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# Monthly Forecast Performance over the Po-Valley region

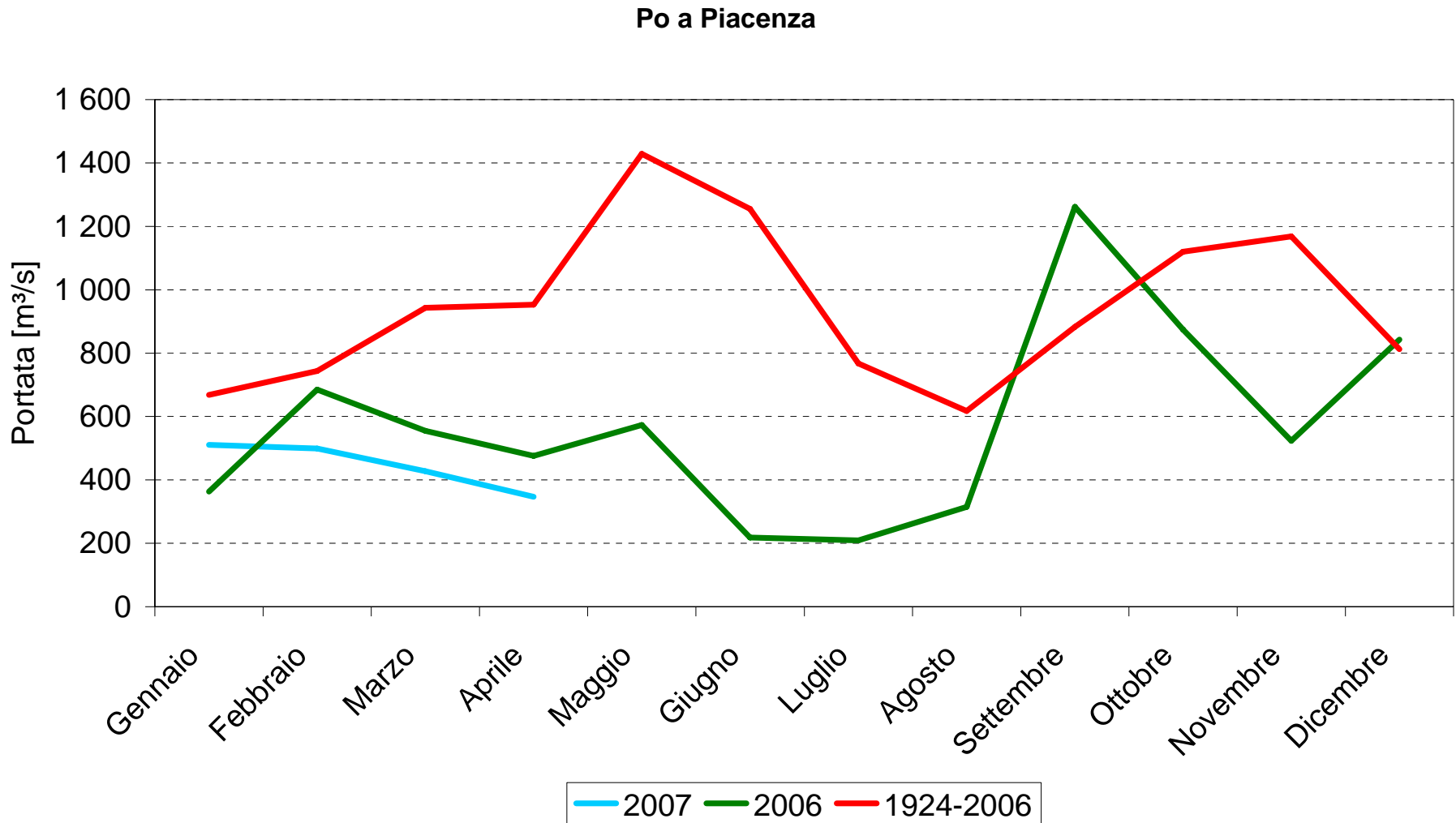
*Federico Grazzini – ARPA Servizio IdroMeteorologico  
Bologna - Italy*

# The need of extended forecasts

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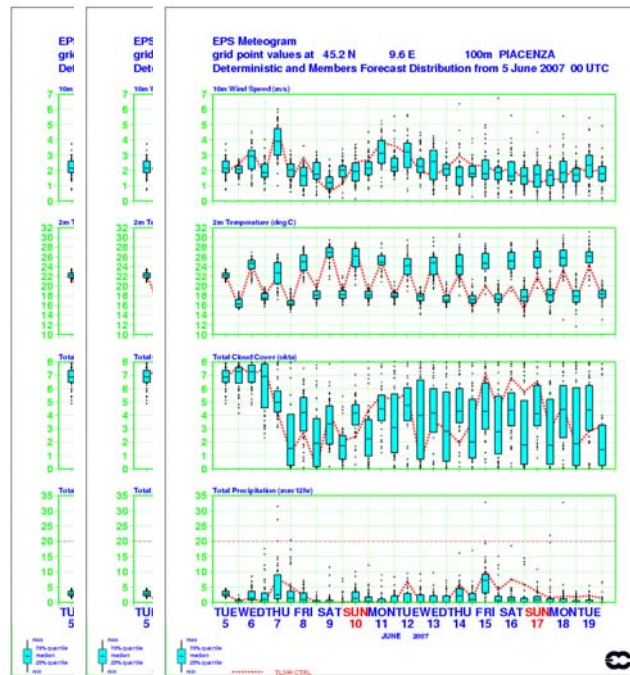
- ARPA-SIM has started to use operationally MF products since January 2007.
- The presence of strong anomalies (especially long spells of dry periods) has induced communities dealing with water management (agriculture, energy production, civil use) to take actions at a growing time lag and therefore to ask for forecast outlooks to base their decision.
- ARPA-SIM is taking part at several technical committees, set up by local and national governments, giving advices and long-range forecasts targeted on the management of water.

# Examples of applications: water management



# Examples of applications: 15 days forecast for agriculture

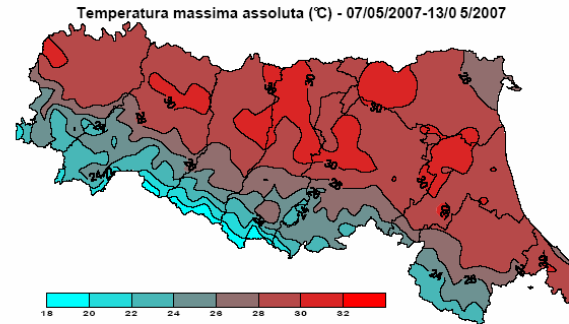
*Every Monday we issue a two weeks outlook based on the latest monthly forecast and the most recent VarEPS runs (6 runs from Friday to Sunday)*



AGENZIA REGIONALE PREVENZIONE E AMBIENTE DELL'EMILIA-ROMAGNA

**arpa** Servizio Idro Meteo

**Bollettino AgroMeteorologico Settimanale**  
n. 19 del 14 maggio 2007  
[www.arpa.emr.it/sim](http://www.arpa.emr.it/sim)



Precipitazioni assenti  
Temperature massime elevatissime, da 5 a 7 °C oltre la norma  
Valori di ETP estivi.  
Da gravissima ad eccezionale la situazione di carenza idrica nel suolo nel settore centro-orientale  
Forte anticipo fenologico

## Sommario dal 7 al 13 maggio

**Temperature:** minime in aumento; massime elevatissime  
**Precipitazioni:** assenti  
**Evapotraspirazione potenziale:** in forte aumento rispetto alla settimana precedente  
**Bilancio idro-climatico :** negativo su tutta la regione  
**Sommatorie termiche:** permane il forte anticipo  
**Fenologia:** riempimento cariossidi per i cereali autunno vernini; pomacee e drupacee in accrescimento frutti.

## Previsioni dal 15 al 20 maggio

Da **martedì 15** si avranno condizioni di cielo nuvoloso, con locali addensamenti cumuliformi e possibilità di locali rovesci, anche a carattere temporalesco, su tutto il territorio regionale. Le temperature massime e minime in diminuzione. La tendenza **da giovedì 17 a domenica 20 maggio** prevede l'approfondimento di una minimo depressionario in quota, localizzato sul bacino centrale del Mediterraneo ed in lento spostamento verso sud-est, che favorirà l'afflusso di correnti intense nord orientali, determinando per la giornata di **giovedì** residue precipitazioni, anche a carattere di rovescio. Dalla giornata di **venerdì** e fino alla fine del periodo, l'instaurarsi di un flusso di masse d'aria dai quadranti settentrionali apporterà condizioni di tempo stabile, caratterizzate da cielo prevalentemente sereno o poco nuvoloso e assenza di precipitazioni. Le temperature saranno in graduale aumento, sia nei valori minimi che in quelli massimi.

## Proiezione quindicinale dal 21 al 27 maggio

Per la settimana in considerazione è previsto un consolidamento di un campo di alta pressione sull'Europa centro-orientale e deboli flussi sud-occidentali sul Mediterraneo occidentale. Tale situazione determinerà sulla nostra regione prevalenti condizioni di tempo stabile e soleggiato ma con temperature decisamente superiori alla media. Valori massimi intorno ai 30 gradi.  
Non sono previste precipitazioni significative.

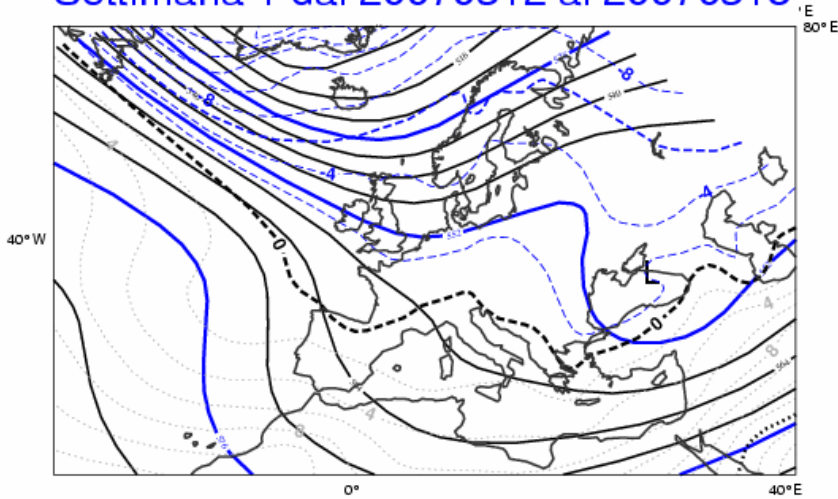
Questo nuovo prodotto previsionale, al momento sperimentale, è stato elaborato sulla base delle informazioni fornite dal sistema di previsione mensile ECMWF, corsa del 10/05/2007, e integrato con altre informazioni disponibili ad ARPA-SIM.

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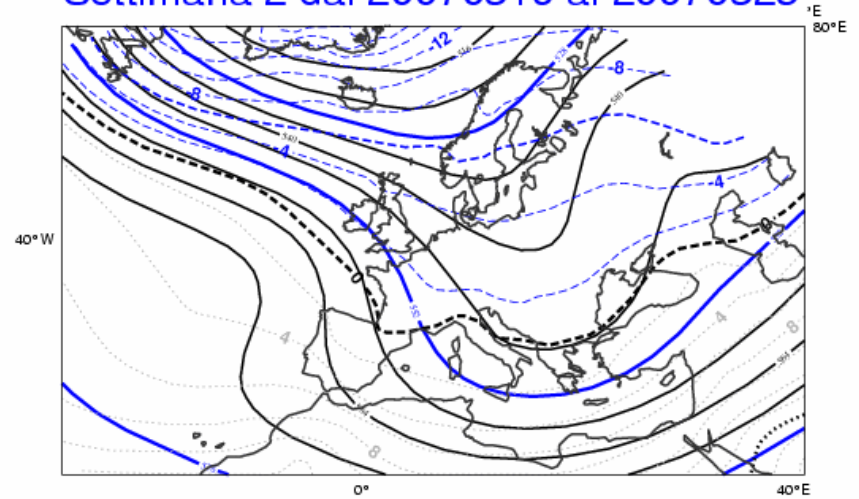
# How we use the products ?

Giovedì 08 03 2007 - Previsioni Mensili ECMWF/ Medie settimanali EM Z500 - T850

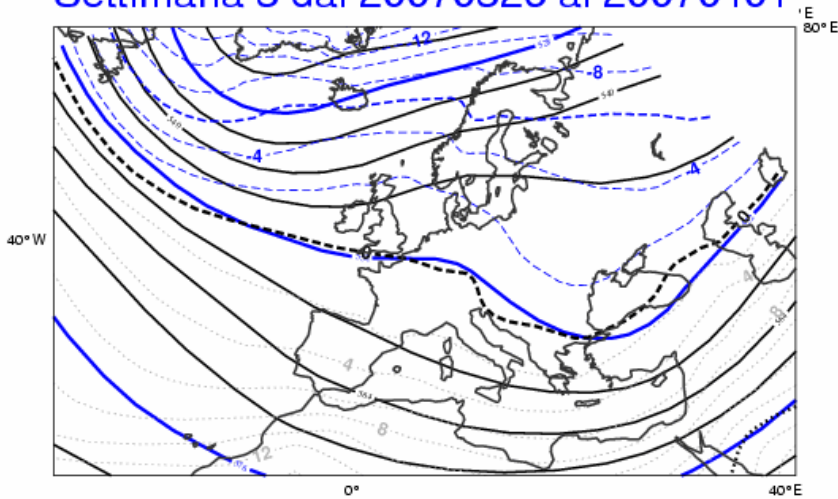
Settimana 1 dal 20070312 al 20070318



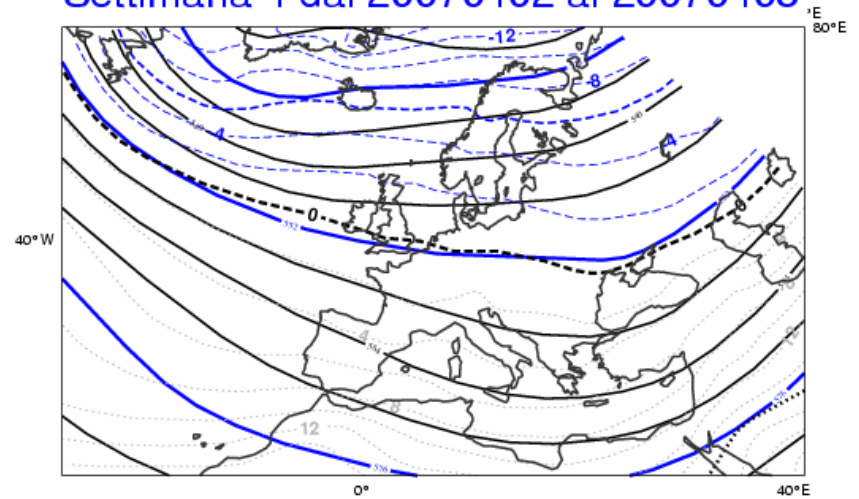
Settimana 2 dal 20070319 al 20070325



Settimana 3 dal 20070326 al 20070401

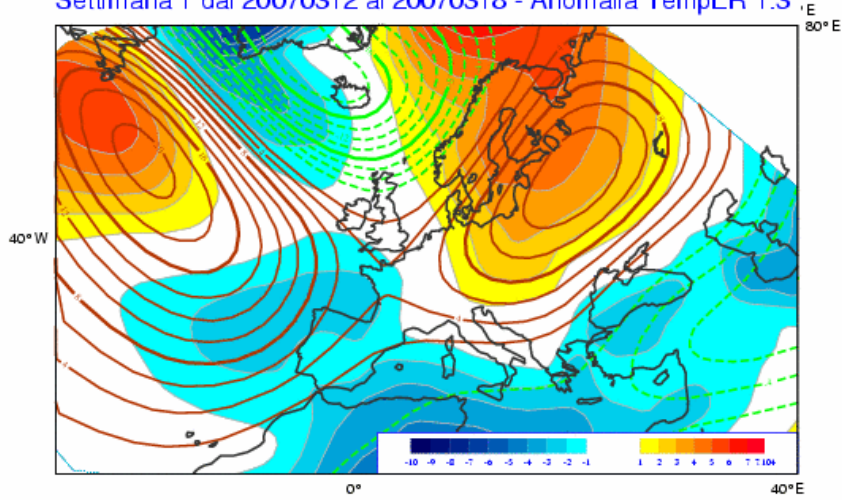


Settimana 4 dal 20070402 al 20070408

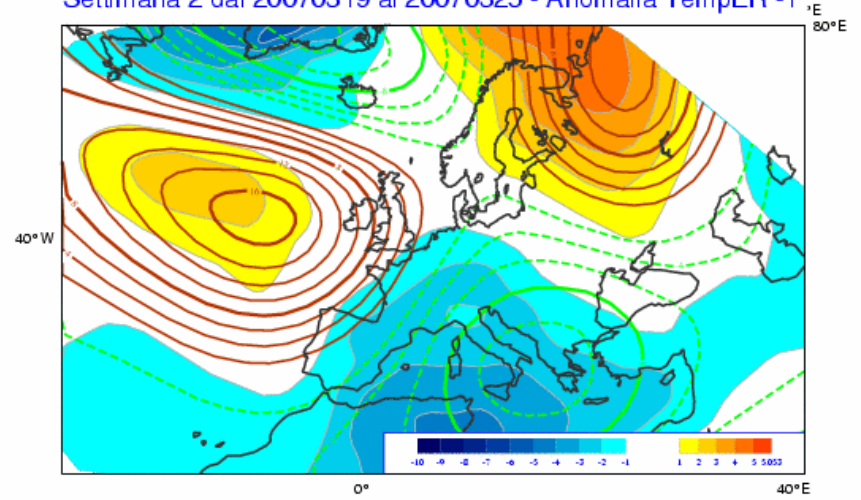


Giovedì 08 03 2007 - Previsioni Mensili ECMWF/ Anomalie settimanali EM Z500 - T850

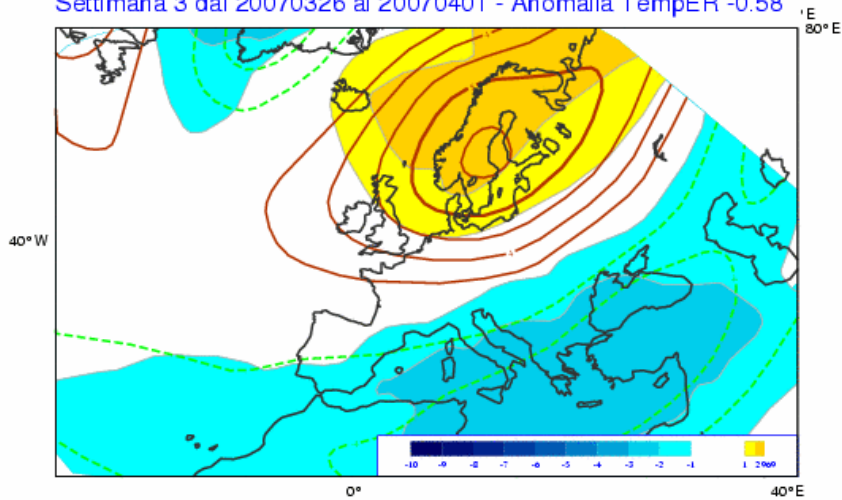
Settimana 1 dal 20070312 al 20070318 - Anomalia TempER 1.3



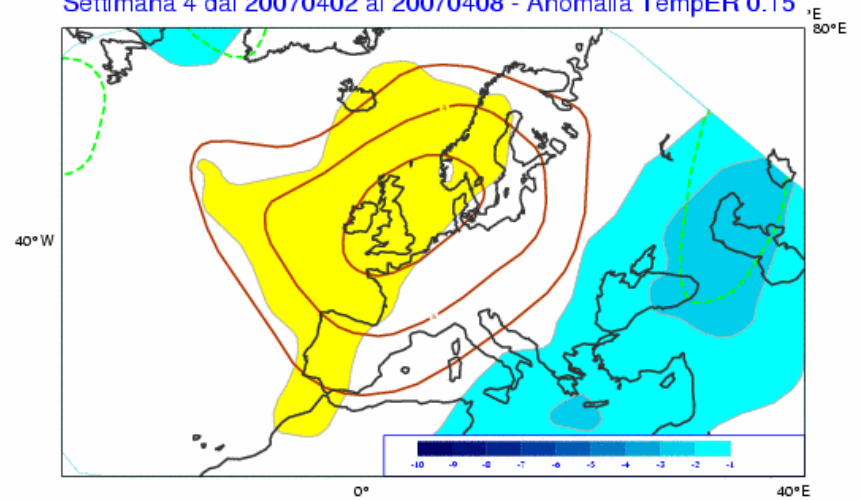
Settimana 2 dal 20070319 al 20070325 - Anomalia TempER -1



Settimana 3 dal 20070326 al 20070401 - Anomalia TempER -0.58

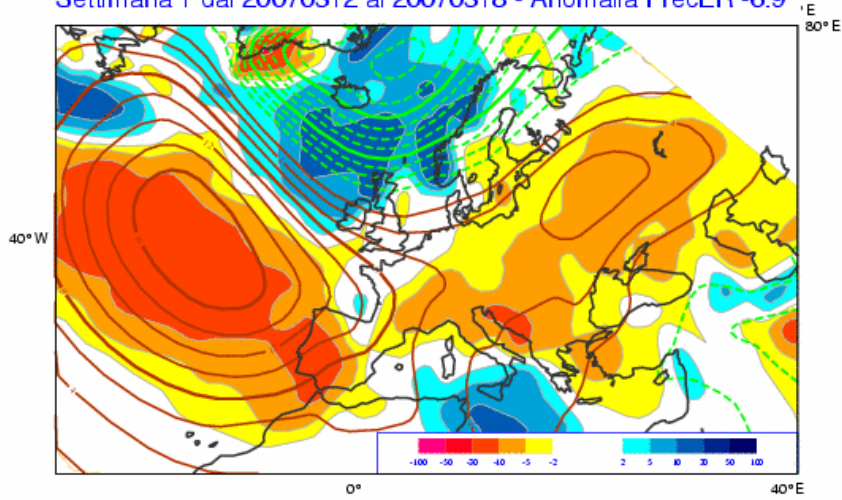


Settimana 4 dal 20070402 al 20070408 - Anomalia TempER 0.15

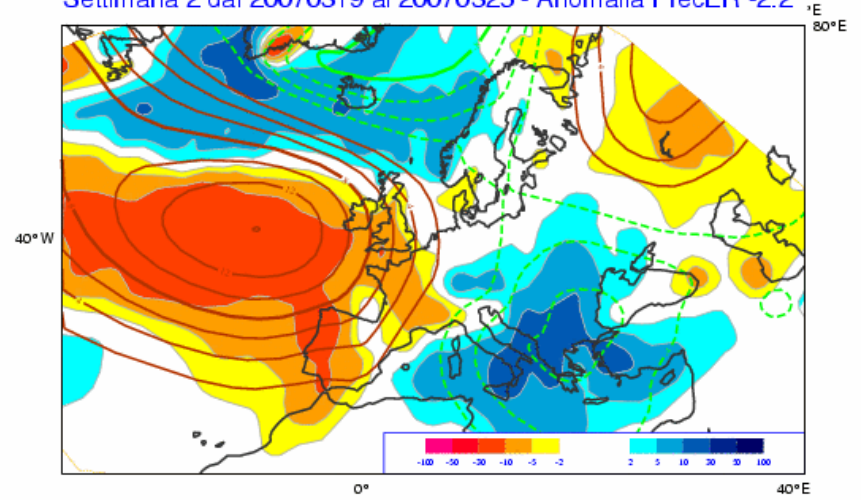


Giovedì 08 03 2007 - Previsioni Mensili ECMWF/ Anomalie settimanali EM MSL - TP

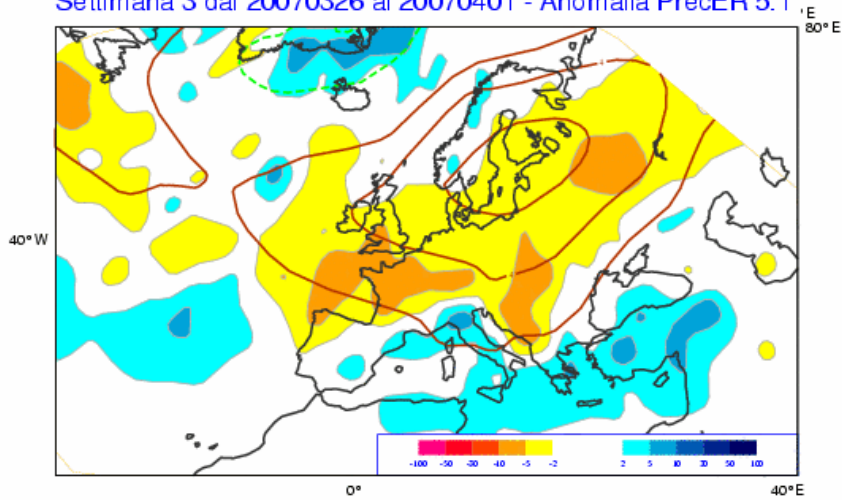
Settimana 1 dal 20070312 al 20070318 - Anomalia PrecER -6.9



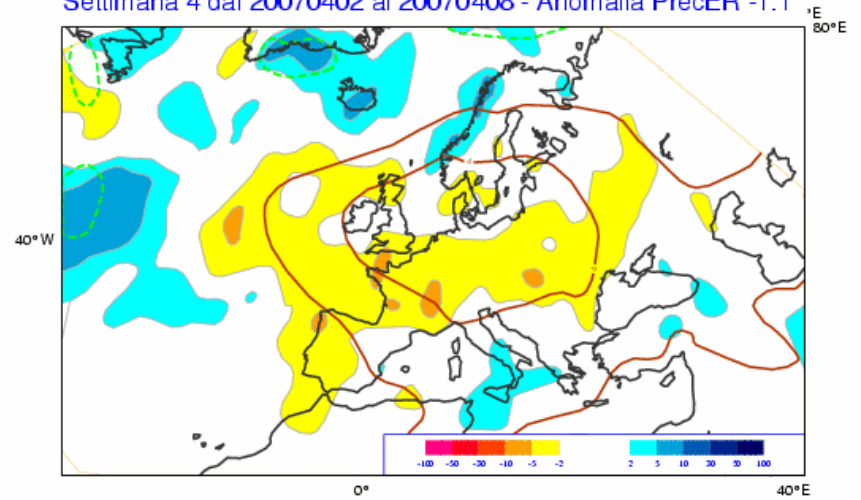
Settimana 2 dal 20070319 al 20070325 - Anomalia PrecER -2.2



Settimana 3 dal 20070326 al 20070401 - Anomalia PrecER 5.1

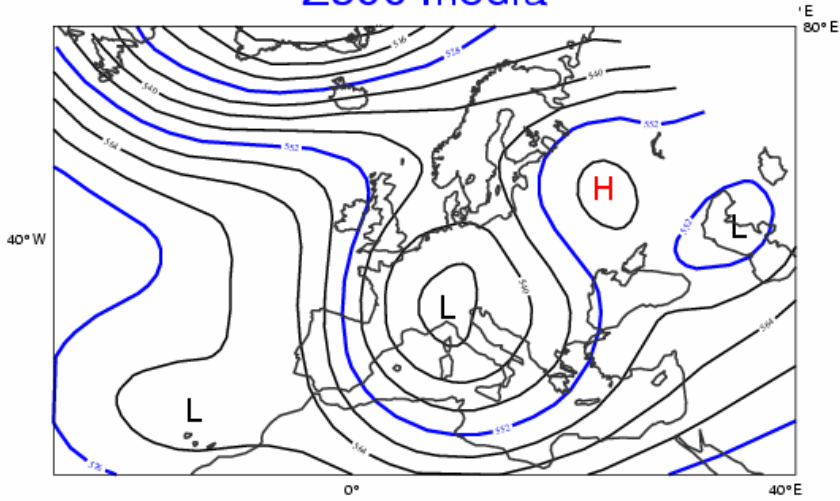


Settimana 4 dal 20070402 al 20070408 - Anomalia PrecER -1.1

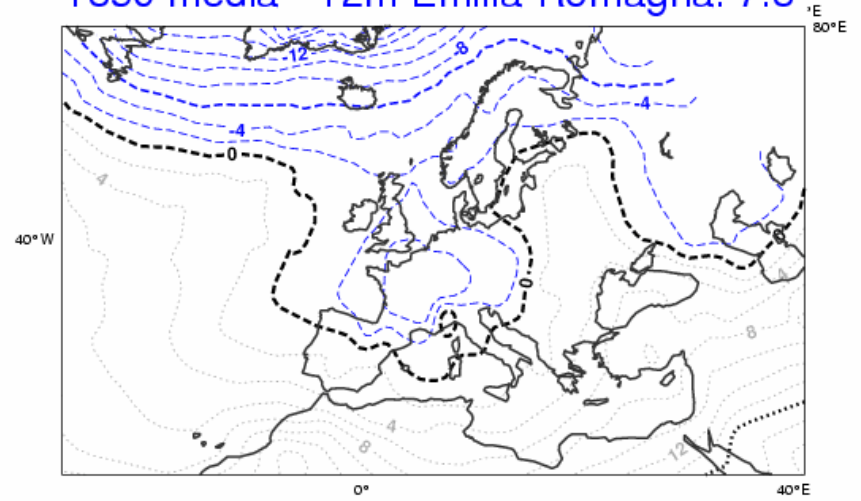


Valori medi osservati dal: 19 03 2007 al 25 03 2007

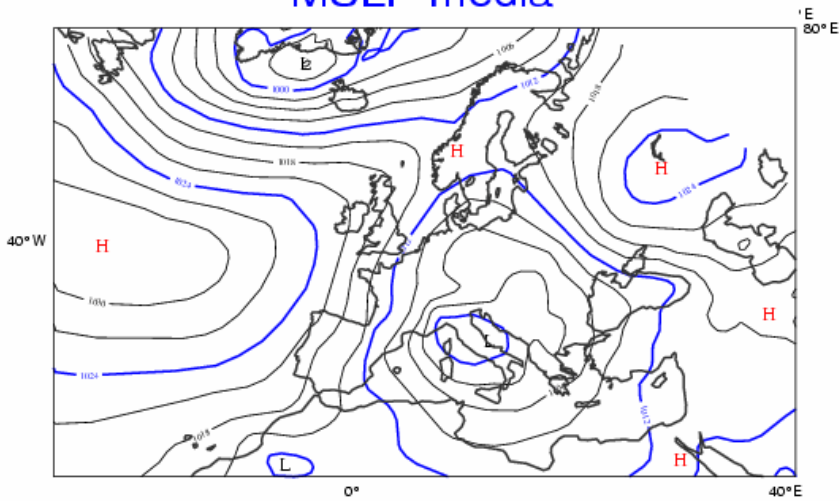
Z500 media



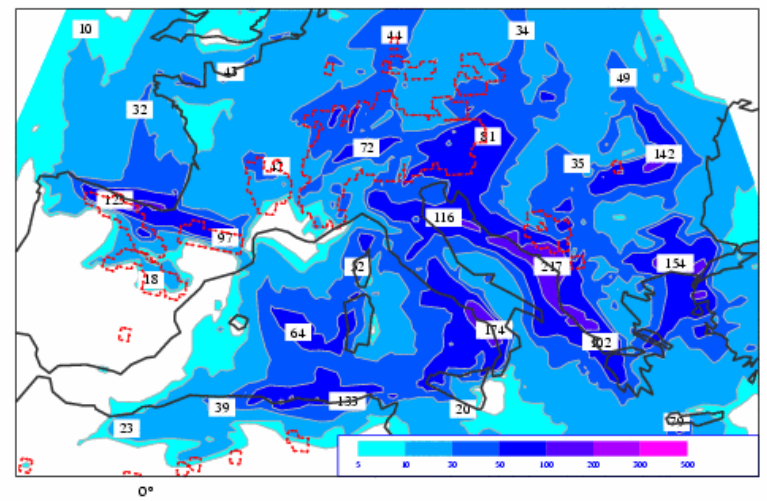
T850 media - T2m Emilia-Romagna: 7.8



MSLP media



Pioggia totale e snowratio - Emilia-Romagna: 43 mm/7 giorni

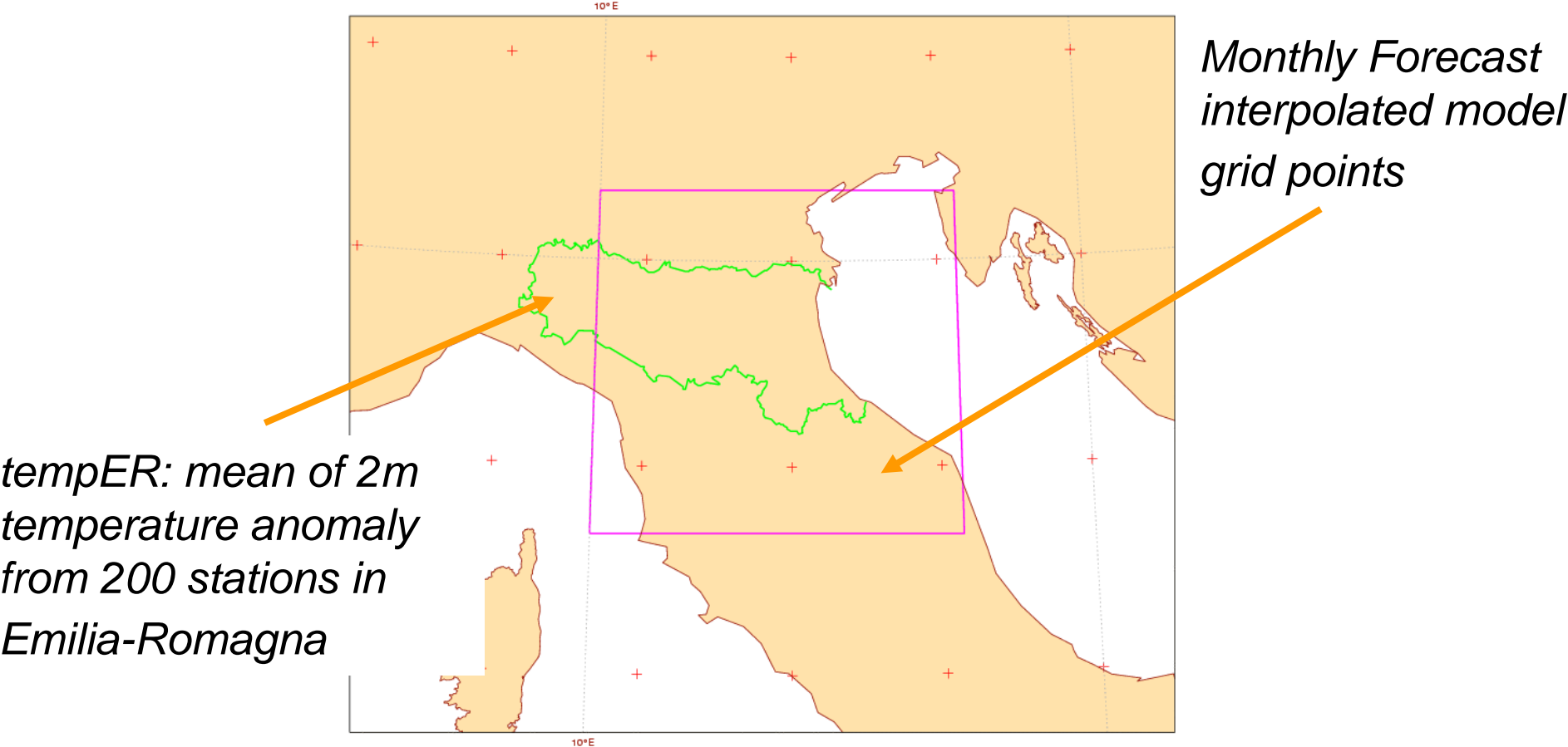


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*Deterministic Verification of MF against a temperature index of Emilia-Romagna region tempER\**

*\*V. Marletto, [http://www.arpa.emr.it/ia%5Fsiccita/download/Temper\\_un%20nuovo%20indice.pdf](http://www.arpa.emr.it/ia%5Fsiccita/download/Temper_un%20nuovo%20indice.pdf)*

*Correlation between weekly tempER anomaly and MF ensemble mean weekly anomaly in the six model grid points around the region*



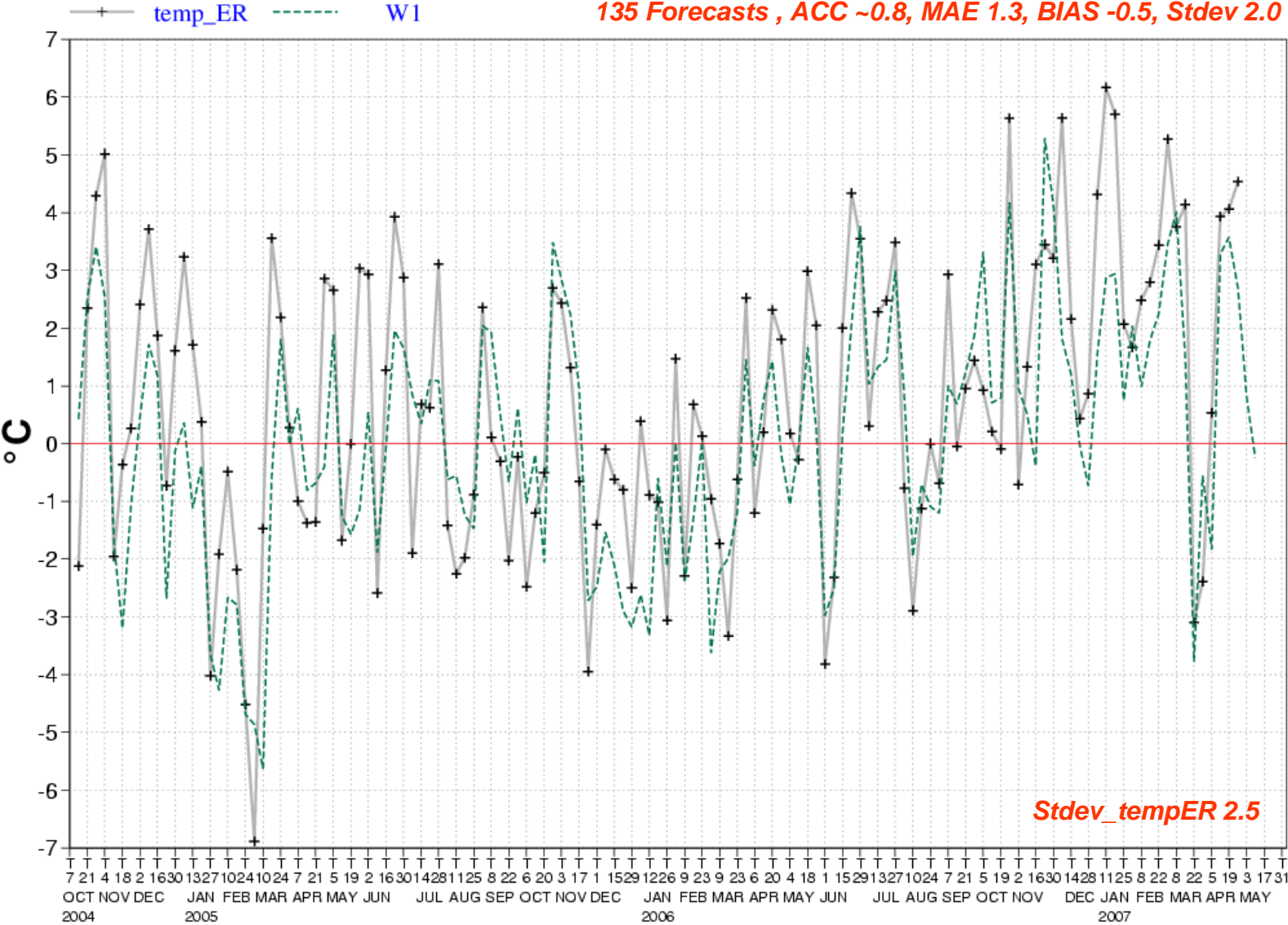
*Monthly Forecast interpolated model grid points*

*tempER: mean of 2m temperature anomaly from 200 stations in Emilia-Romagna*



# Weekly anomalies of tempER and monthly forecast

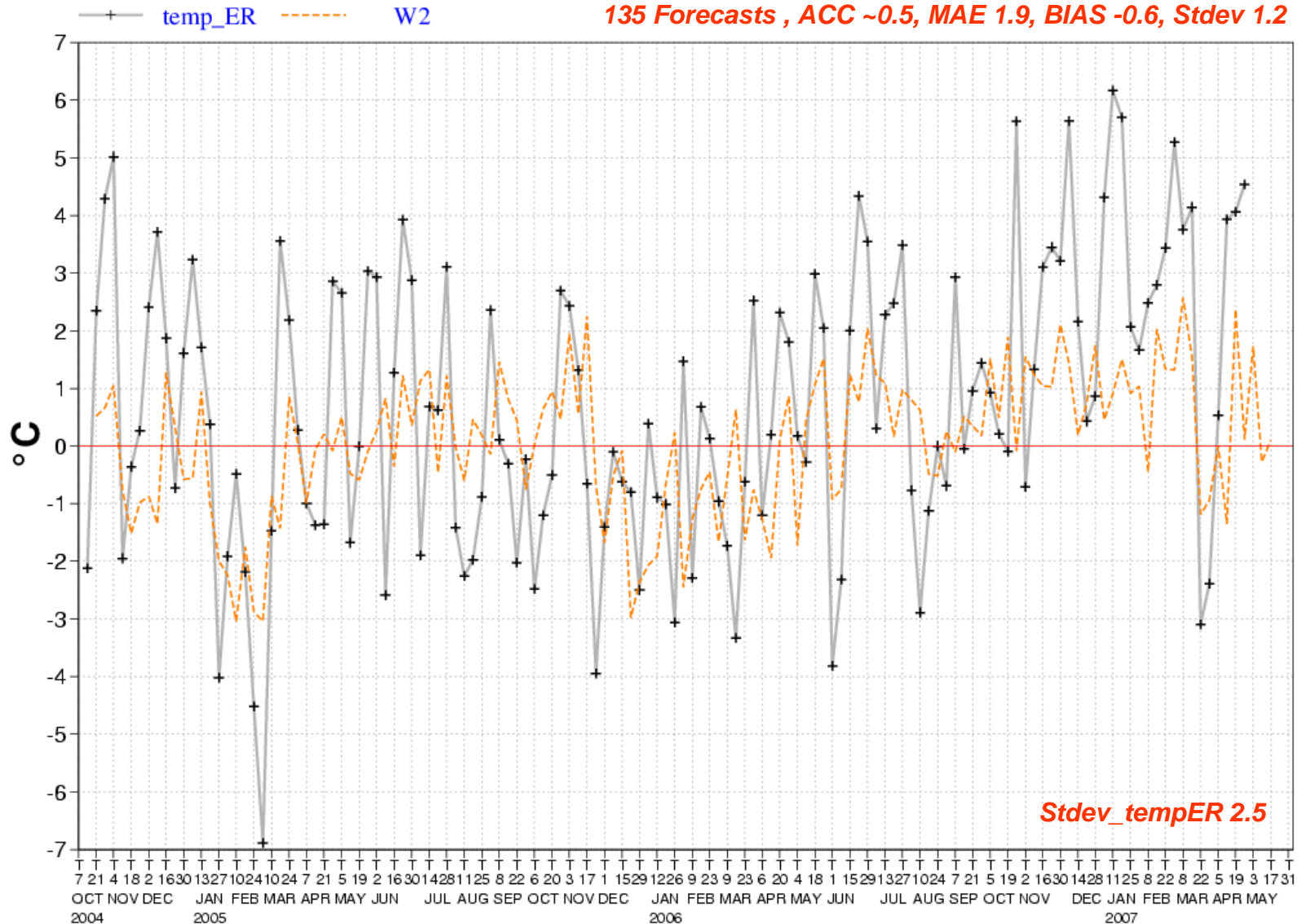
135 Forecasts , ACC ~0.8, MAE 1.3, BIAS -0.5, Stdev 2.0



DATE

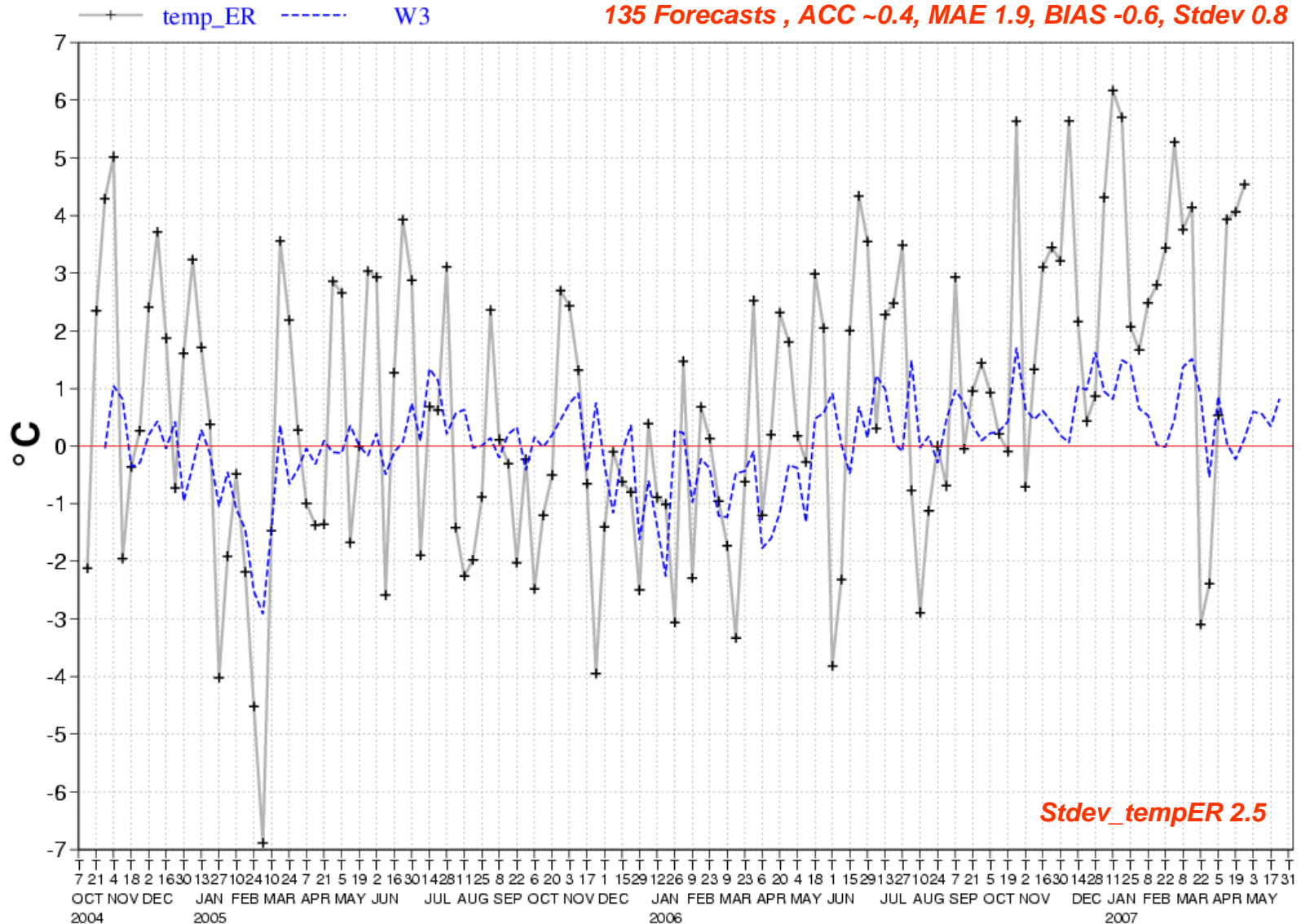
# Weekly anomalies of tempER and monthly forecast

135 Forecasts , ACC ~0.5, MAE 1.9, BIAS -0.6, Stdev 1.2



# Weekly anomalies of tempER and monthly forecast

135 Forecasts , ACC ~0.4, MAE 1.9, BIAS -0.6, Stdev 0.8

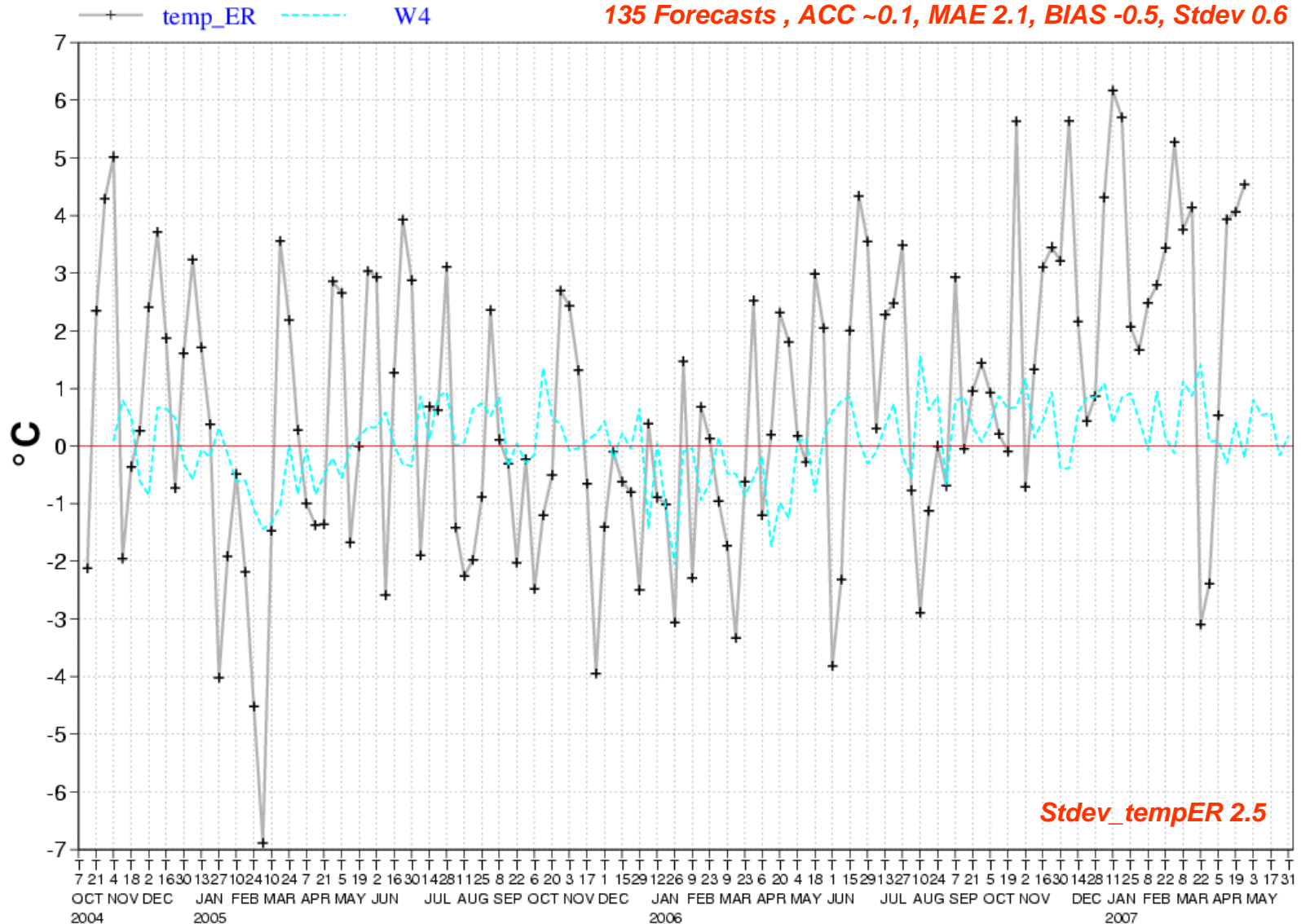


Stdev\_tempER 2.5

DATE

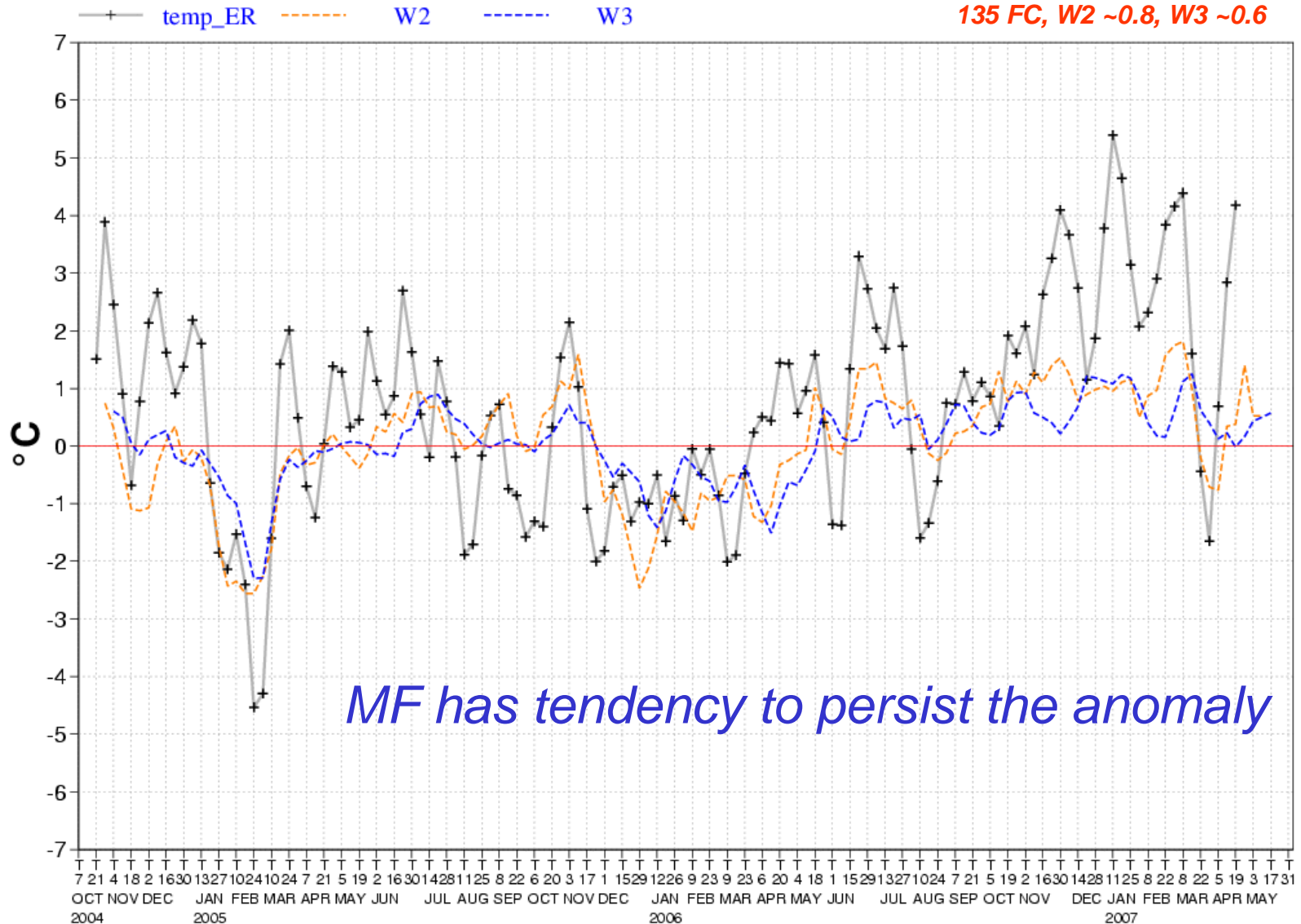
# Weekly anomalies of tempER and monthly forecast

135 Forecasts , ACC ~0.1, MAE 2.1, BIAS -0.5, Stdev 0.6



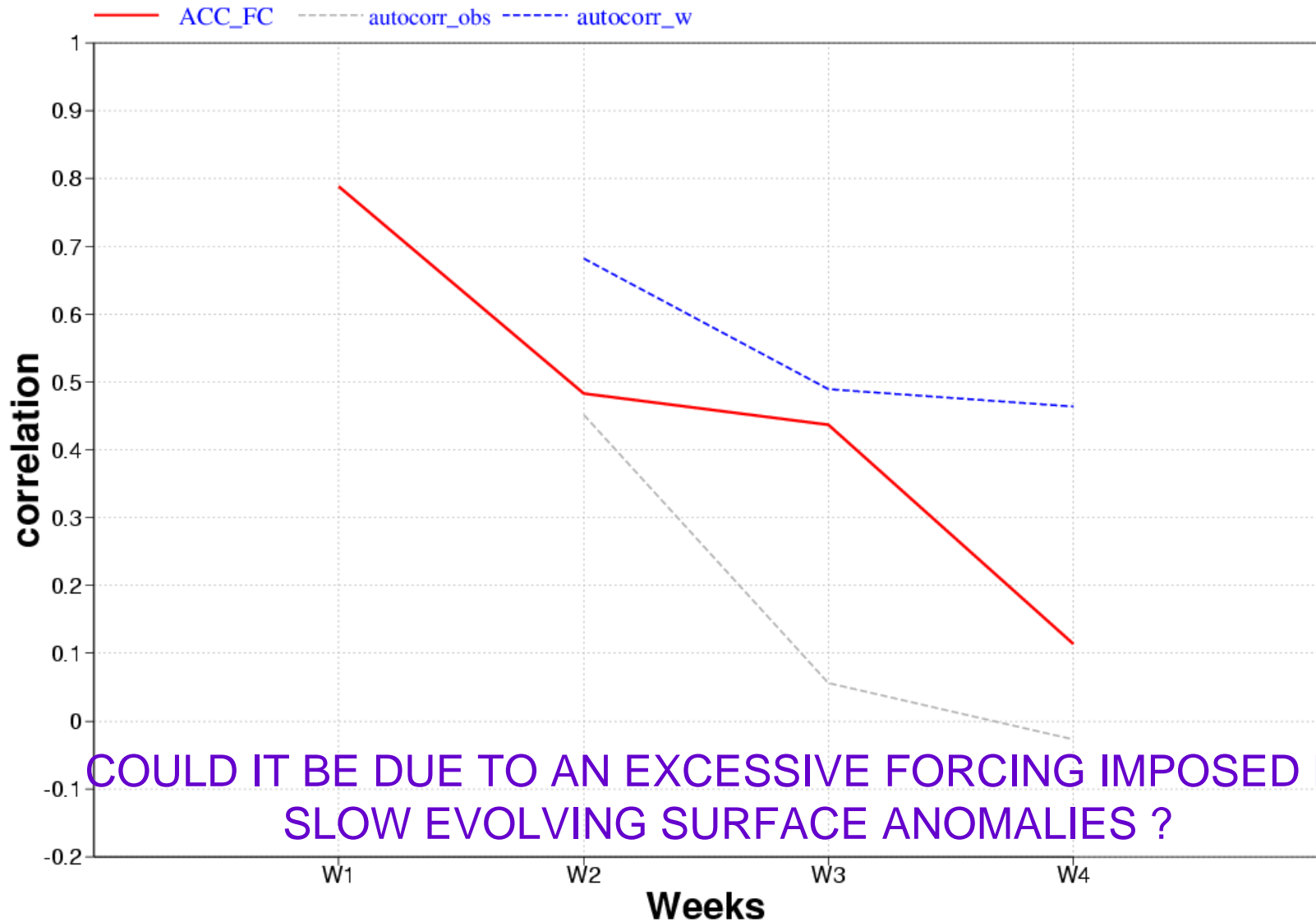
# Weekly anomalies of tempER and monthly forecast (3 weeks filter)

135 FC, W2 ~-0.8, W3 ~-0.6



# STRONG AUTOCORRELATION IN THE FORECAST

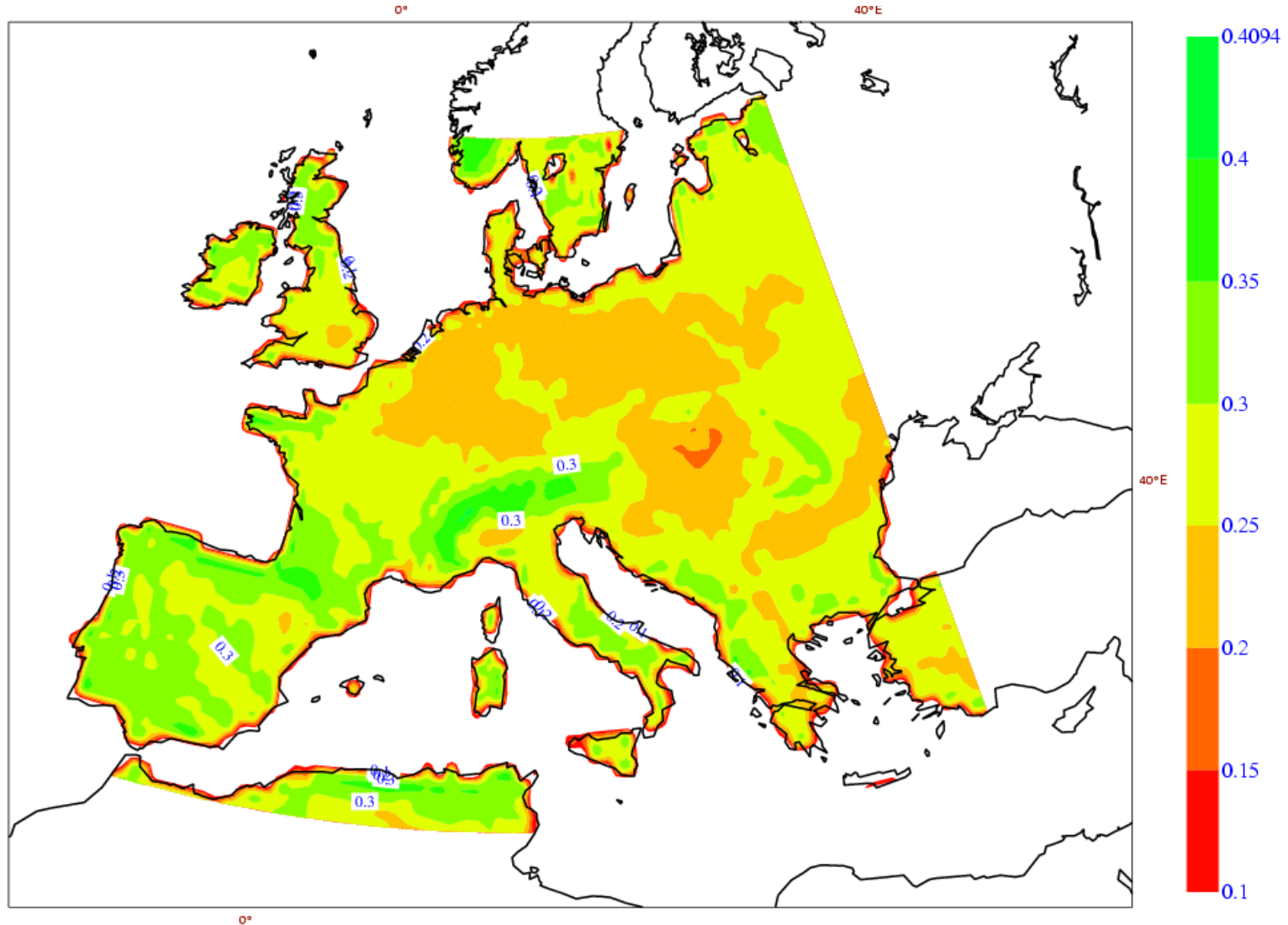
20041007 - 20070503 n fc : 135



COULD IT BE DUE TO AN EXCESSIVE FORCING IMPOSED BY SLOW EVOLVING SURFACE ANOMALIES ?

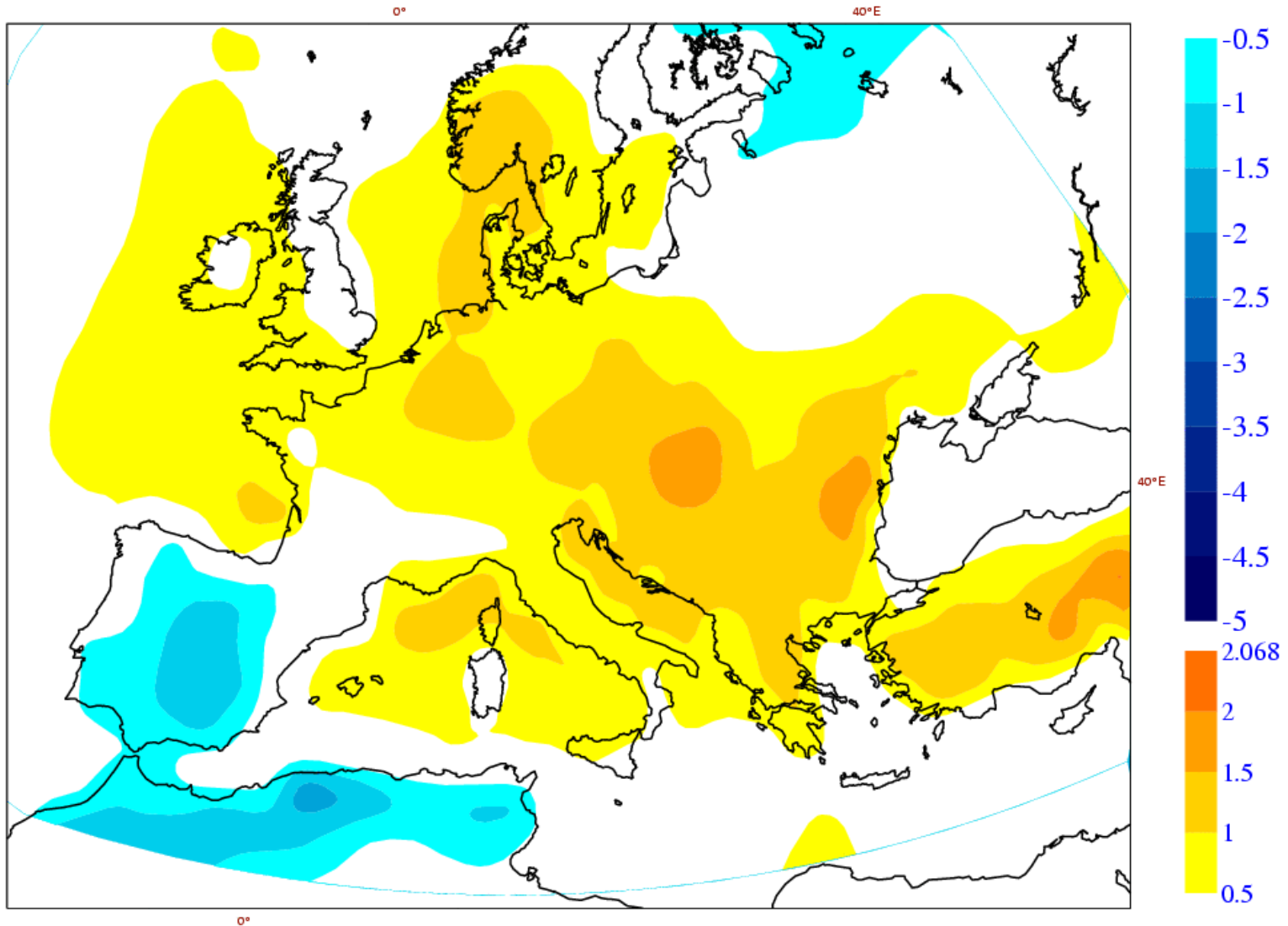
# THE EFFECT OF SOIL WETNESS

ECMWF Analysis VT:Thursday 3 May 2007 00UTC Surface: *Volumetric soil water content (L1+L2+L3)*

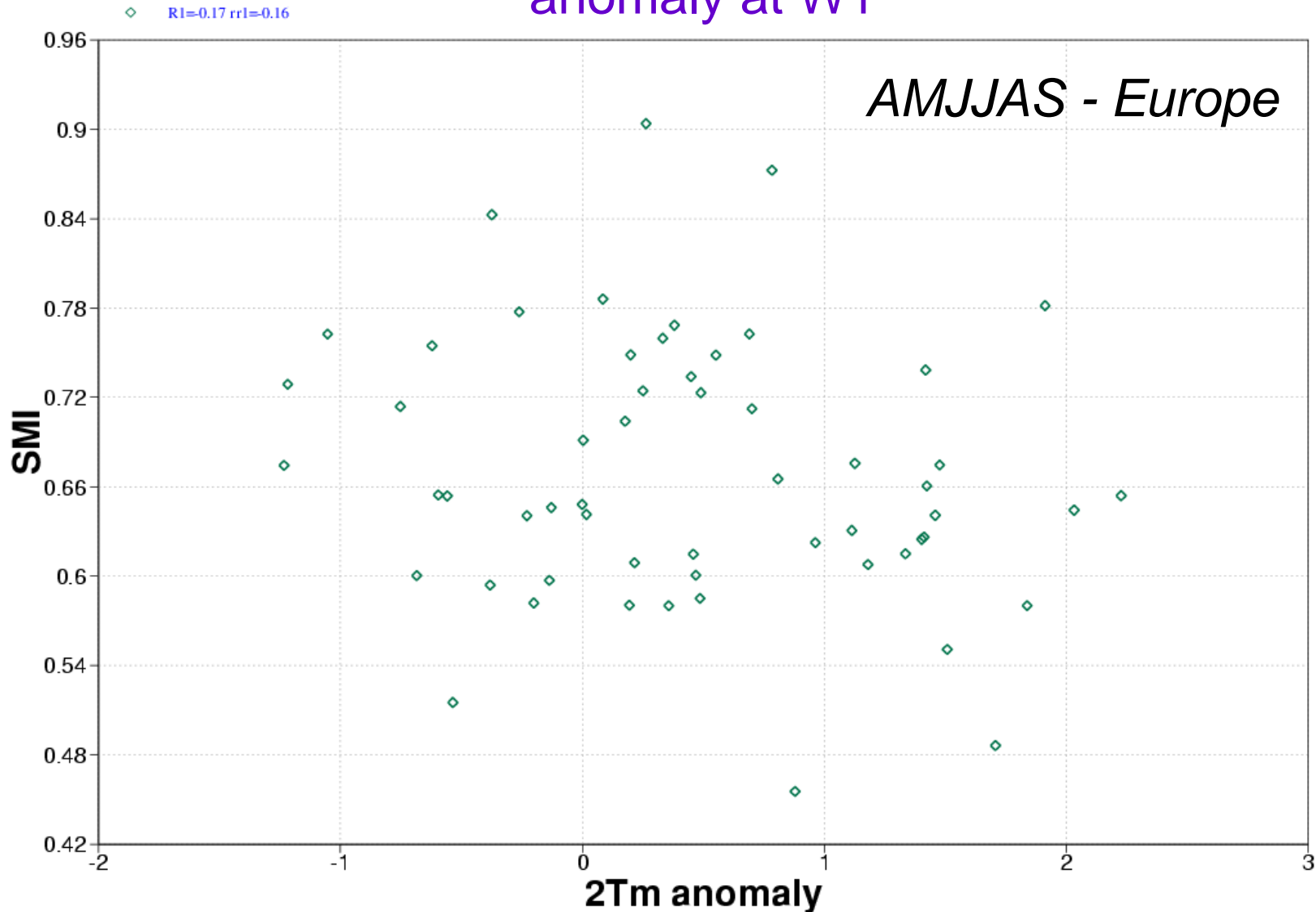


# W3 forecast of 2mT anomaly from 03/05/2007 MF run

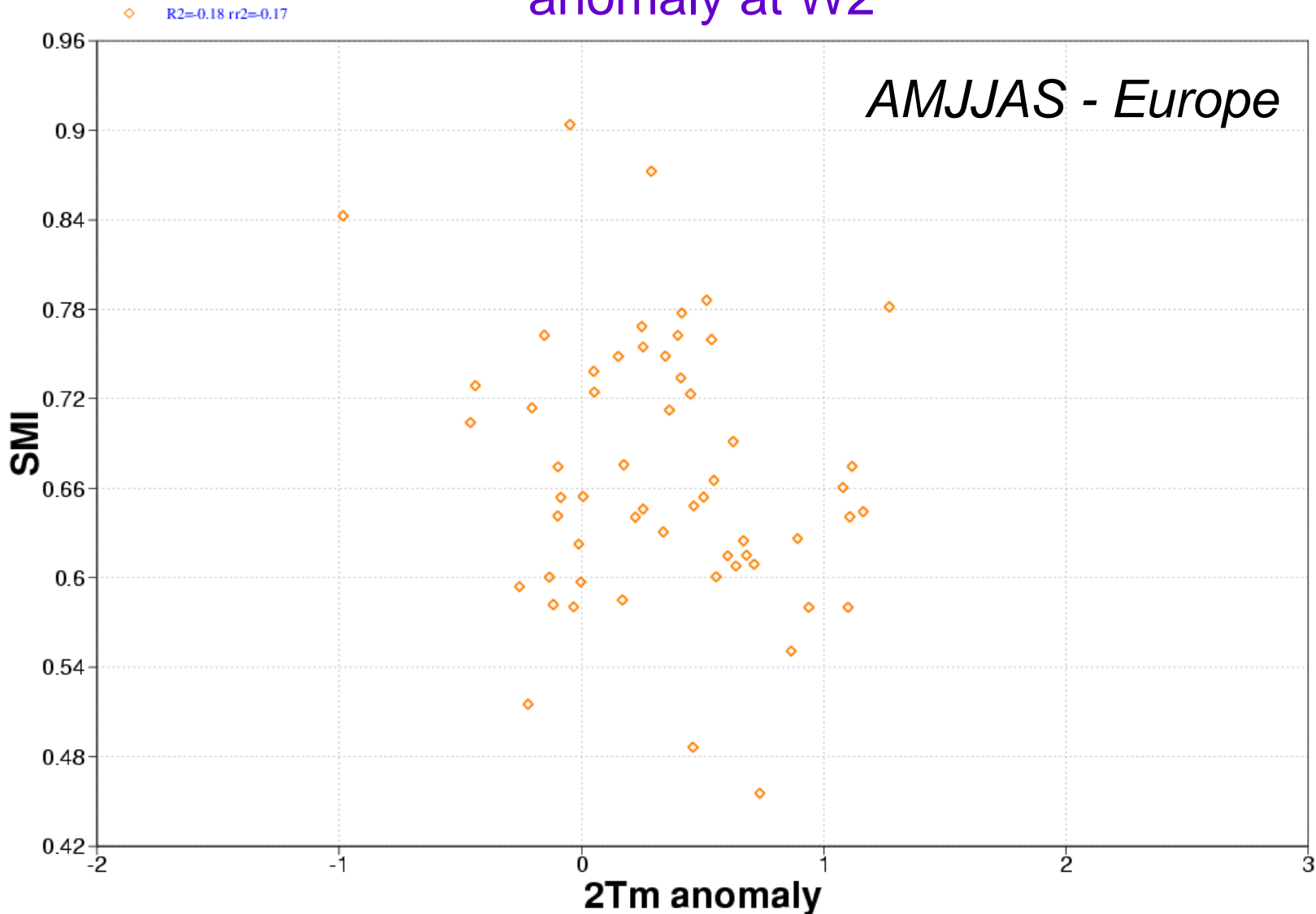
3 May 2007 19UTC ECMWF Time-range Indicator not yet implemented t+ VT: 31 May 2007 Surface: 2 metre temperature/Surf: 2 metre temp



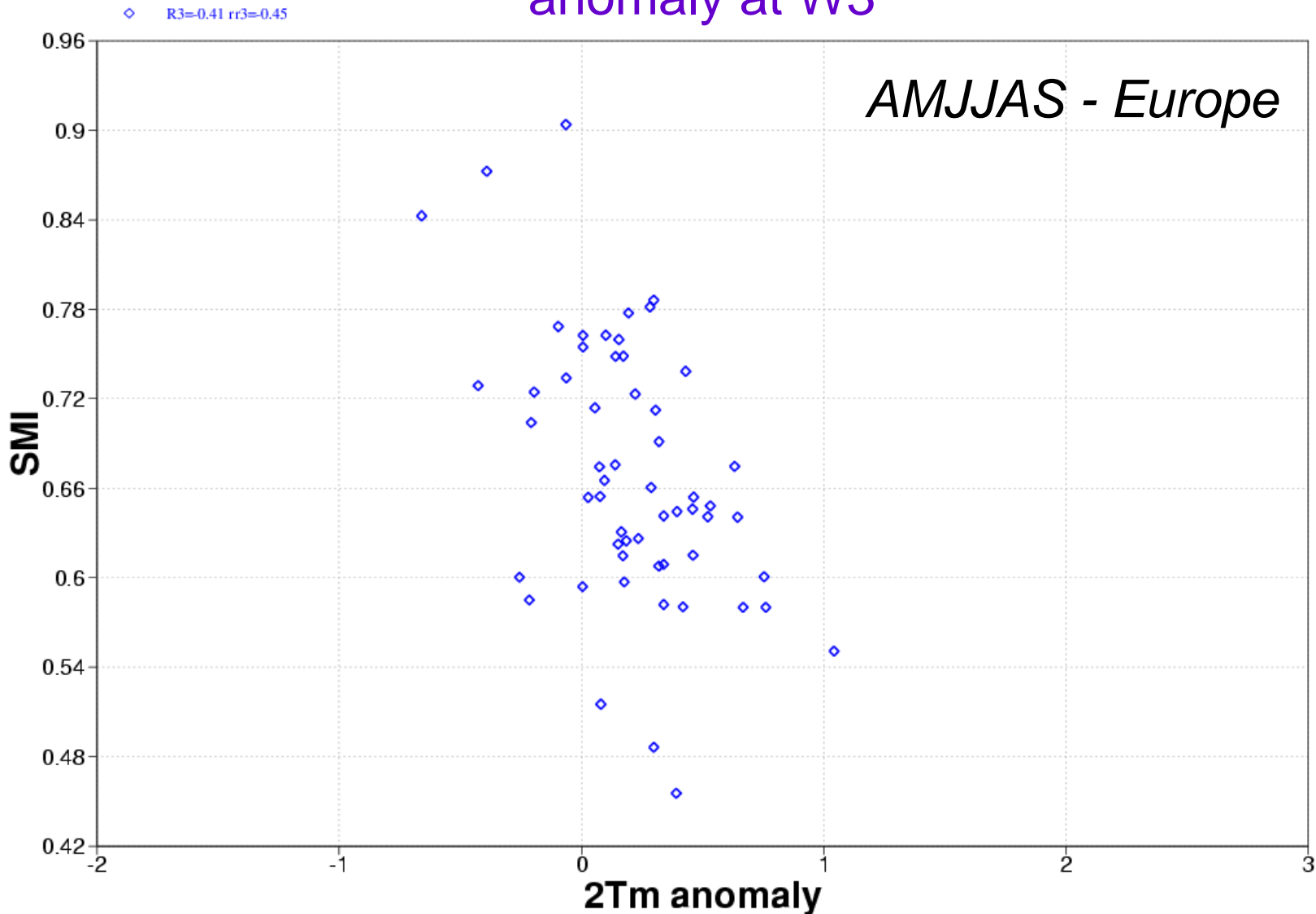
# Correlation between soil water content (SMI\*) in the initial condition and 2m temperature ensemble mean anomaly at W1



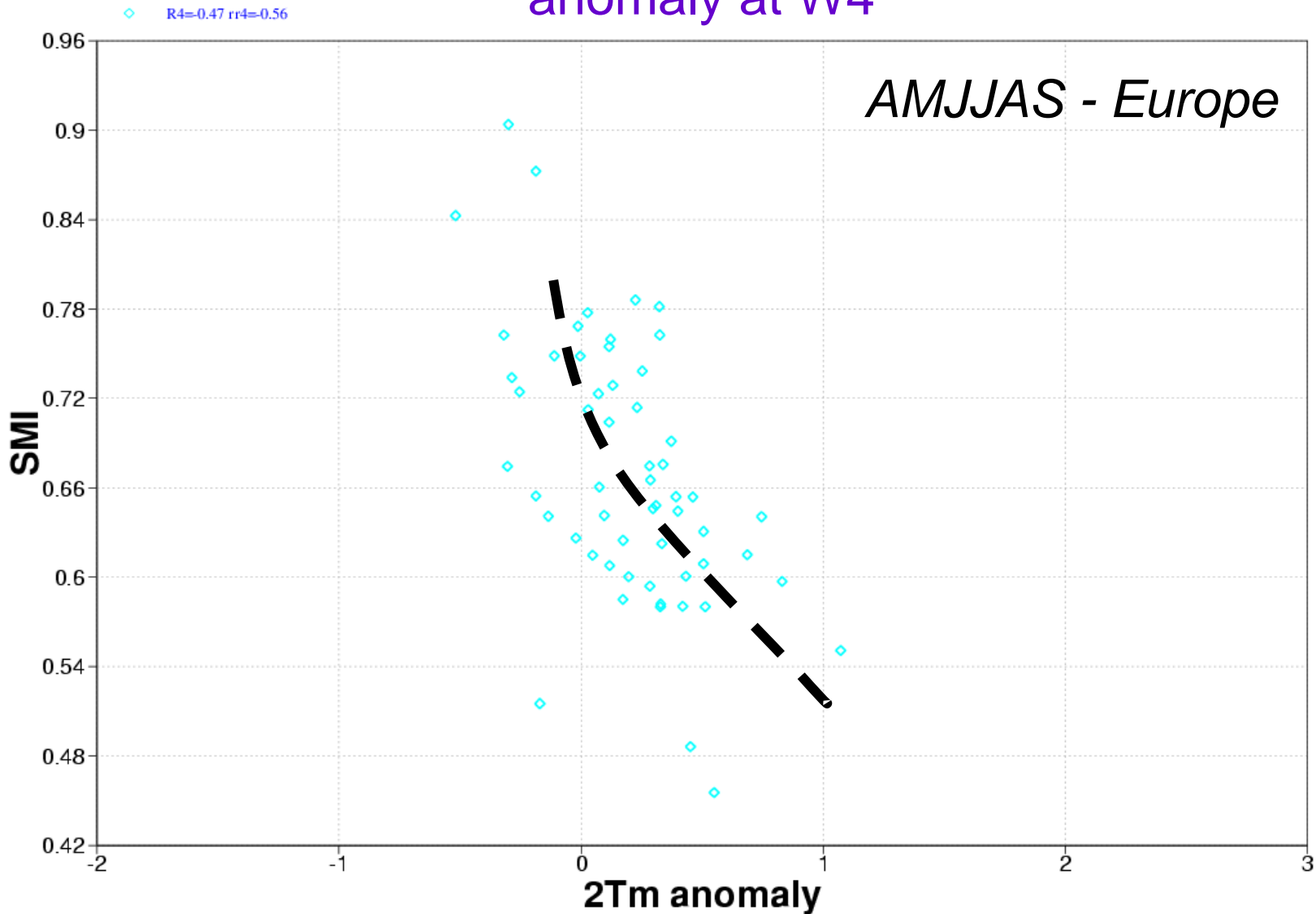
# Correlation between soil water content (SMI) in the initial condition and 2m temperature ensemble mean anomaly at W2



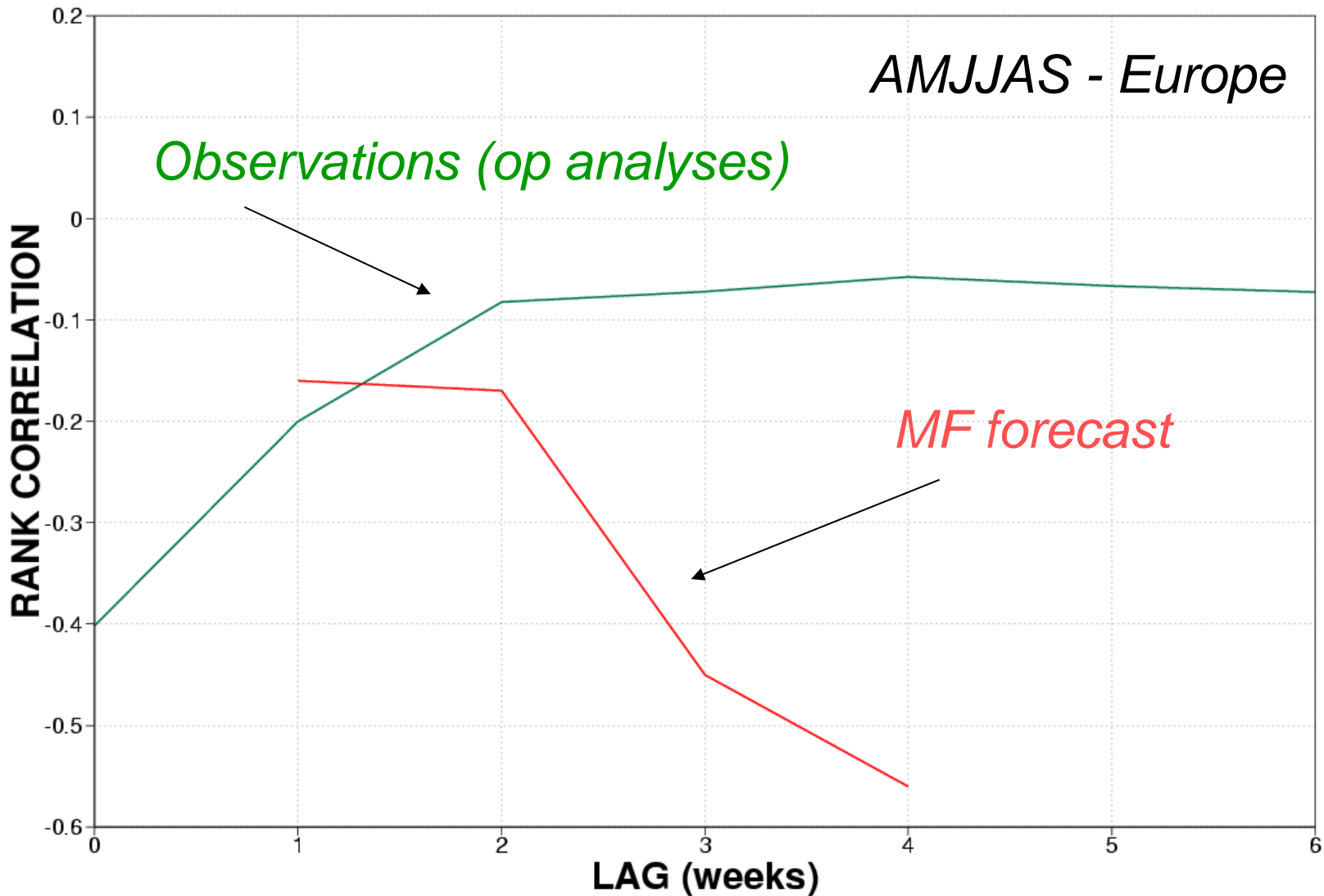
# Correlation between soil water content (SMI) in the initial condition and 2m temperature ensemble mean anomaly at W3



# Correlation between soil water content (SMI) in the initial condition and 2m temperature ensemble mean anomaly at W4



# Rank correlation between SMI at week 0 (initial conditions) and 2mT anomaly at different time lag



# Summary

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- We think that such a system it is useful and could help to address the growing demand of forecasts ranging from a week to a months. The impact of forecasts at even longer ranges at the moment is smaller.
- Quantitatively the monthly forecast produces useful outlooks over our region up to 12-18 days with a skill (for 2mT anomaly) better than persistence. Kalman filtering could increase the skill even further removing the systematic error.
- Beyond week 2 atmospheric predictability reduces drastically, the remaining anomaly signal often seem to be induced by slow varying surface processes that introduces a strong autocorrelation in the forecast. In particular the initial anomaly tend to persist (excessively ?) through the forecast. Is it because the feedback with the soil is too strong especially at low values of water content ?
- What about at longer ranges like seasonal forecast ? The introduction of perturbations in the soil might be useful to avoid the system drifting (especially in summer) towards a dry “eigenstate”.