

Forecast of the *Platanus* L. pollen levels in Catalonia (North-East Spain)

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Introduction

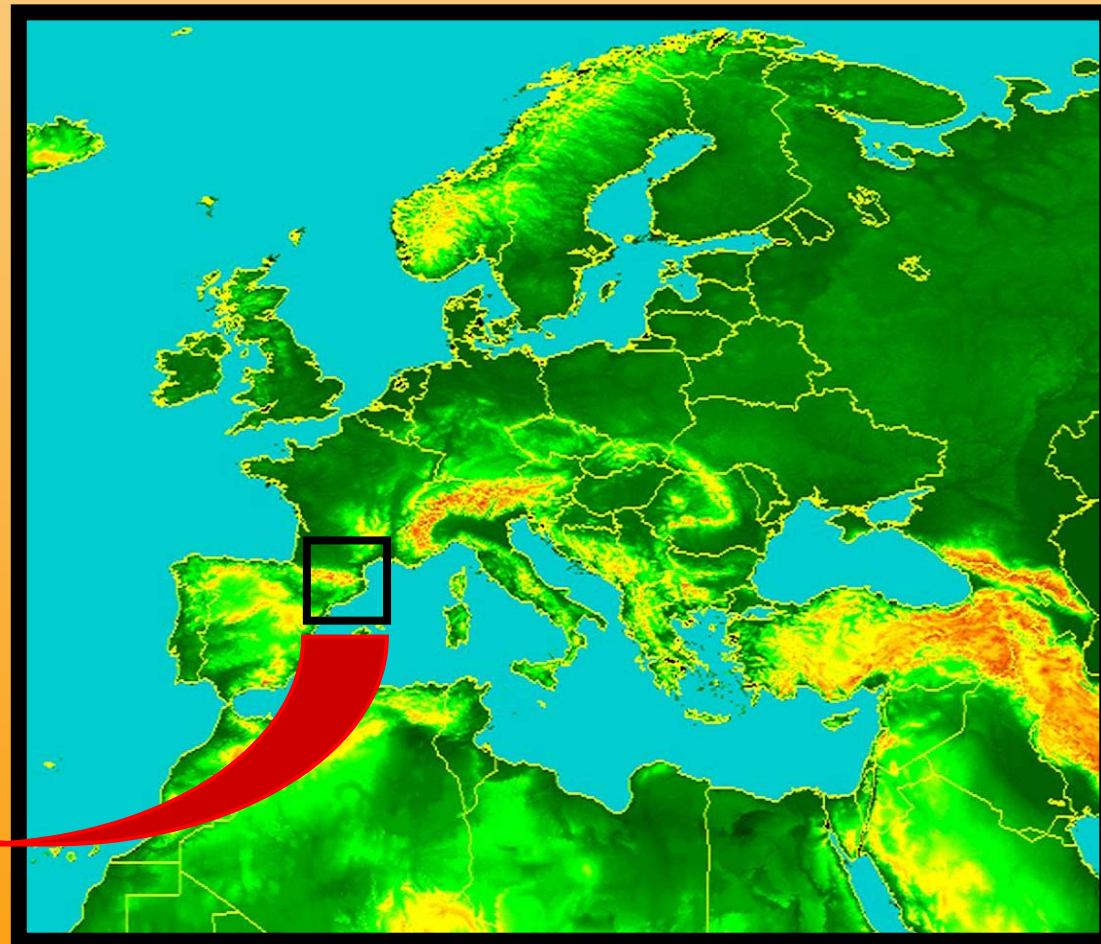
- *Platanus* pollen counts are very high and present in all the pollen spectra of the XAC (Gabarra *et al.* in press).
- Its allergenicity has been recognised (Lewis *et al.* 1983; Belmonte, 1988; Hernández de Rojas *et al.* 1991, Subiza *et al.* 1994).
- It has cross-reactivity with other taxa as Poaceae (Varela *et al.* 1997).
- Recent papers associate *Platanus* pollen and food allergy (Miralles *et al.* 2002; Enrique *et al.* 2002).

Floral phenology and distribution of the *Platanus* L. species in the Iberian Peninsula

Species	Flowering period	Habitat	Altitude (m)	Geographical distribution
<i>Platanus x hybrida</i> Brot. (= <i>P. acerifolia</i> (Aiton) Willd., = <i>P. cuneata</i> Willd., = <i>P. hispanica</i> Miller ex Münchh., = <i>P. occidentalis</i> x <i>orientalis</i> .)	IV-VI	Planted as an ornamental tree Sometimes naturalized near streams and river margins specially wet regions	0-1500	The whole Iberian Peninsula
<i>P. orientalis</i> L.	-	Planted as an ornamental tree	-	Rare in the Iberian Peninsula
				North East of North America
<i>P. occidentalis</i> L.	-	Planted as an ornamental tree	-	Rare in the Iberian Peninsula
				South West of North America

Bolòs, O. (1995)

Aerobiological sampling stations



Geographical and climatic characteristics of Sampling Stations

Sampling Stations	Geographical characteristics		Climatic characteristics		
	Altitude	Geographical	Annual Mean	Total Annual	Phytoclimates
	(m.a.s.l.)	Coordinates	Temp. (°C)	Rainfall (mm)	(Allue, 1990. Atlas fitoclimático de España. INIA)
Girona	70	41° 59' N, 02° 60' E	15,0	740	Fresh-Continental Oriental-semihumid
Manresa	238	41° 43' N, 01° 50' E	13,6	619	Fresh-Continental Oriental-semihumid
Lleida	221	41° 37' N, 00° 37' E	15,1	385	Fresh-Transitional-semiarid
Bellaterra	190	41° 33' N, 02° 07' E	15,2	594	Fresh-Continental Oriental-semihumid
Barcelona	12	41° 24' N, 02° 11' E	16,4	593	Fresh-Tethyc-semiarid
Tarragona	20	41° 07' N, 01° 15' E	15,8	478	Fresh-Tethyc-semiarid

Objectives

- A better knowledge of the *Platanus* pollen behaviour in relation to meteorological parameters.
- To obtain a reliable **multiple regression model** based on meteorological data, in order to forecast:
 - *Platanus* pollen concentrations for a given period.
 - The dates when these concentrations will occur.

The model is tested with 2002 data.

Material and Methods - Pollen and Sampling Site

Pollen Data:

- Seven-day spore Hirst trap (Hirst, 1952).
- Counting method proposed by the REA (Dominguez *et al.* 1991).
- Base results expressed as mean daily pollen concentrations (P/m³).

Site:

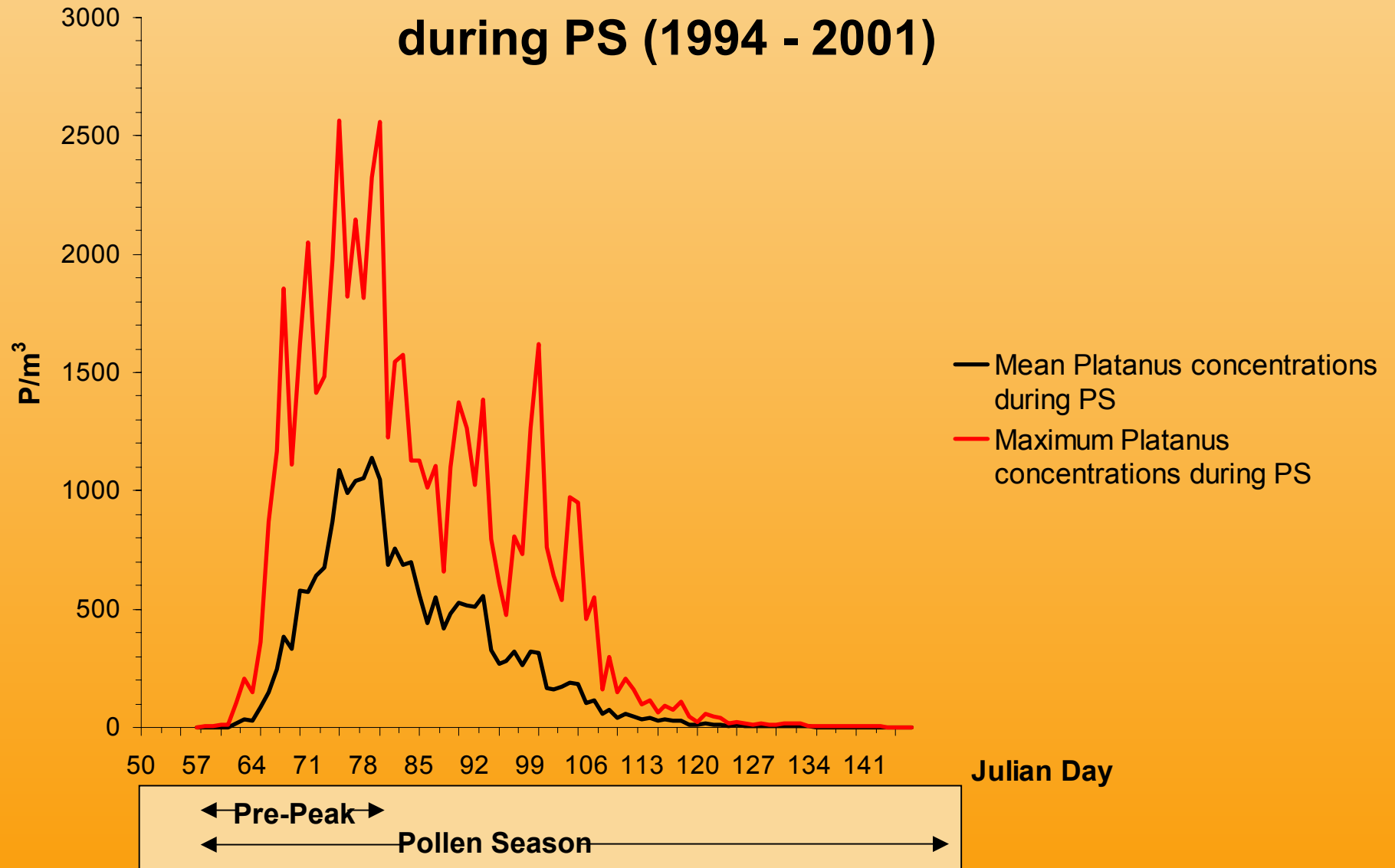
- Barcelona sampling site (1994-2001; 2002).

Materials and Methods - Study Period

Concepts on Pollen:

- **Pollen Season (PS)** - Period comprised between the date when the pollen level in the air is equal or superior uninterruptedly to 1 P/m^3 until the date when the first zero value is recorded.
- **Pre-Peak Period (PP)** - Period running from the beginning of the PS until the date when the annual maximum occurs.

Mean *Platanus* concentrations in Barcelona during PS (1994 - 2001)



Platanus Pollen Season Barcelona (1994-2001)

Year	PS Beginning date		PS Maximum date		PS Ending date		PS Duration	PP Duration
	Month/Day	Julian Day Nr	Month/Day	Julian Day Nr	Month/Day	Julian Day Nr	(Nr of Days)	(Nr of Days)
1994	M3	62	M11	70	MY9	129	67	9
1995	F28	59	M19	78	MY18	138	79	20
1996	M17	77	A9	100	MY19	140	63	24
1997	F26	57	M12	71	MY27	147	90	15
1998	M6	65	M20	79	MY24	145	80	14
1999	M7	66	M21	80	MY14	134	68	15
2000	M5	65	M15	75	MY15	136	71	11
2001	M4	63	M17	76	MY1	121	58	14

F= February

M=March

A=April

MY= May

Platanus Pre-Peak Period Barcelona (1994-2001)

Year	Duration of the PP (Nr days)	Total PP Pollen (Pollen Grains)	Mean concentration during PP Total PP/Duration PP [Pollen/m3]	Daily Maximum [Pollen/m3]	Julian Day Nr	Month/Day
1994	9	3732	415	1620	70	M11
1995	20	6399	320	1543	78	M19
1996	24	13938	581	1622	100	A9
1997	15	9169	611	2052	71	M12
1998	14	9591	685	2022	79	M20
1999	15	9052	603	2557	80	M21
2000	11	7636	694	2567	75	M15
2001	14	7001	500	1386	76	M17

Retained for modelling

M=March

A=April

(Varela *et al.* 1997)

Materials and Methods- Meteorology

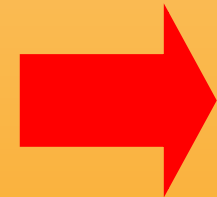
Site and study period:

- Barcelona (1994-2001; 2002)
- The study period for these parameters are :
 - January*
 - First fortnight of January*
 - Second fortnight of January*
 - The Pre-Peak period

*Alba and Díaz de la Guardia, 1998

Meteorological parameters, base data:

- Daily Temperature (°C)
 - Maximum
 - Minimum
 - Mean
- Daily Rainfall (mm)



Materials and Methods- Meteorology

- **Temperatures - Concepts applied for each period:**
 - Mean
 - Median
 - Maximum absolute
 - Minimum absolute
 - Cumulated
- **Rainfall - Concepts applied for each period:**
 - Mean
 - Maximum absolute
 - Cumulated
- **Parameters retained:**
 - Mean of the maximum temperatures
 - Maximum of the maximum temperatures
 - Mean of the minimum temperatures
 - Mean of the mean temperatures
 - Median of the mean temperatures
 - Cumulated Rainfall
- These parameters are considered for each of the four periods of study.

Results - Multiple regression analysis (Stepwise)

- The meteorological parameters of the months prior to Pre-Peak were not significant.
- The absolute maximum of the maximum temperatures from the pre-peak help Pre-Seasonal data to “enter” in the regression model. However this model can not be valid for forecasting since includes a parameter from the same Pre-Peak.
- Alternative Proposal - To use the absolute mean maximum of the maximum temperatures of the previous periods (1994-2001).

Predictive formula for daily maximum concentration

Adjusted $R^2 = 0,99$

Y = (Dependent variable) Daily maximum concentration

$$Y = -1237,11 + 295,63 T_{MXmx}^{PP} - 189,05 T_{MINmn}^{1stF} - 152,06 T_{MXmx}^{2ndF} - 5,51 R_{TOTAL}^J + 211,70 T_{MINmn}^J - 0,258 R_{TOTAL}^{1stF}$$

T_{MXmx}^{PP} : Absolute maximum of the maximum temperatures during the Pre-Peak

T_{MINmn}^{1stF} : Mean of the minimum temperatures during the first fortnight of January

T_{MXmx}^{2ndF} : Maximum of the maximum temperatures during the second fortnight of January

R_{TOTAL}^J : Total rainfall during January

T_{MINmn}^J : Mean of the minimum temperatures during January

R_{TOTAL}^{1stF} : Total rainfall during the first fortnight of January

Model validation using 2002 data

Adjusted $R^2 = 0,99$

Y = (Dependent variable) Daily maximum concentration

$$Y = -1237,11 + 295,63 T_{MXmx}^{PP} - 189,05 T_{MINmn}^{1stF} - 152,06 T_{MXmx}^{2ndF} - 5,51 R_{TOTAL}^J + 211,70 T_{MINmn}^J - 0,258 R_{TOTAL}^{1st}$$

$$T_{MXmx}^{PP} = 19,9 \text{ } ^\circ\text{C}$$

$$T_{MINmn}^{1stF} = 7,5 \text{ } ^\circ\text{C}$$

$$T_{MXmx}^{2ndF} = 20,1 \text{ } ^\circ\text{C}$$

$$R_{TOTAL}^J = 20,2 \text{ mm}$$

$$T_{MINmn}^J = 8 \text{ } ^\circ\text{C}$$

$$R_{TOTAL}^{1stF} = 18,6 \text{ mm}$$

Expected: 1706 pollens/m³ on the julian day 76

Observed: 1812 pollens/m³ on the julian day 78

Alternative 2002 model

Adjusted R²= 0,99

Y= Dependent variable, maximum concentration

$$Y = -1237,11 + 295,63 T_{MXmx}^{PP} - 189,05 T_{MINmn}^{1stF} - 152,06 T_{MXmx}^{2ndF} - 5,51 R_{TOTAL}^J + 211,70 T_{MINmn}^J - 0,258 R_{TOTAL}^{1st}$$

$T_{MXmx}^{PP} = 19,925$ °C (Mean period 1994-2001)

$T_{MINmn}^{1stF} = 7,5$ °C (2002 data)

$T_{MXmx}^{2ndF} = 20,1$ °C (2002 data)

$R_{TOTAL}^J = 20,2$ mm (2002 data)

$T_{MINmn}^J = 8$ °C (2002 data)

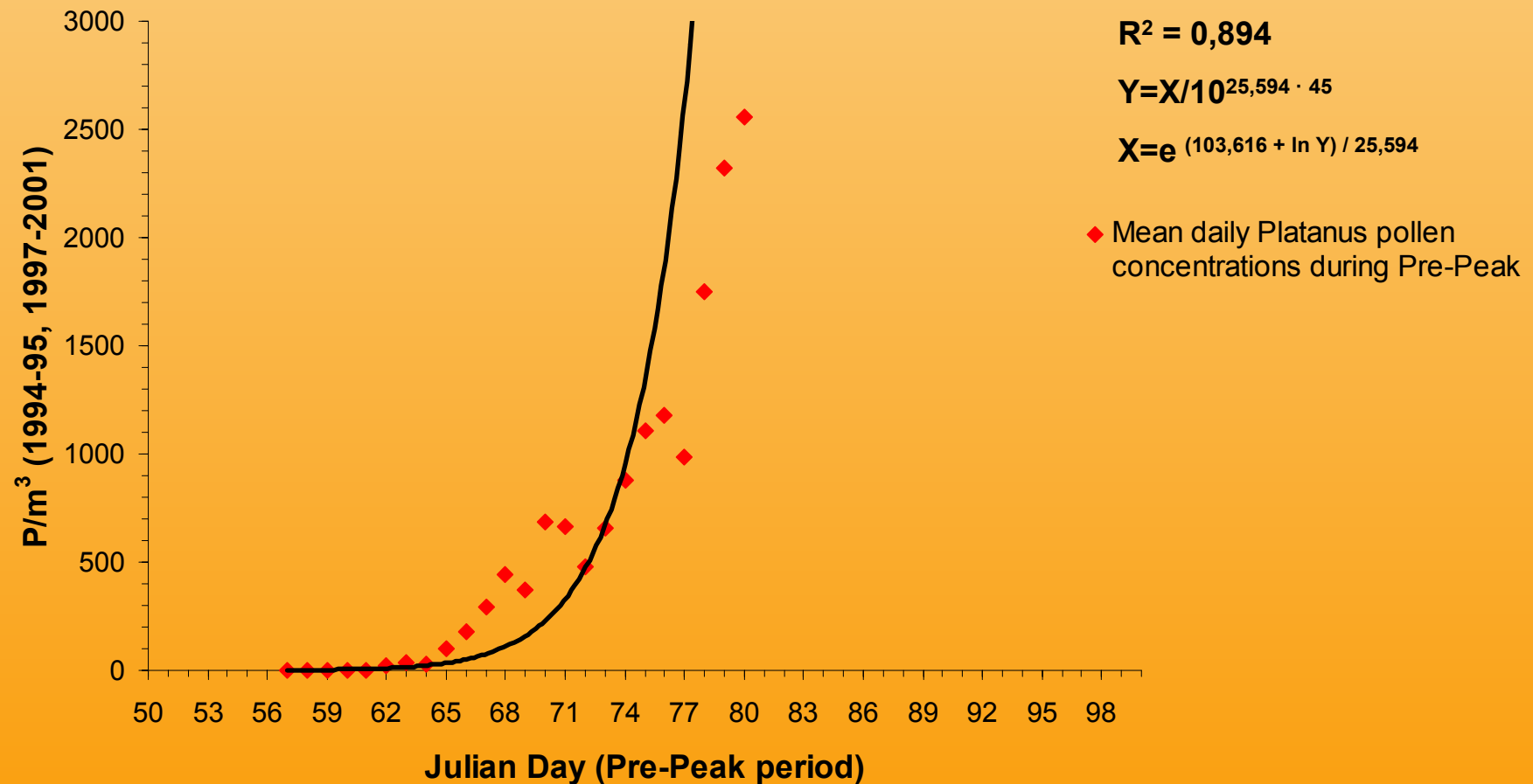
$R_{TOTAL}^{1stF} = 18,6$ mm (2002 data)

Expected: 1756 pollens/m³ on the julian day 77

Observed: 1812 pollens/m³ on the julian day 78

Estimation of the date of the maximum concentration

Curve of Mean *Platanus* Pollen concentrations during the Pre-Peak (1994-95, 1997-2001)



Conclusions

- Maximum temperature during the Pre-Peak influences the *Platanus* pollen concentrations.
- Pre-Seasonal meteorological parameters influence *Platanus* pollen levels, but not enough to allow Pre-Season forecast.
- More pollen and meteorological data are necessary to confirm the good adjustment of the forecast alternative model proposed.
- Other Pre-Seasonal periods should be investigated to establish if Pre-Season forecast can be undertaken.
- Our next aim is to work deeper in this model and widespread the model to the rest of the XAC sampling stations.

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