)	00Z	**-0,50**
Delta - T (^{o}C)	24 hours	**0,38**
925 mb wind speed (Km/h)	00Z	**-0,36**
Precipitation (mm)	24 hours	**-0,35**
Surface temperature (^{o}C)	12Z	**-0,33**
Relative humidity (%)	Evening average	**-0,27**

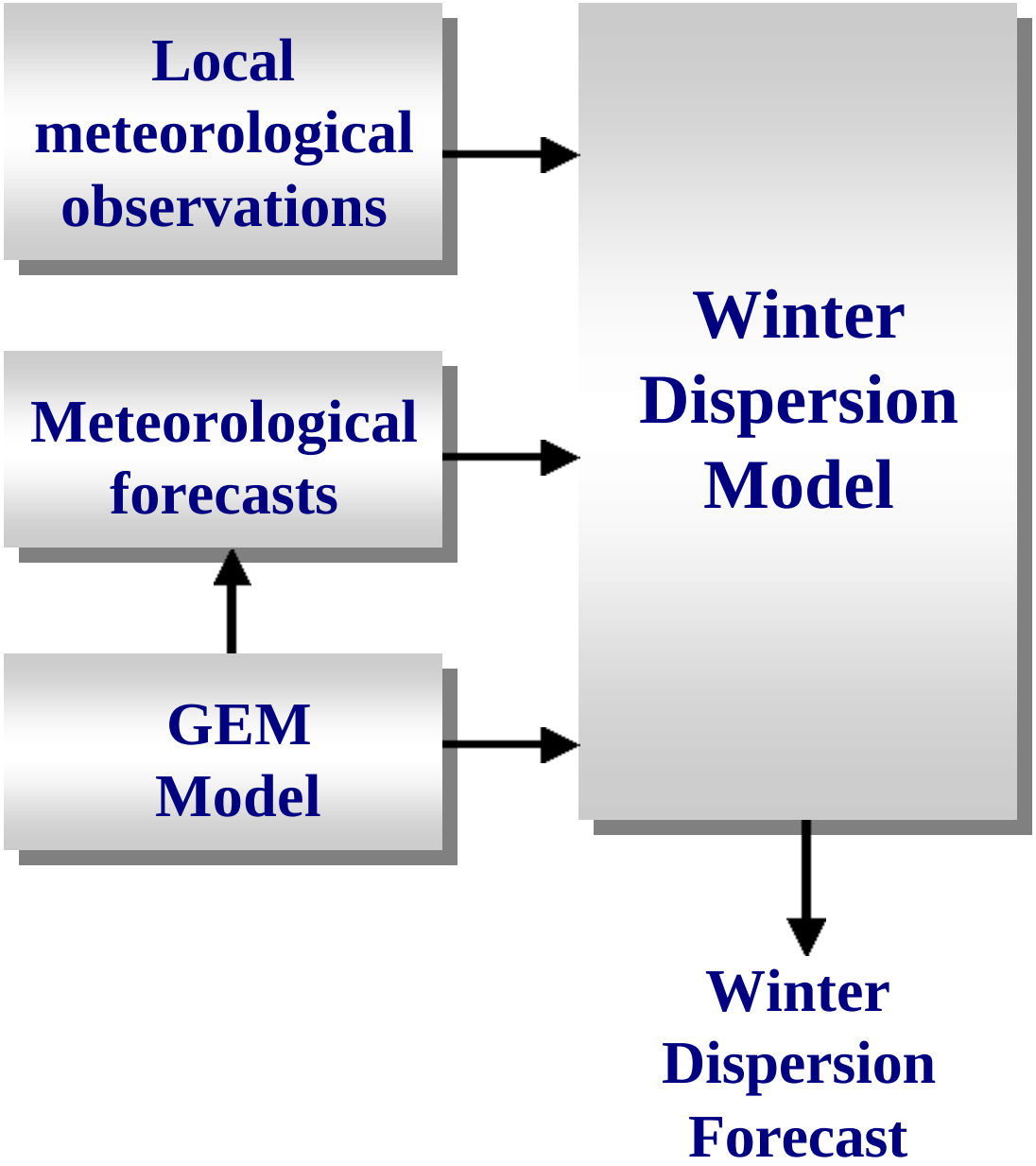
Class distribution

winter 98-99, 99-00 and 00-01 (n = 341)

Poor :			$PM_{2.5}$	^{3}	30 µg/m^3	14,2 % of the time
Fair :	15 µg/m^3	$\leq$	$PM_{2.5}$	$<$	30 µg/m^3	31,5 % of the time
Good :			$PM_{2.5}$	$<$	15 µg/m^3	54,3 % of the time

Model


Wind
(sfc, 925 mb)
Stability (Hypsometric equation)
Temp(sfc, 925 mb) Pressure (MSL)
PBL
Temp, RH
PCPN
Discriminant analysis (assign prior probabilities)
POOR
FAIR
GOOD
Regression analysis
Regression analysis
Regression analysis
PM2.5 3 30
15 ≤ PM2.5 < 30
PM2.5 < 15


Local meteorological observations
Meteorological forecasts
GEM Model
Winter Dispersion Model
Winter Dispersion Forecast

Air stability

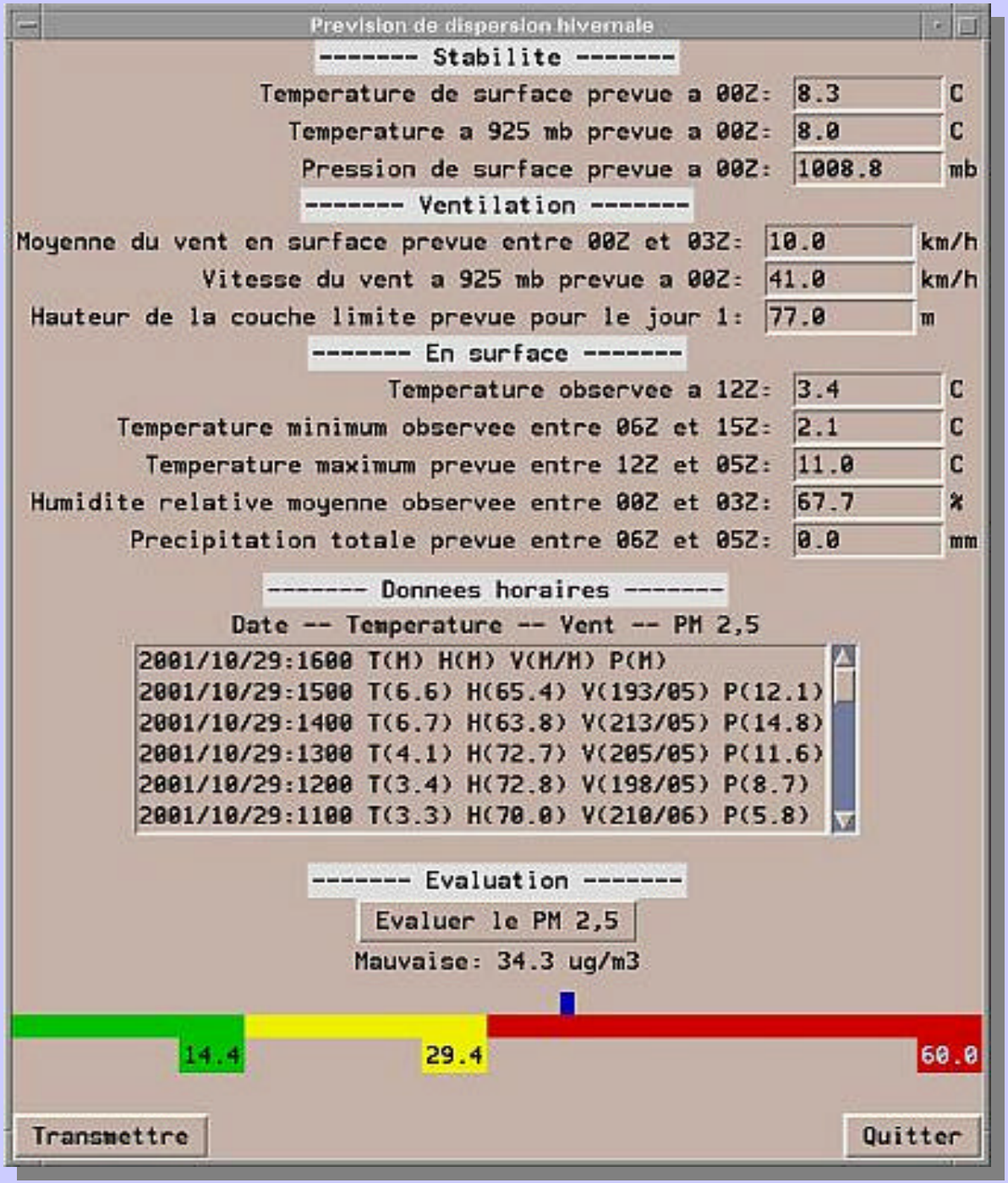
Ventilation

SFC Parameters

Local Measurements

Results

Transmission

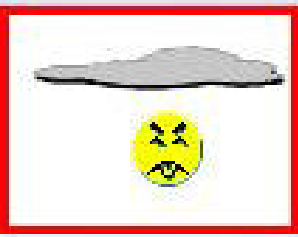


Meteorological conditions leading to POOR dispersion

- Weak surface gradient (low wind speeds)
- Low mixing height value
- Temperature inversion (stable condition)
- Ahead of warm front
- Back of high-pressure system

Forecast issued at 2:00 PM on wednesday 31 january 2001 for the next 24 hours.

Next forecast issued at 2:00 PM on thursday 1 february 2001.



Winter dispersion:
POOR

In the Greater Montreal Area, weather conditions for the next 24 hours are favourable to an accumulation of air pollutants. In order to improve the poor air quality, you should refrain as much as possible from using fireplaces and wood stoves. You could also use public transportation for your daily cummutings.

People should not experience significant health effects. However, more vulnerable people like young children and those suffering from asthma, bronchitis, emphysema or coronary problems, can be affected. To avoid risks and problems, it is recommended that these people reduce their outdoor activities.

For more information, please contact your CLSC Health Line.

WEB site at http://www.qc.ec.gc.ca/atmos/smog/

Performance results

	Good	Fair	Poor	Overall
POD	**84 %**	**56 %**	**84 %**	**77 %**
FAR	**15 %**	**40 %**	**27 %**	**23 %**
CSI	**73 %**	**41 %**	**64 %**	**62 %**

POD : Measures the percentage of events correctly forecasted

FAR : Measures the tendency to over forecast

CSI : Combines observed and forecasted occurrences

Features

Data

Meteorological : Environment Canada
Air Quality : Environment Canada
Quebec Ministry of Environment
Montreal urban Community

↓

Winter Info-Smog Model

↓

Dissemination

media, WEB site : Environment Canada
Regional offices : Quebec Ministry of Environment
WEB site : Montreal urban Community
CLSC, Health line : Public Health Department

Conclusion

Statistical Forecast

- Multi-sources pollutants (widespread sources over area)
- Pollutants are mainly local (no significant transport)
- Steady emission over long time period (day after day)
- Weather is the main driver
- Low altitude emission (no high stack)

http://www.qc.ec.gc.ca/atmos/smog

Future work

Integration of :

- Wind direction at upper level
  (long range transportation of $PM_{2,5}$)
- Integration of others $PM_{2,5}$ stations over southern Québec
  (spatial extension of the program)
- Forecast produce and distribute directly with Scribe
(interface linking models outputs to all kind of forecasts)
- Use of numerical model's outputs as predictors

(CHRONOS)