



Universitat  
de les  
Illes Balears

Final meeting  
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Rome, Italy

# **SIM PROJECT-WATERWORKS 2014**

## **SMART IRRIGATION FROM SOIL MOISTURE FORECAST USING SATELLITE AND HYDROMETEOROLOGICAL MODELLING**

### **WP4: Meteorological forecast**



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# Goals and problematic

- WP4 aims at providing **quantitative meteorological forecasts** (QPFs) from Limited Area Models (LAMs) for each test site
- Accurate numerical prediction of weather is challenging. Especially, for precipitation.
- The atmosphere is a nonlinear system
- Imperfect representation of atmospheric processes: convection, PBL, land physics and moist microphysics
- Misrepresentation of the initial atmospheric state
- Errors can grow fast during the forecast for convective episodes

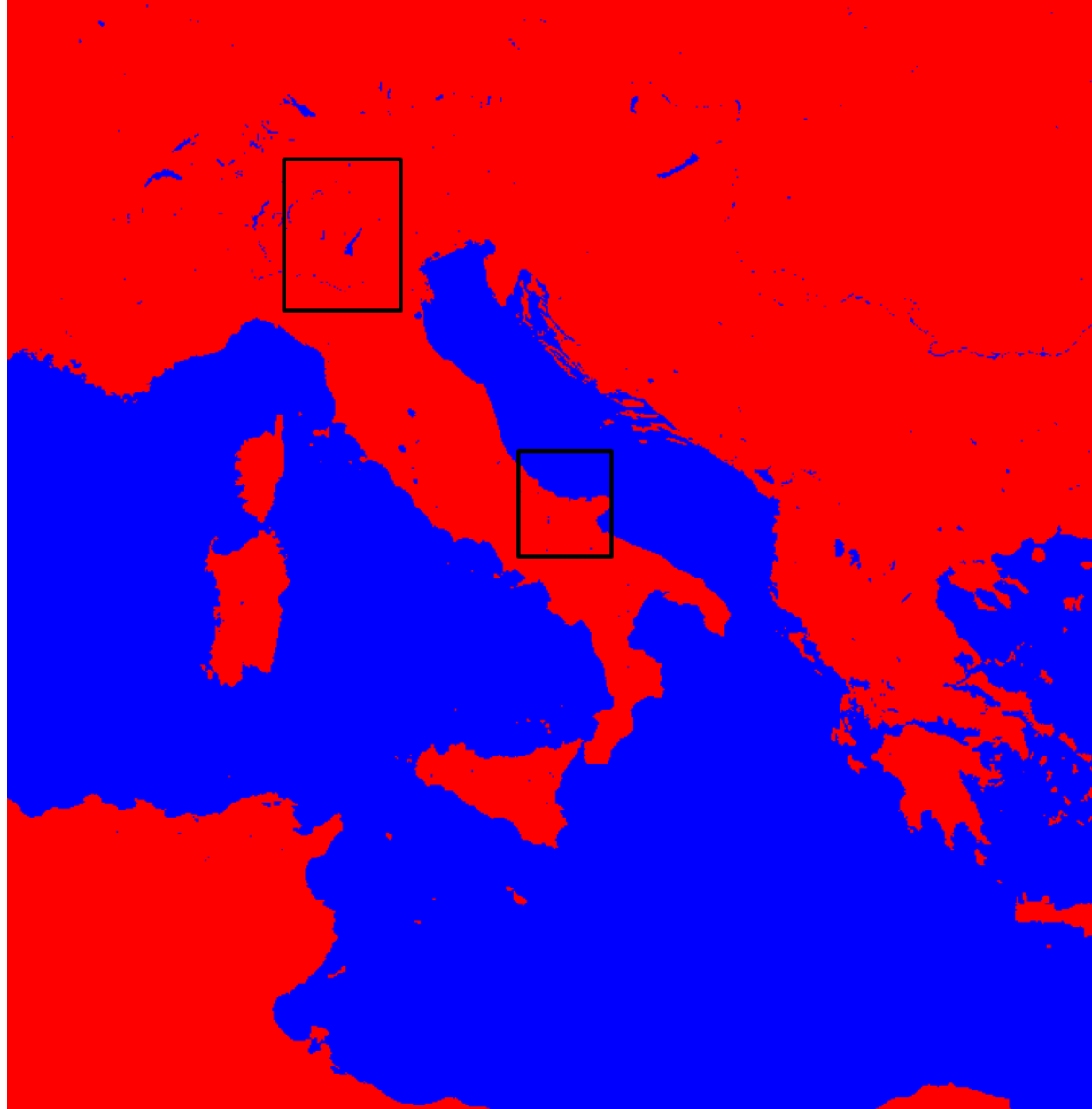
# Addressing uncertainties in the forecasting process

- Advanced **Ensemble Prediction Systems (EPSs)** aim at forecasting the probability of weather events as accurately as possible. Sample and propagate into the hydrometeorological forecast these inherent inaccuracies
- Physical parameterizations (multiple physics ensemble, **MPS**)  EPSs built on multiple-physics or/and multi-model approaches with the same IC/LBC
- Perturbed IC/LBCs (**PILB**)  sampling the distribution of the plausible atmospheric states. Physical schemes fixed

# Experiments

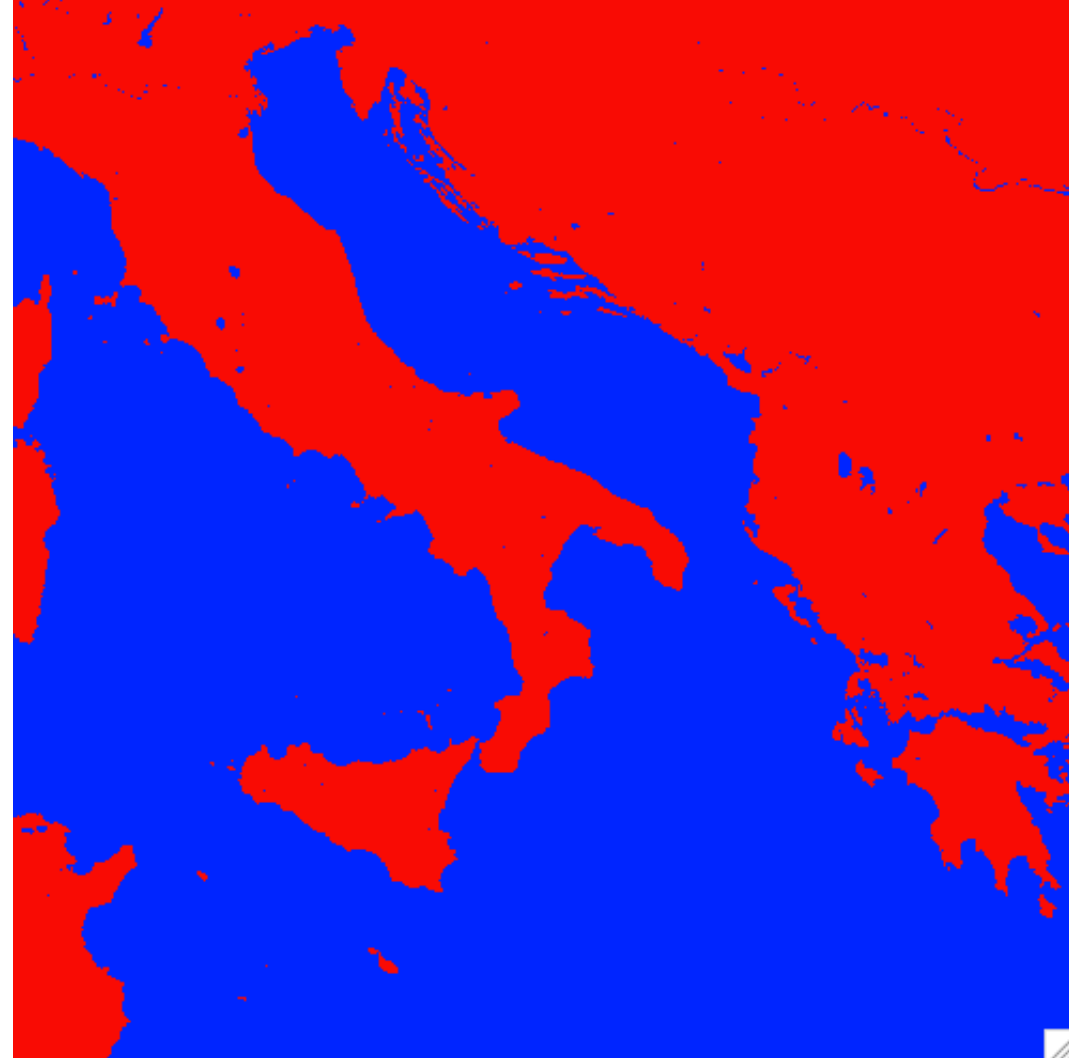
- Deterministic meteorological forecasts produced by:
  1. European Centre for Medium Weather Forecasts (ECMWF) deterministic model
  2. Numerical Weather Research and Forecasting (WRF) model
- Ensemble Prediction System meteorological forecasts produced by:
  1. Global ECMWF-EPS

# ECMWF model domains



# WRF model configuration

- IC/LBCs come from ECMWF
- Physics parameterizations:
  - Microphysics: WRF Single-Moment 6-class scheme
  - Long-wave radiation: RRTM scheme
  - Short-wave radiation: Dudhia scheme
  - Surface layer: Eta similarity
  - Land surface: Noah Land Surface Model
  - PBL: Mellor-Yamada-Janjic scheme

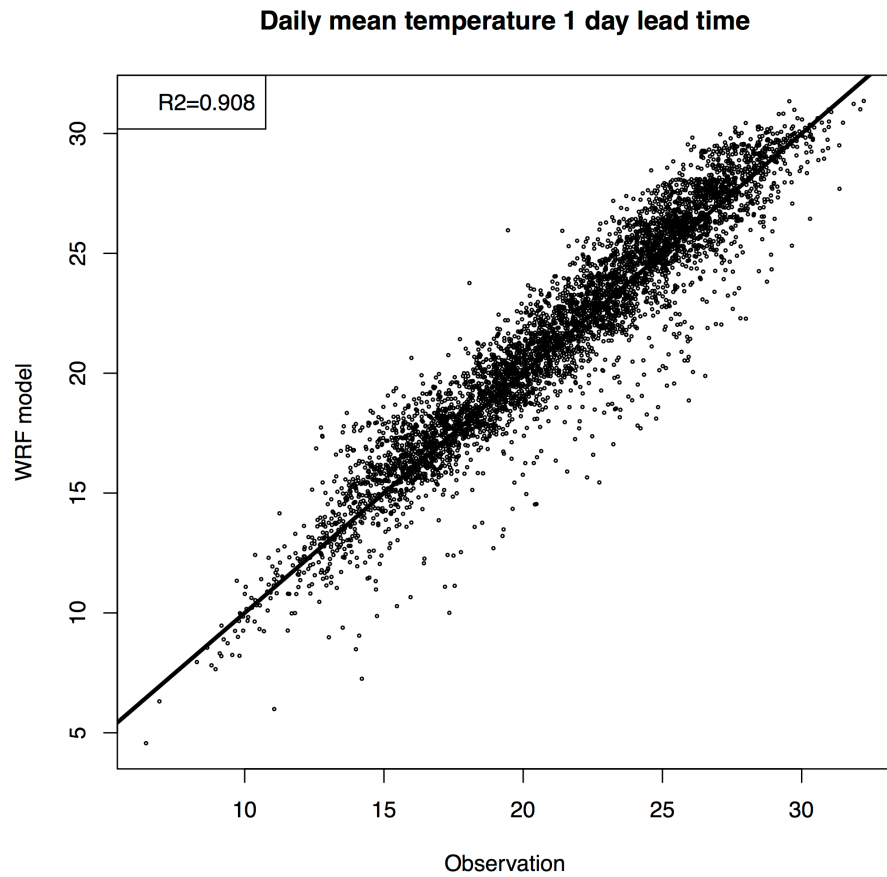


# Meteorological outputs

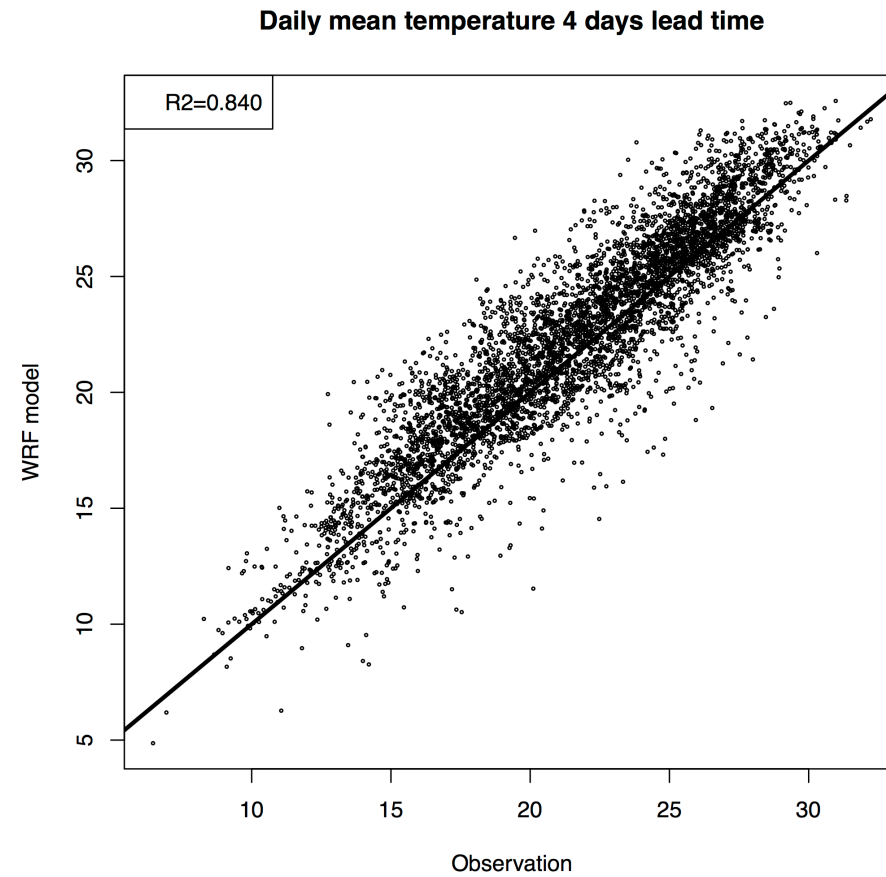
- Accumulated precipitation
- 2-m temperature
- 2-m relative humidity
- 10-m wind speed
- Incoming surface radiation

# Verification of UIB forecasts

- Deterministic WRF forecast for Capitanata



Lead time: 1 day



Lead time: 4 days

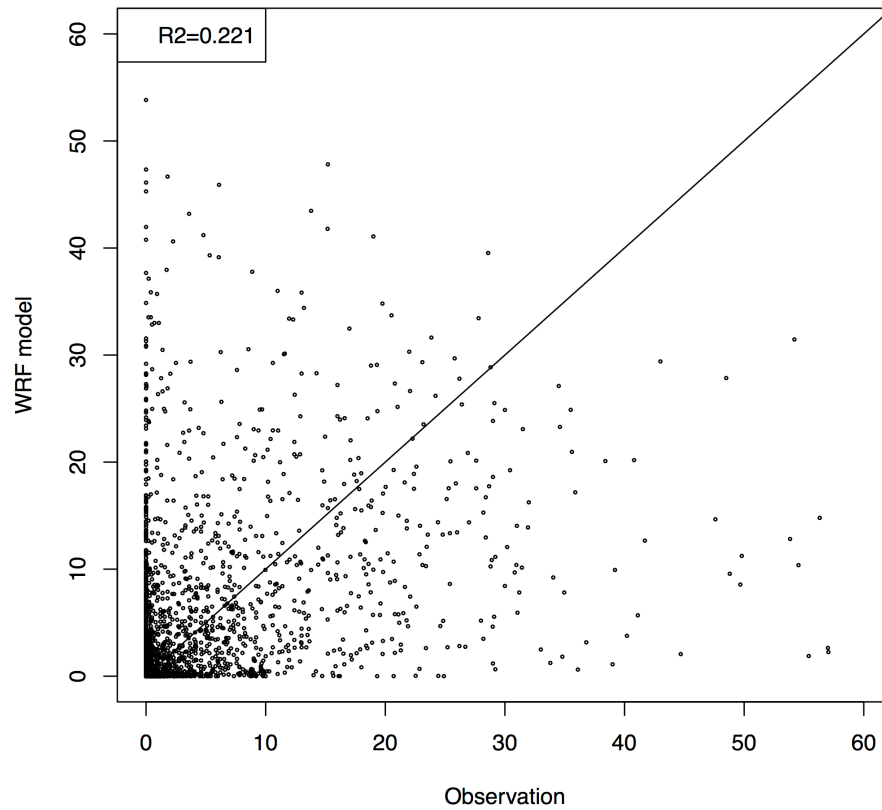
2-metre  
temperature



# Verification of UIB forecasts

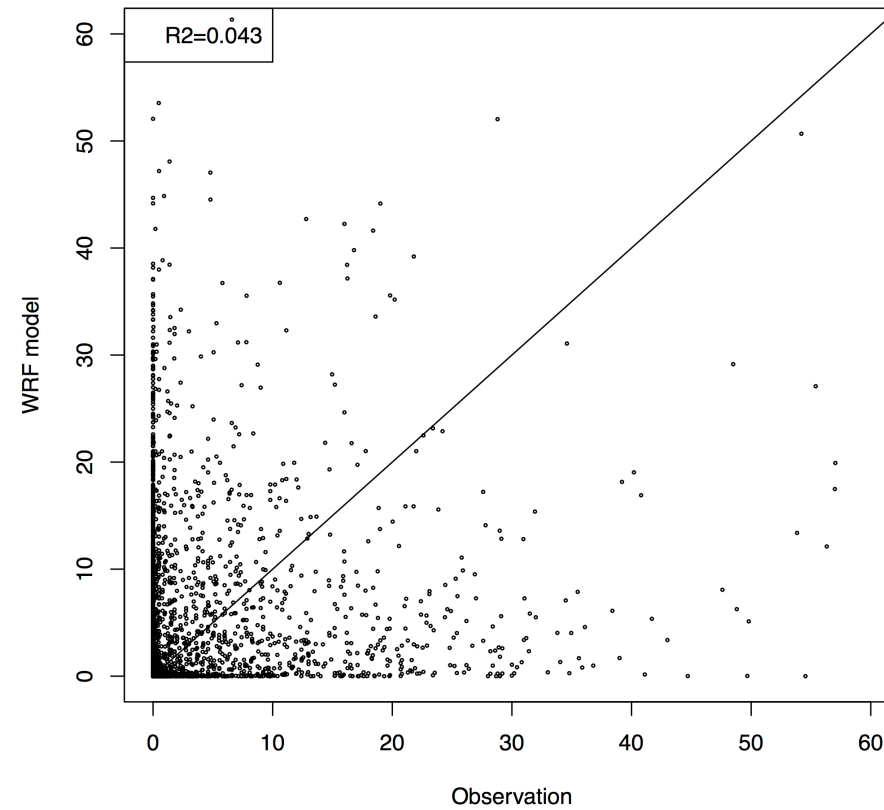
- Deterministic WRF forecast for Capitanata

Daily accumulated preipitation 1 day lead time



Lead time: 1 day

Daily accumulated preipitation 4 days lead time

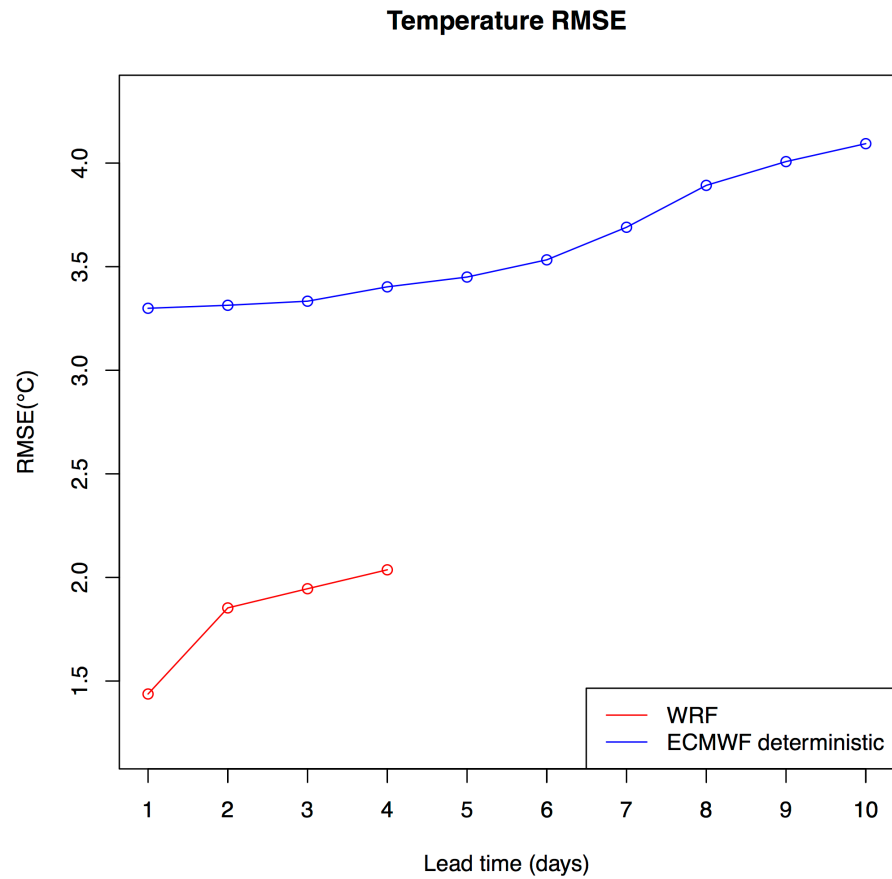


Lead time: 4 days

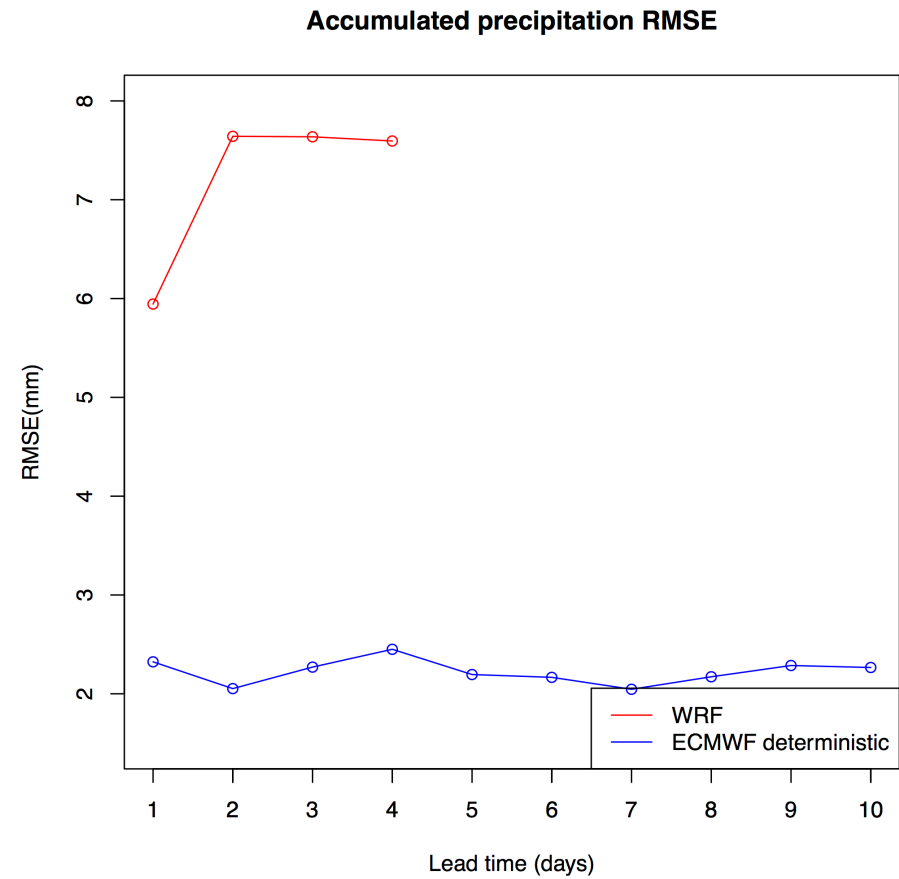
Daily  
precipitation

# Verification of UIB forecasts

- RMSE Deterministic WRF forecast for Capitanata



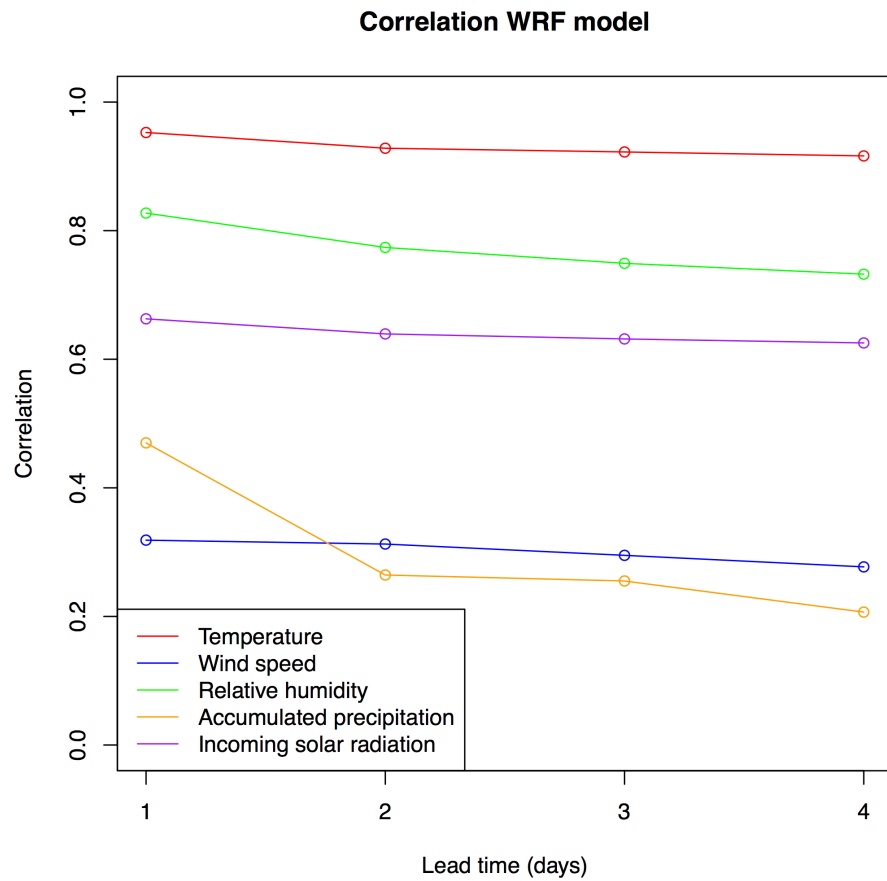
2-metre temperature



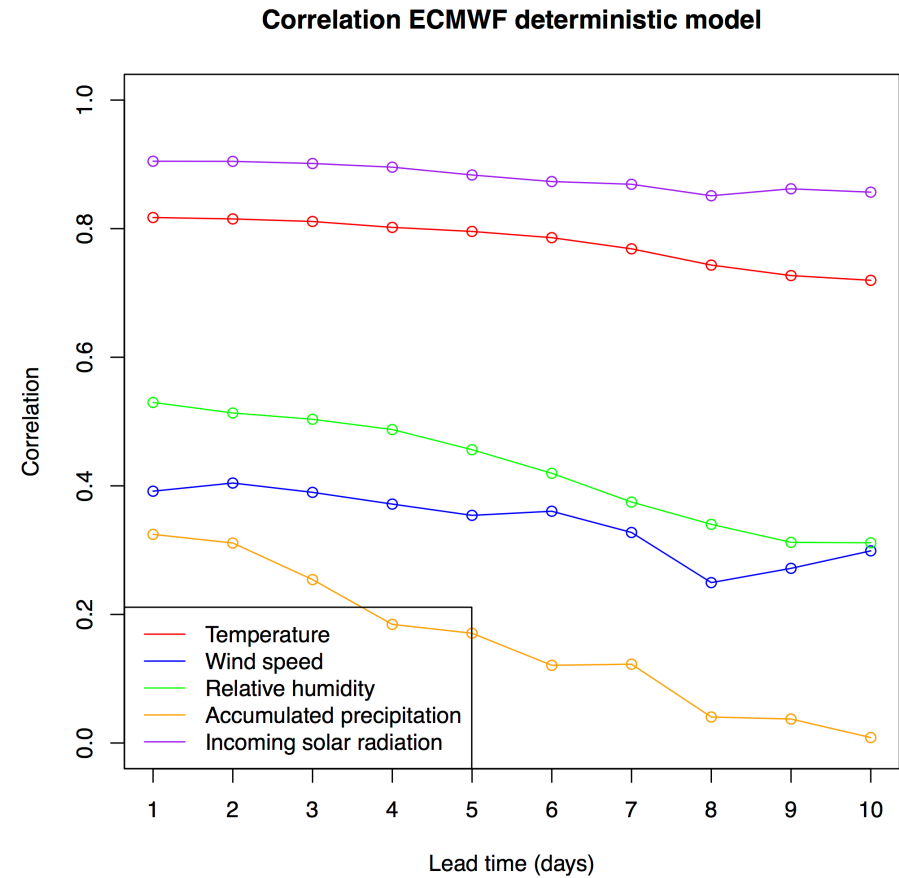
Daily precipitation

# Verification of UIB forecasts

- Correlation Deterministic forecast for Capitanata



WRF

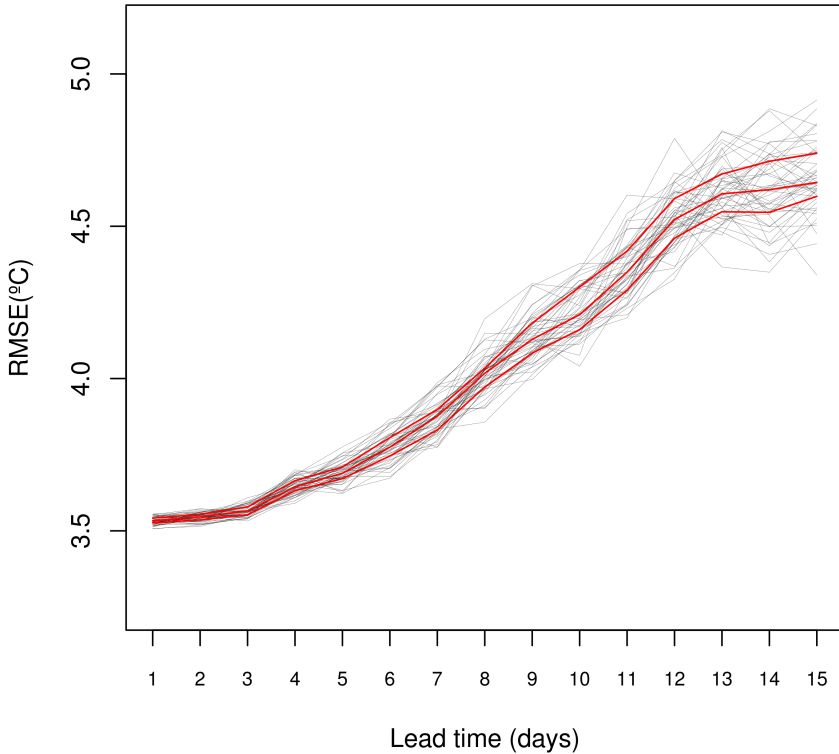


ECMWF

# Verification of UIB forecasts

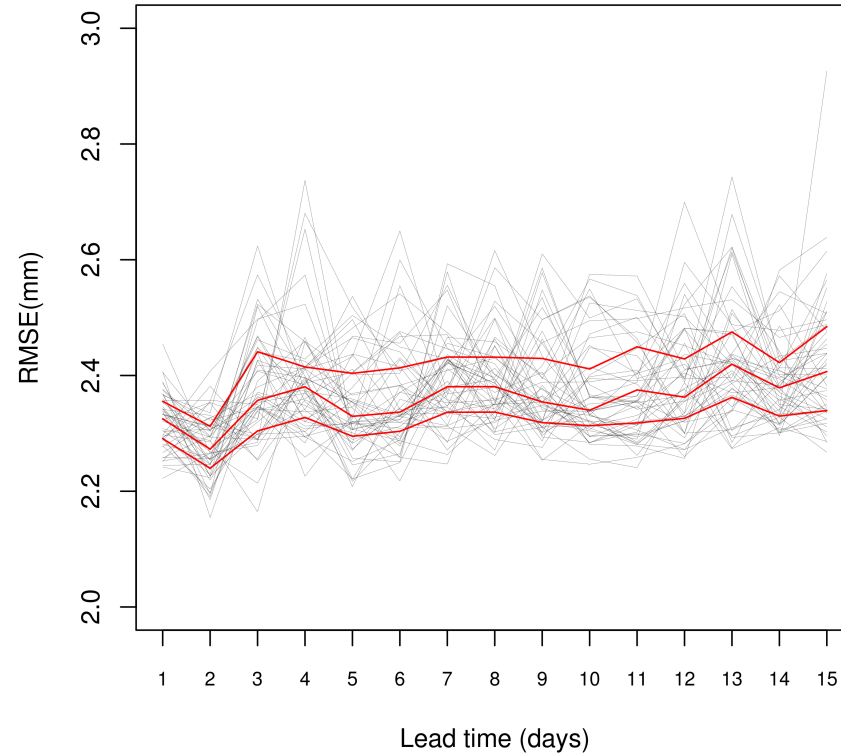
- ECMWF ensemble forecast for Capitanata

Temperature RMSE ECMWF Ensemble



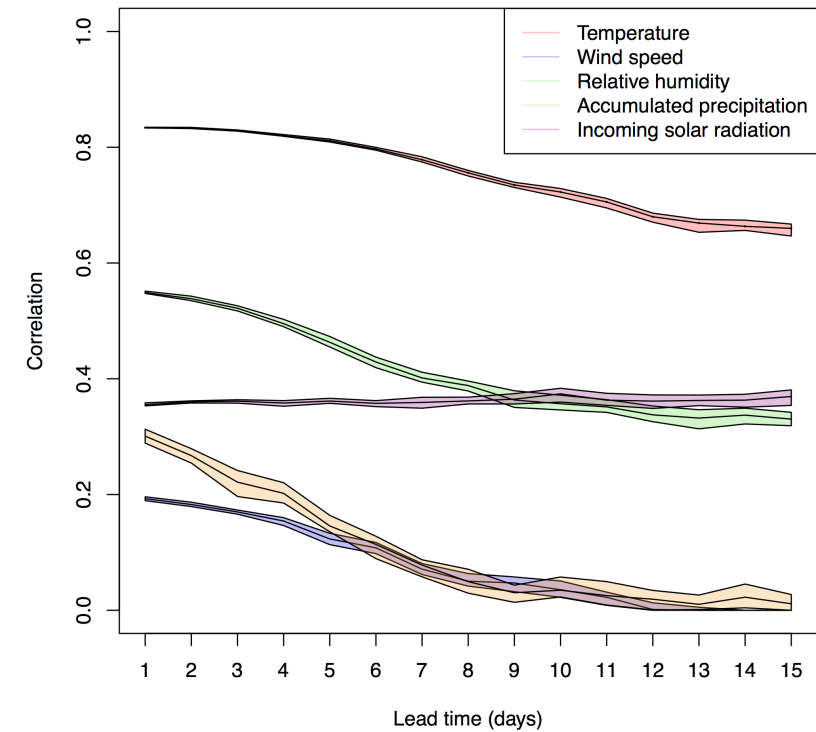
RMSE 2-m temp

Accumulated precipitation RMSE ECMWF Ensemble



RMSE precip

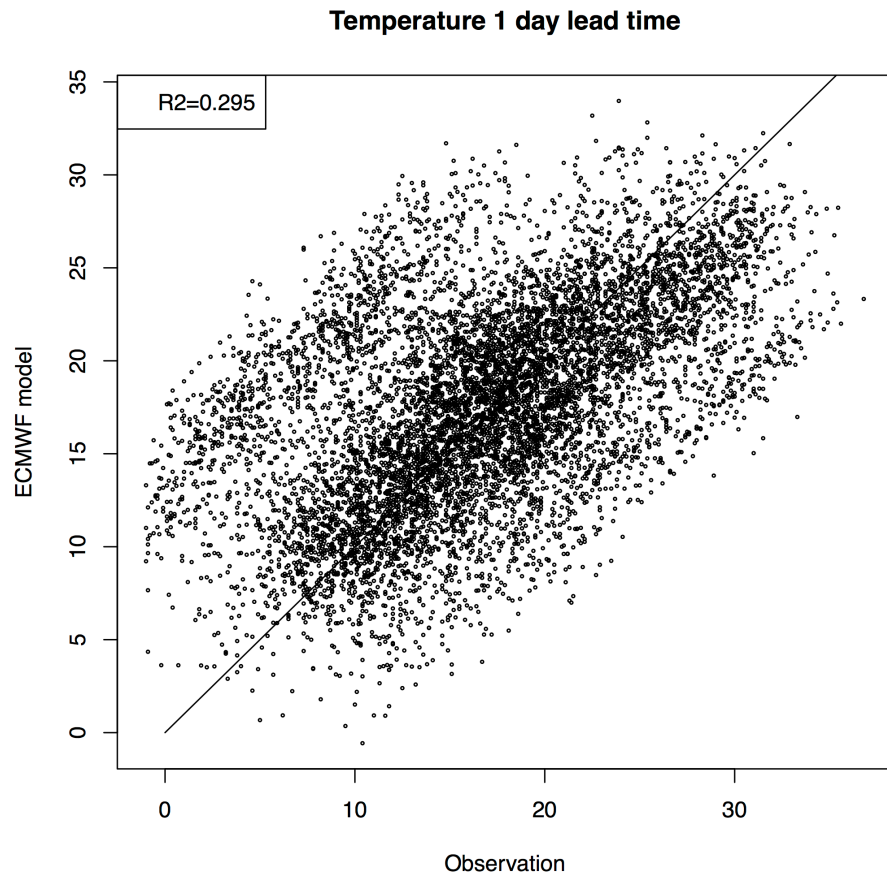
Correlation ECMWF Ensemble



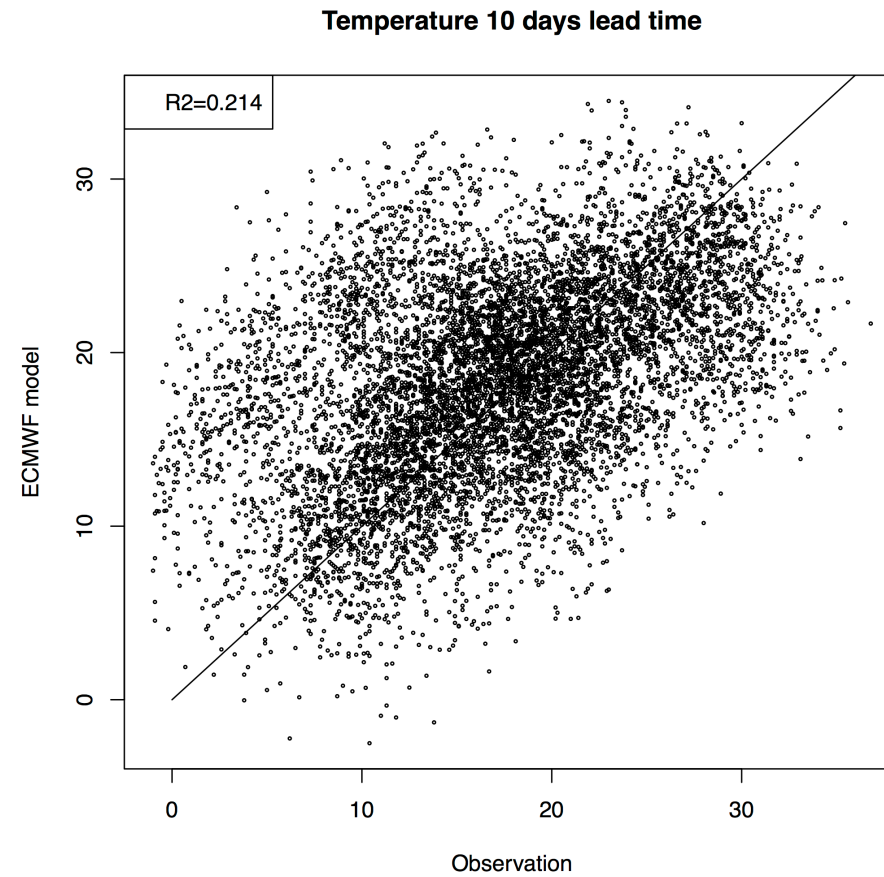
Correlation

# Verification of UIB forecasts

- Deterministic ECMWF forecast for Chiese



Lead time: 1 day

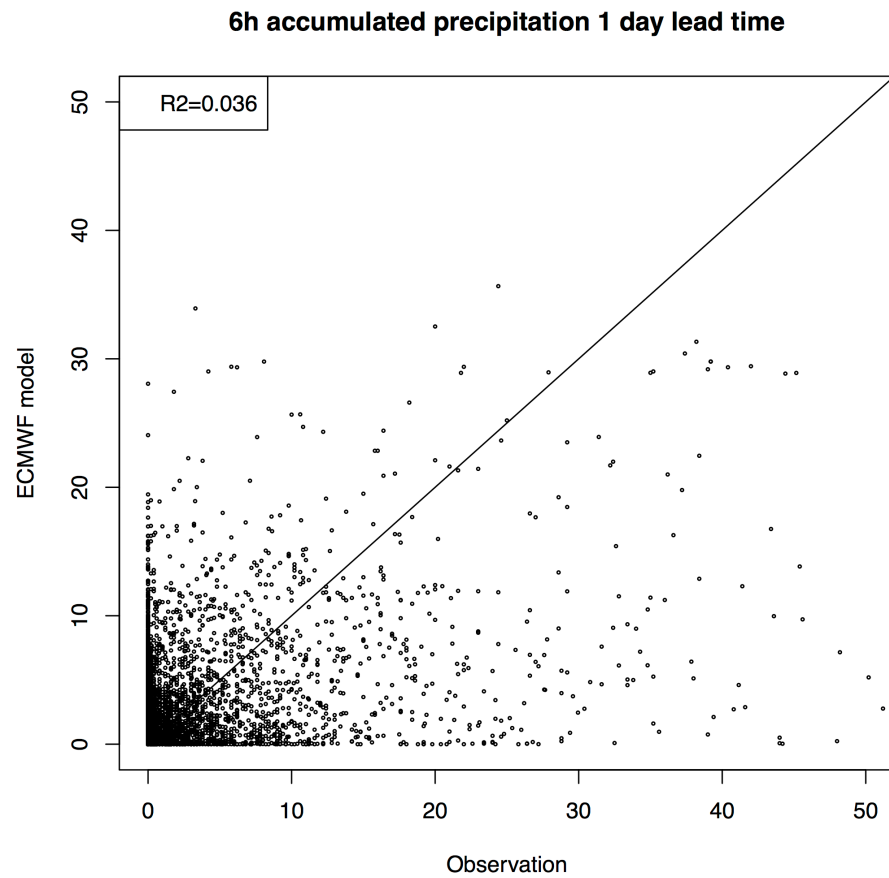


Lead time: 10 days

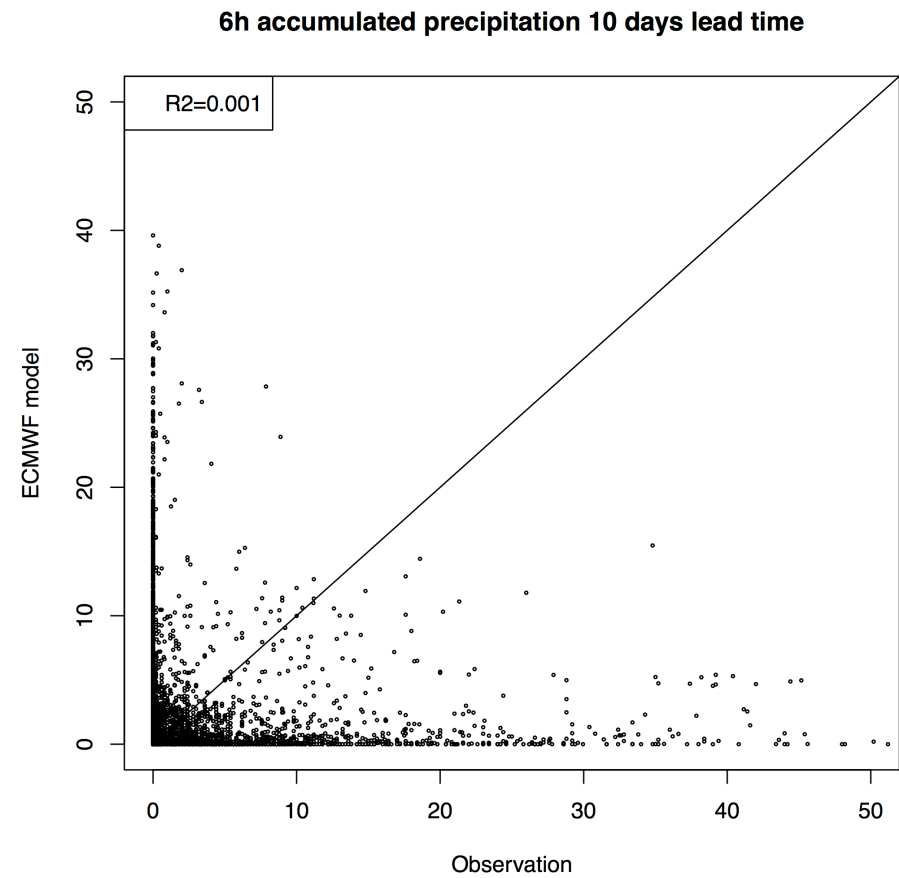
2-metre  
temperature

# Verification of UIB forecasts

- Deterministic ECMWF forecast for Chiese



Lead time: 1 day



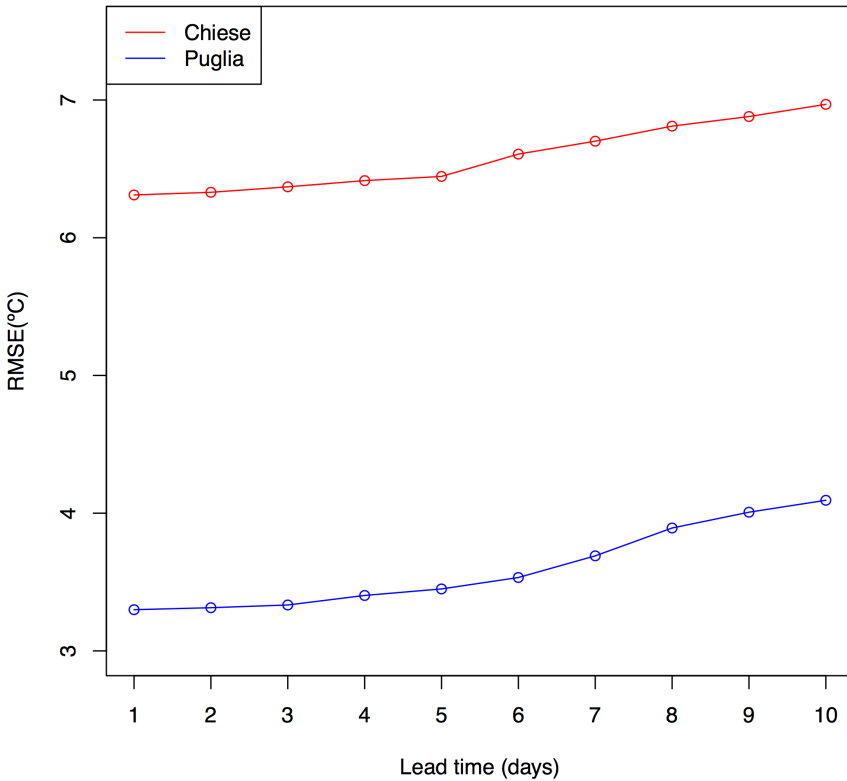
Lead time: 10 days

6h  
precipitation

# Verification of UIB forecasts

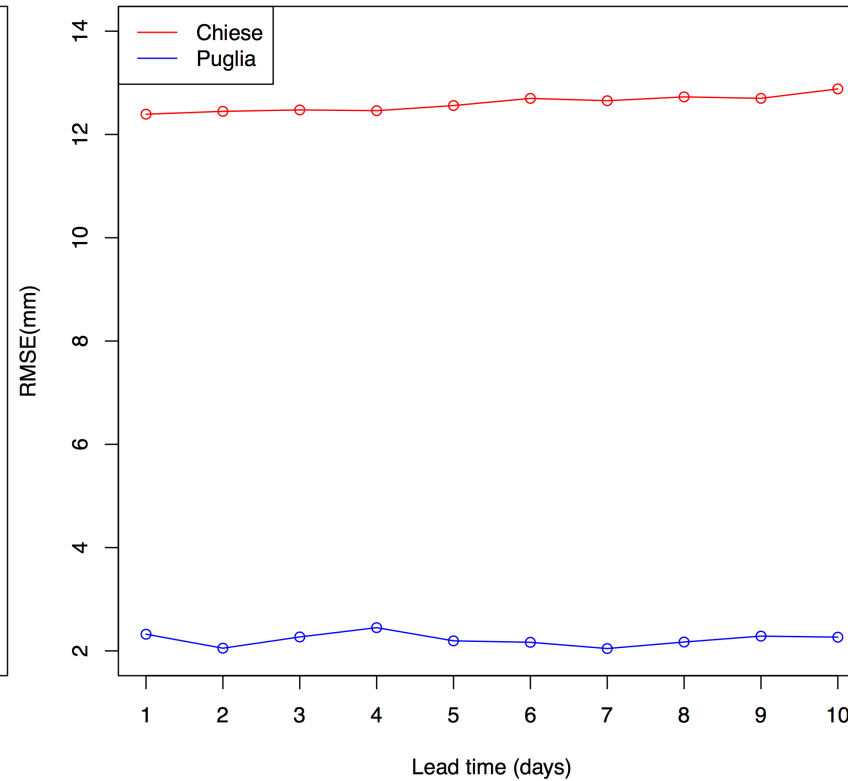
- ECMWF deterministic forecast for Chiese

Temperature RMSE ECMWF deterministic



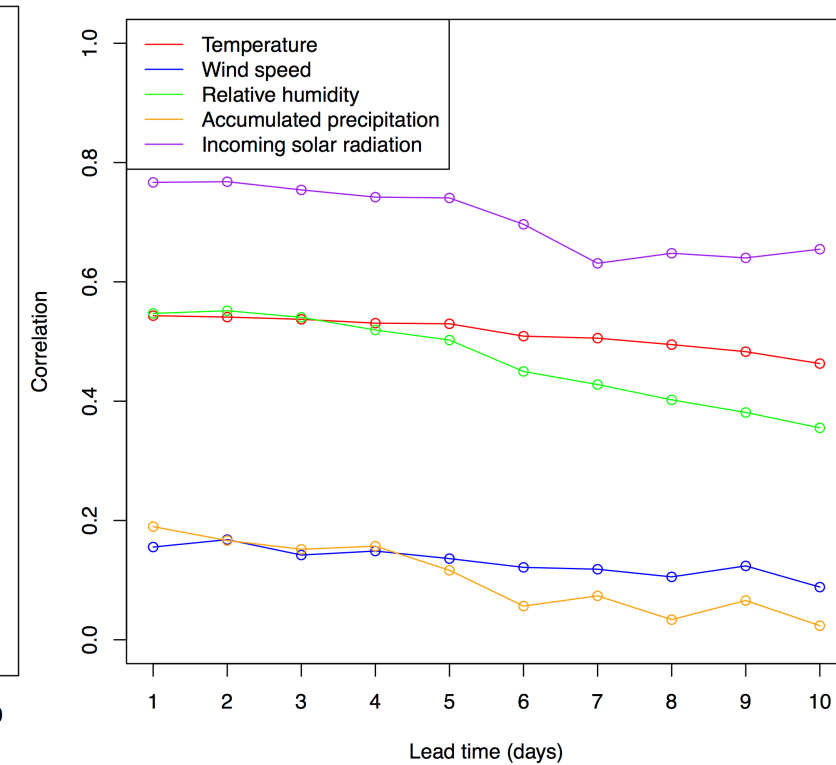
RMSE 2-m temp

Accumulated precipitation RMSE ECMWF deterministic model



RMSE precip

Correlation ECMWF deterministic model

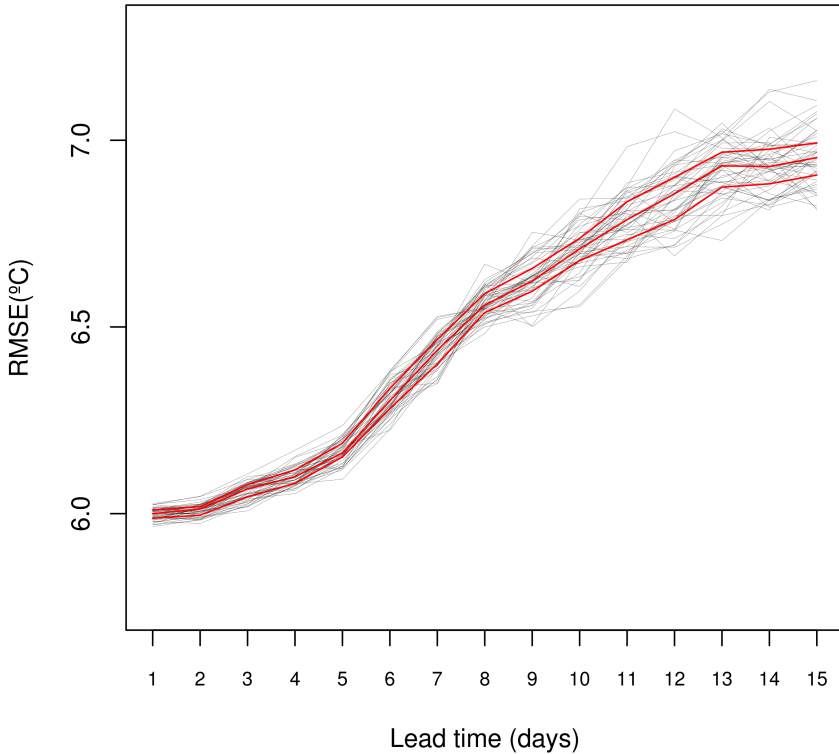


Correlation

# Verification of UIB forecasts

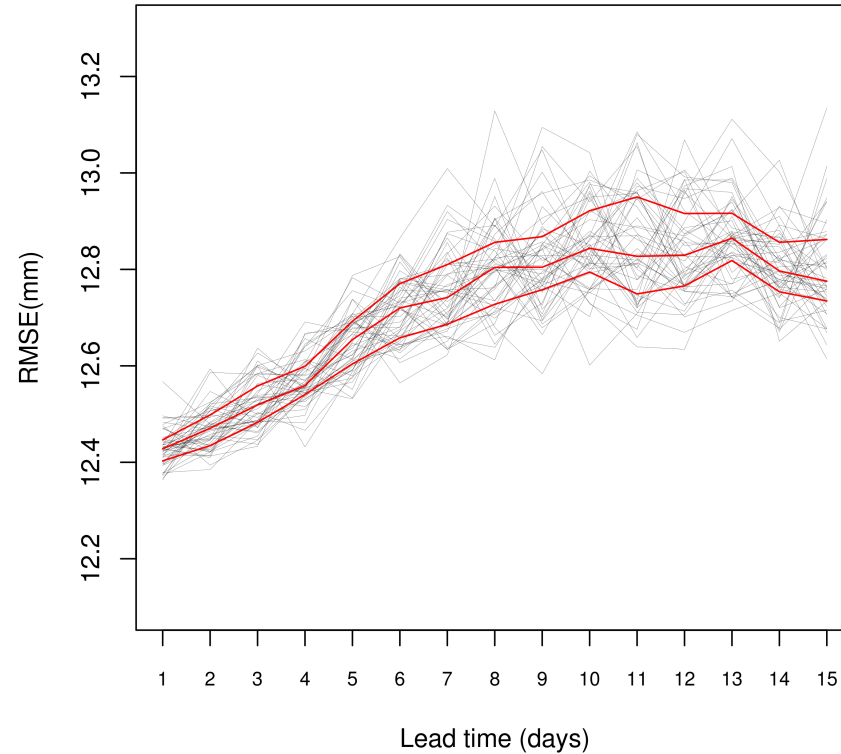
- ECMWF ensemble forecast for Chiese

Temperature RMSE ECMWF Ensemble



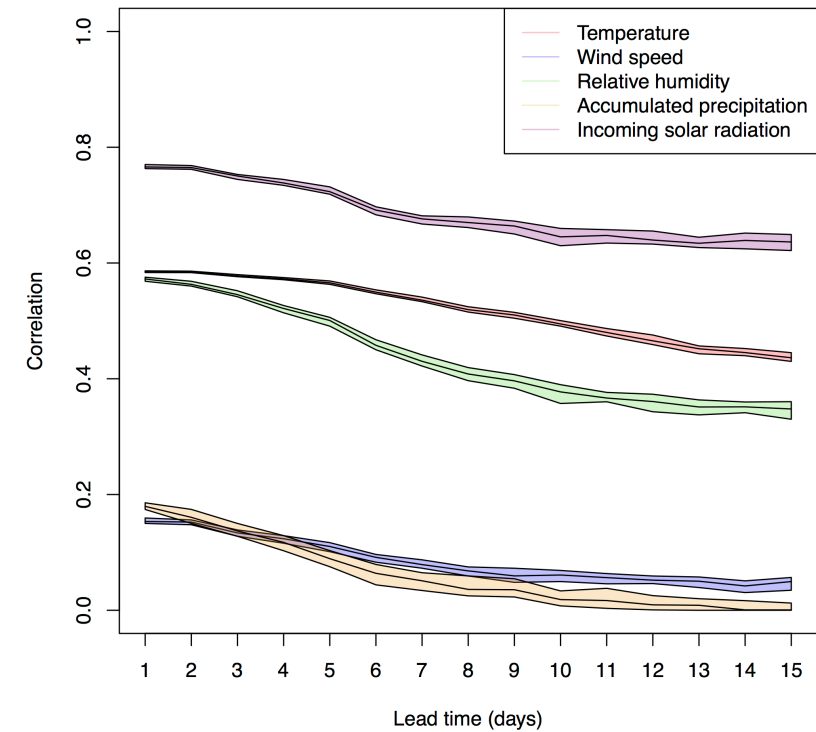
RMSE 2-m temp

Accumulated precipitation RMSE ECMWF Ensemble



RMSE precip

Correlation ECMWF Ensemble



Correlation



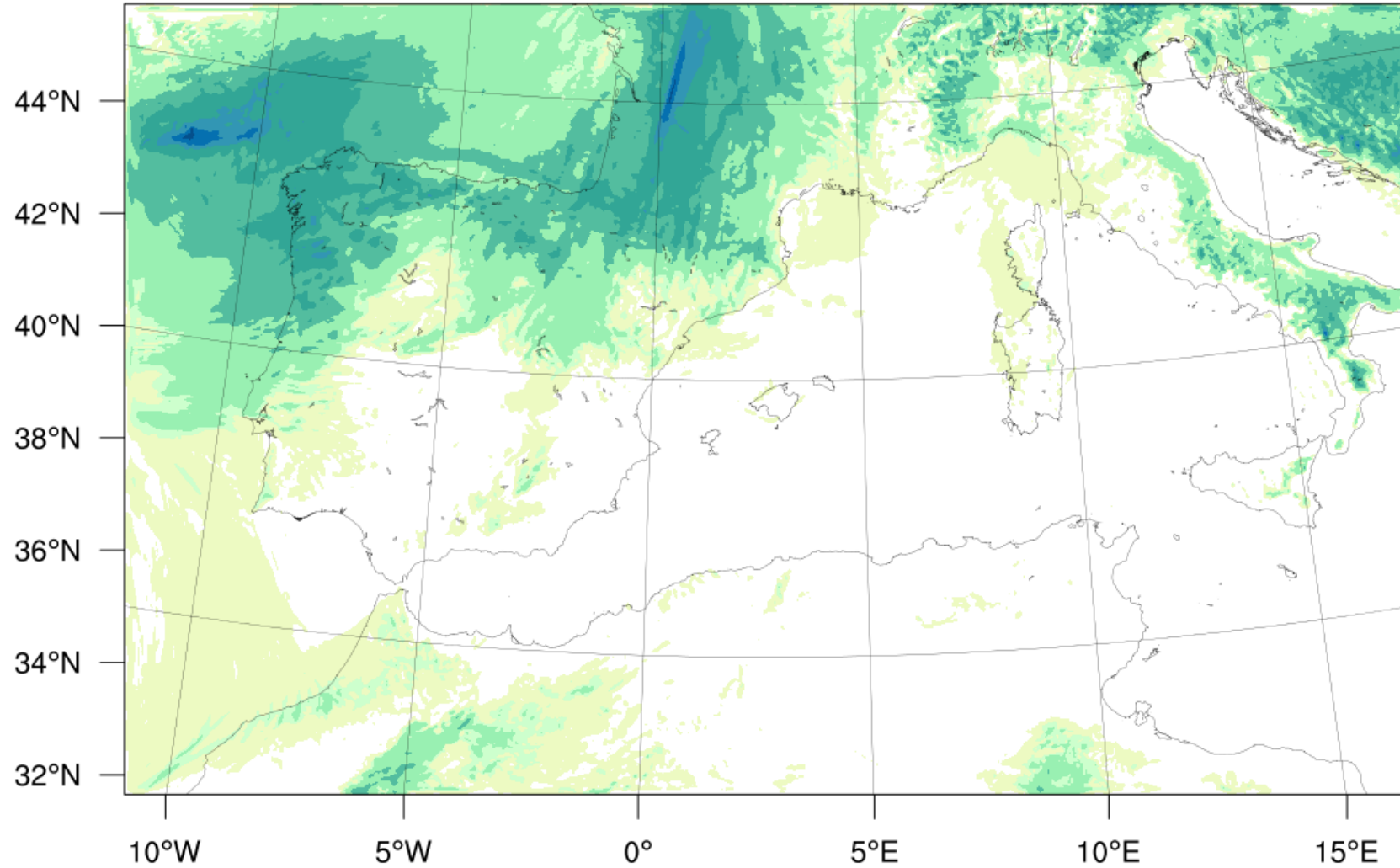
# OPERATIONAL IMPLEMENTATION OF WRF AT UIB

- Model configuration:
  - Horizontal resolution: 4 km
  - 30 vertical levels
  - Initialization time: 00 UTC (GFS)
  - Forecast range: 72 h

# OPERATIONAL IMPLEMENTATION OF WRF AT UIB

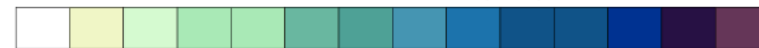
Accumulated Rain (mm)

2019-06-06 18:00 (UTC)



Forecast accumulated  
precipitation from  
04/06/2019 00 UTC to  
06/06/2019 18 UTC

Accumulated Rain (mm)



1 5 25 75 150 300