

MyWater - Merging hydrological models and EO data for reliable information on Water



# A flow forecast system for hydroelectric production

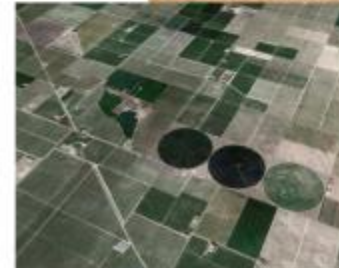
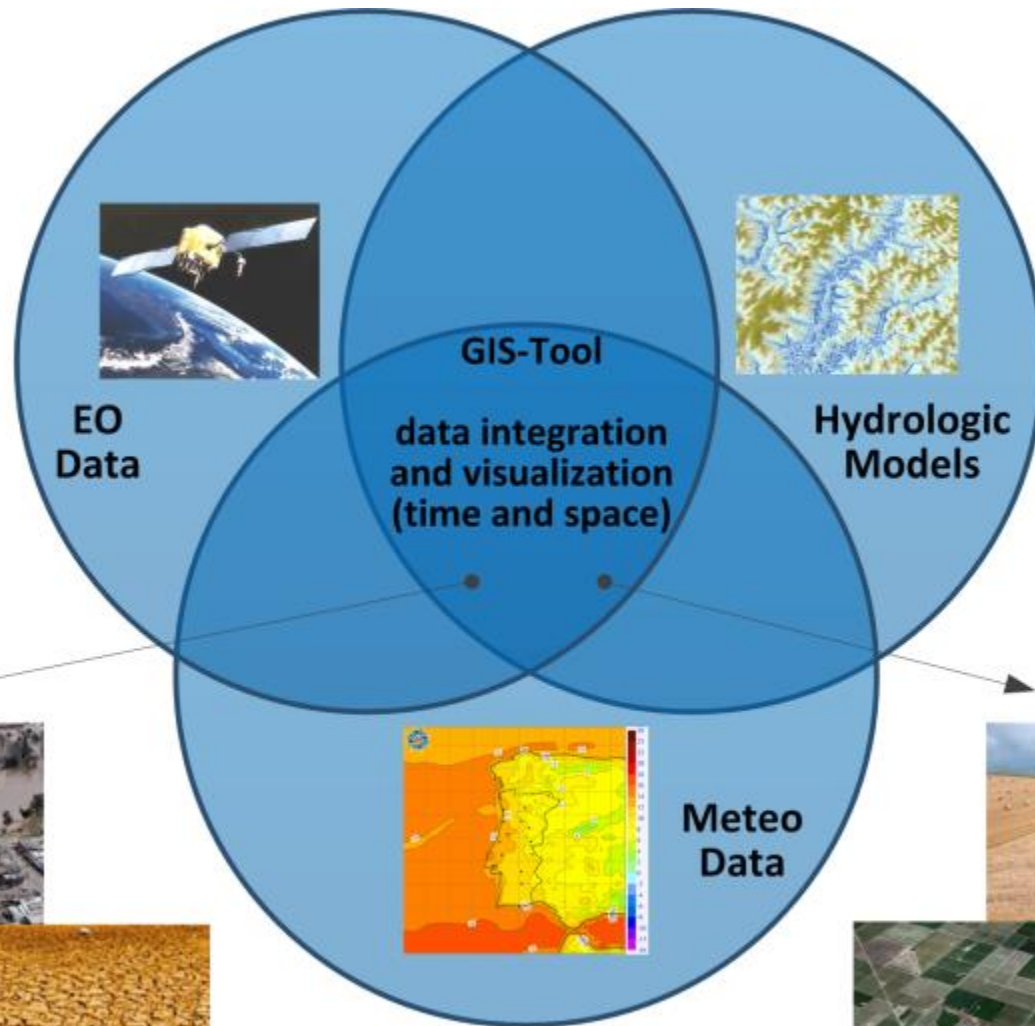
Carina Almeida, Pedro Chambel-Leitao - IST - Portugal

Waldenio Almeida - CPTEC/INPE - Brazil

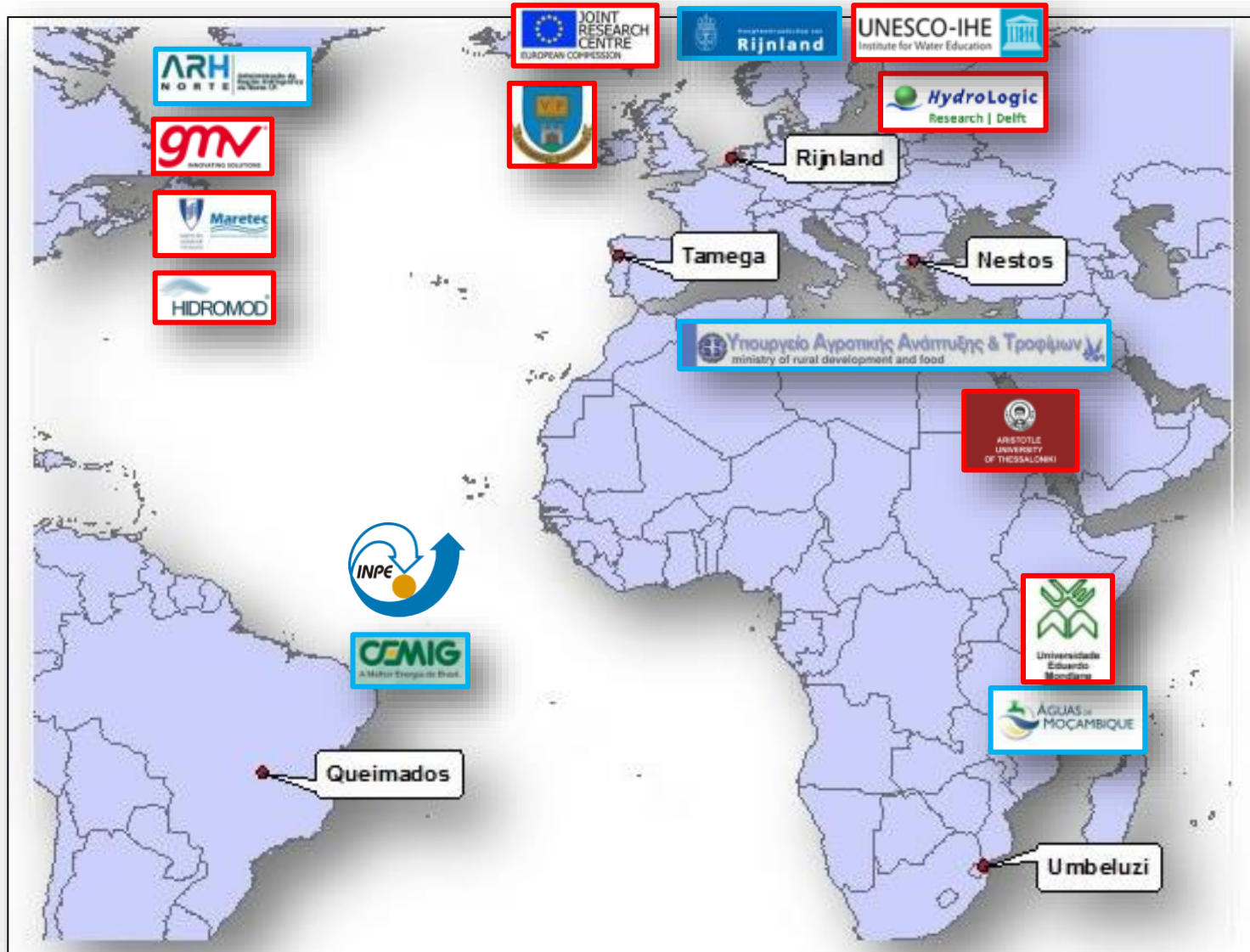


# Summary

- MyWater Project
- SWAT model watershed implementation: the Queimado case study
- Model flow calibration
- CPTec Weather forecast
- Precipitation uncertainty and bias removal in Queimado
- Mohid Land application in Tamega
- Conclusions



# Study sites, Partners and Users

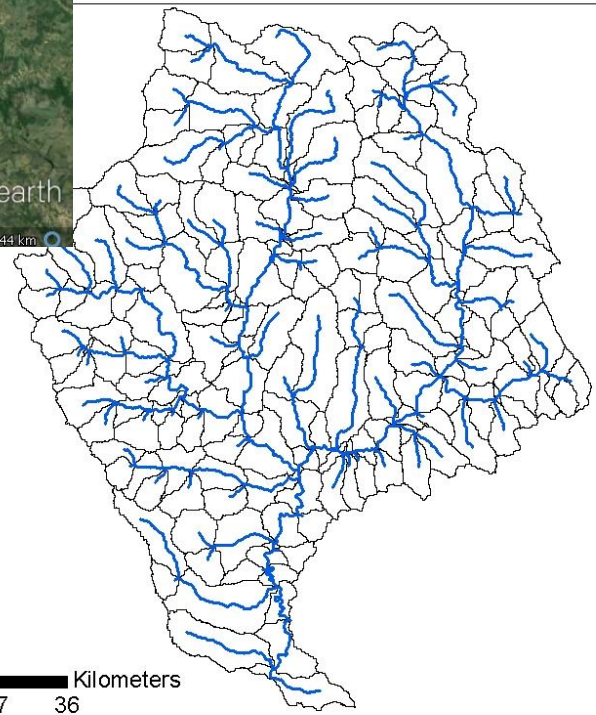
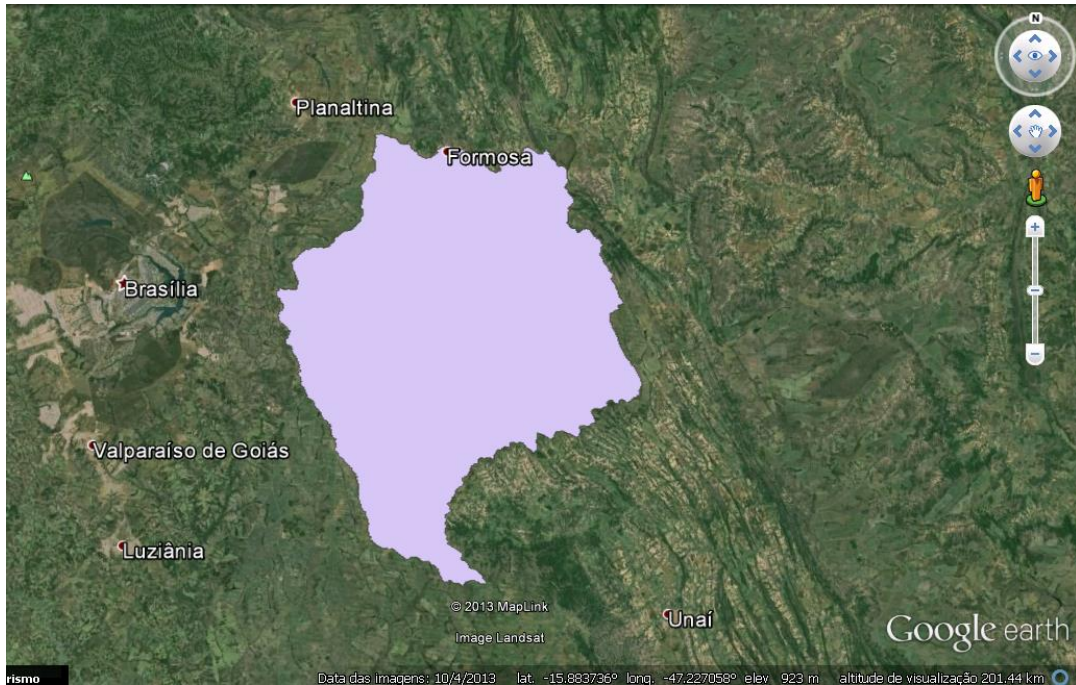


# SWAT model watershed implementation: the Queimado case study

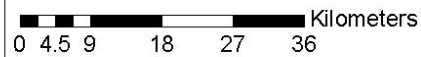
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# SWAT model implementation



Area: 3900 km<sup>2</sup>

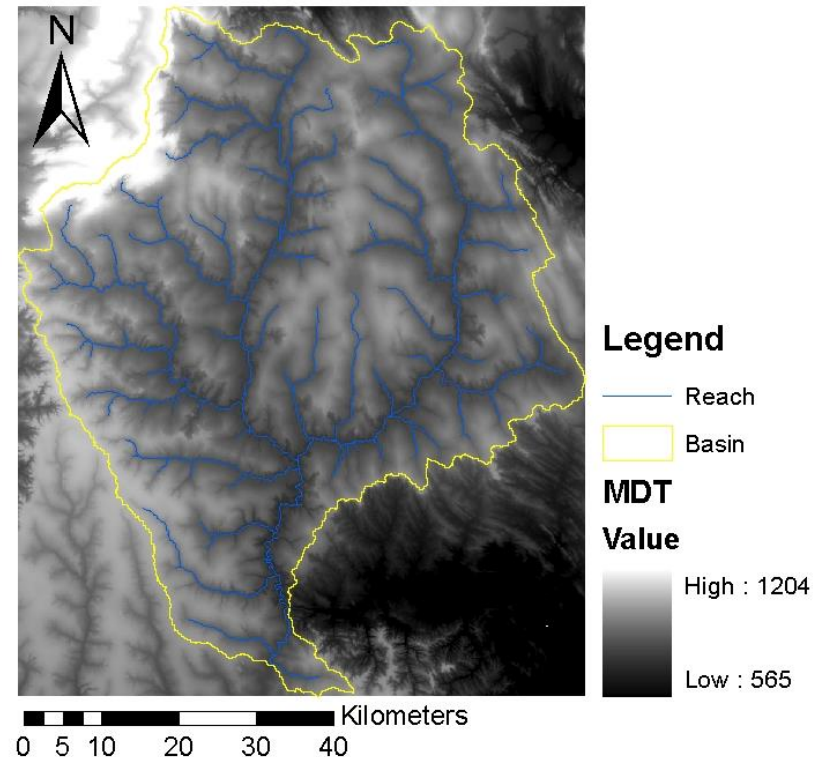


## Legend

- Reach
- ▭ Watershed

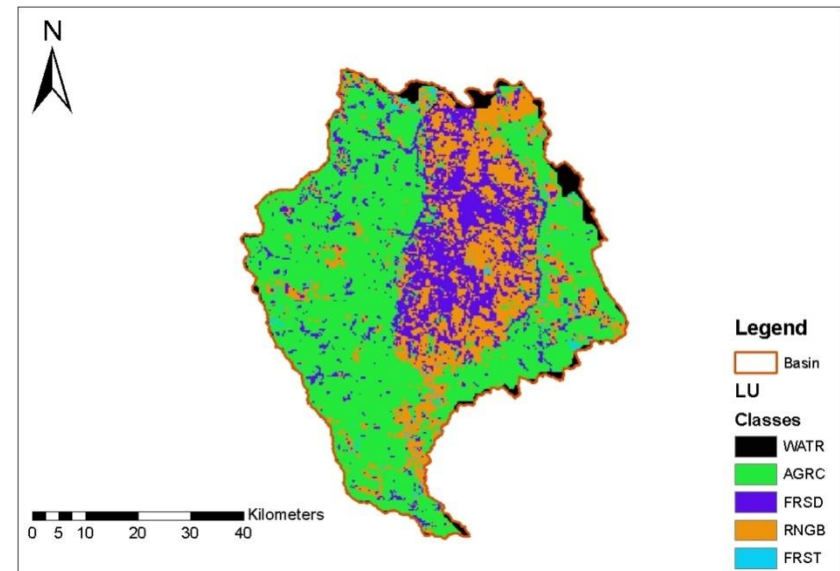
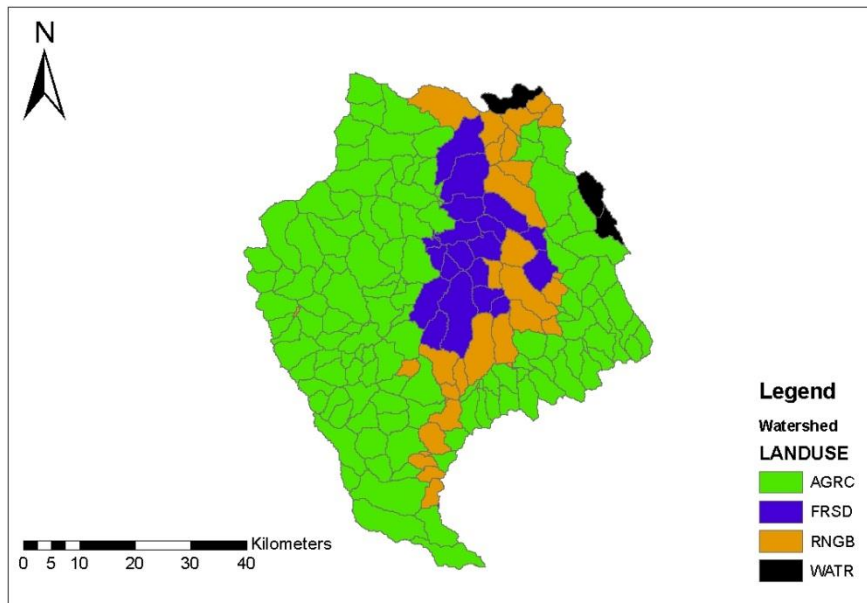
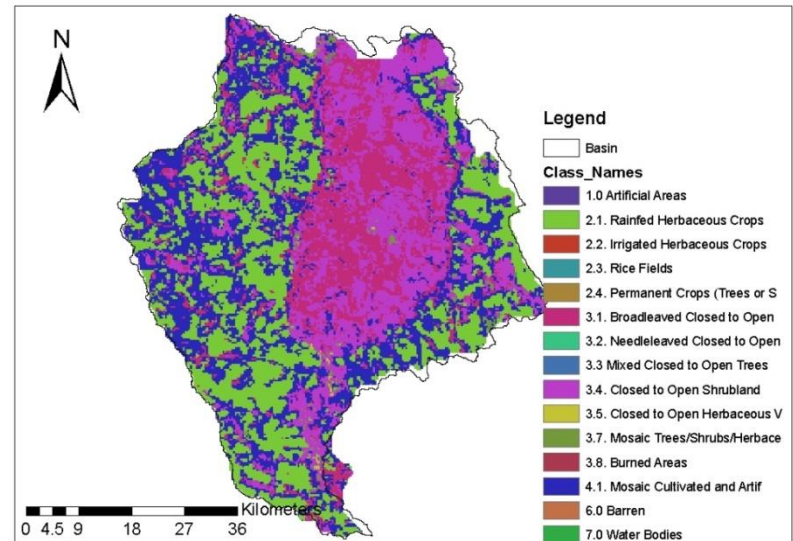
# SWAT model implementation: Inputs

- **Topography** Shuttle Radar Topography Mission
- Land Use
- Soil type
- Meteorological data



# SWAT model implem

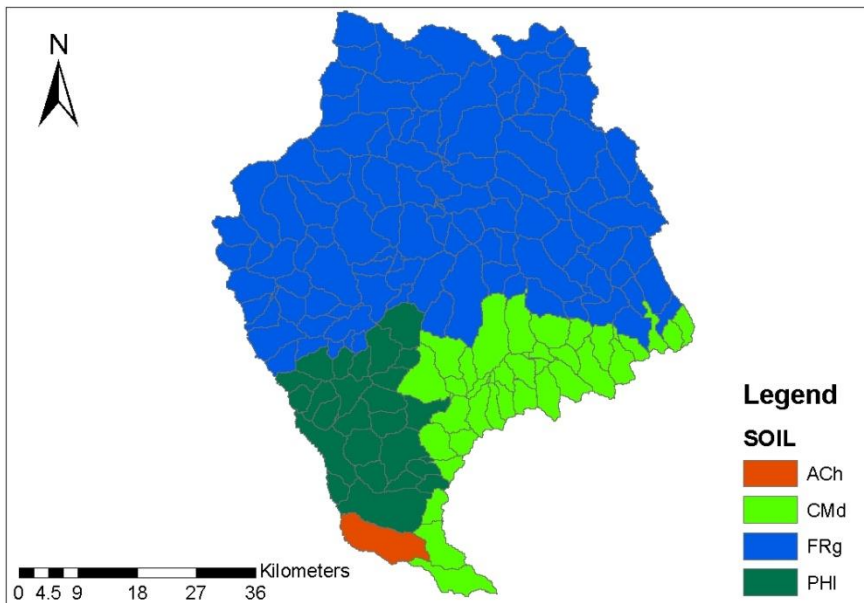
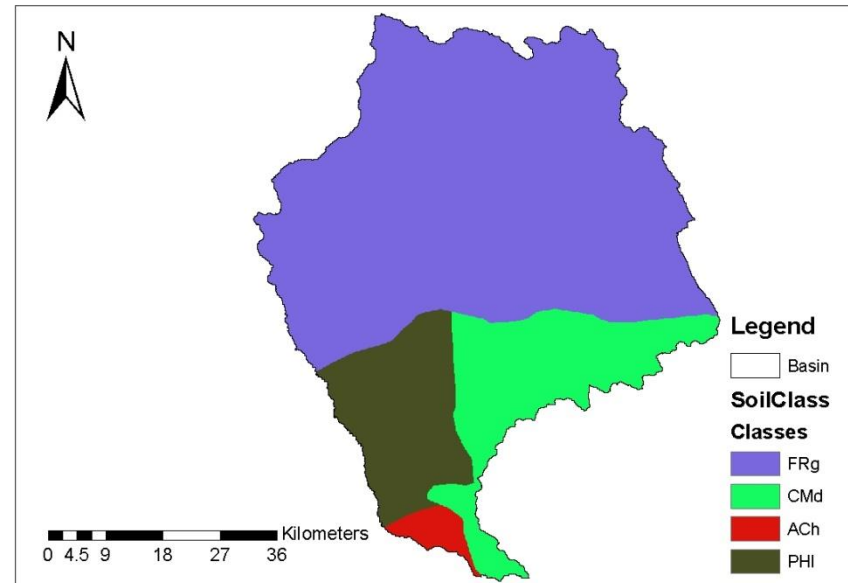
- Topography
- **Land Use** [Regional map](#)
- Soil type
- Meteorological data





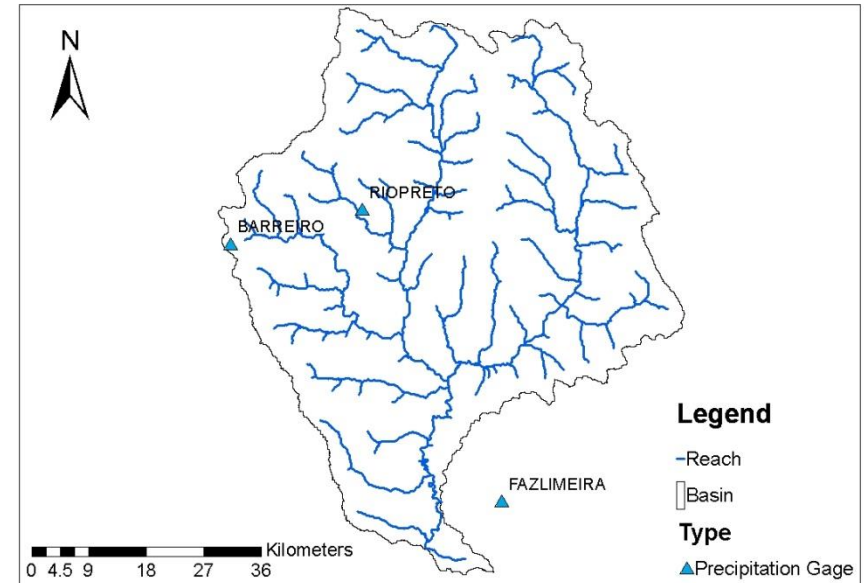
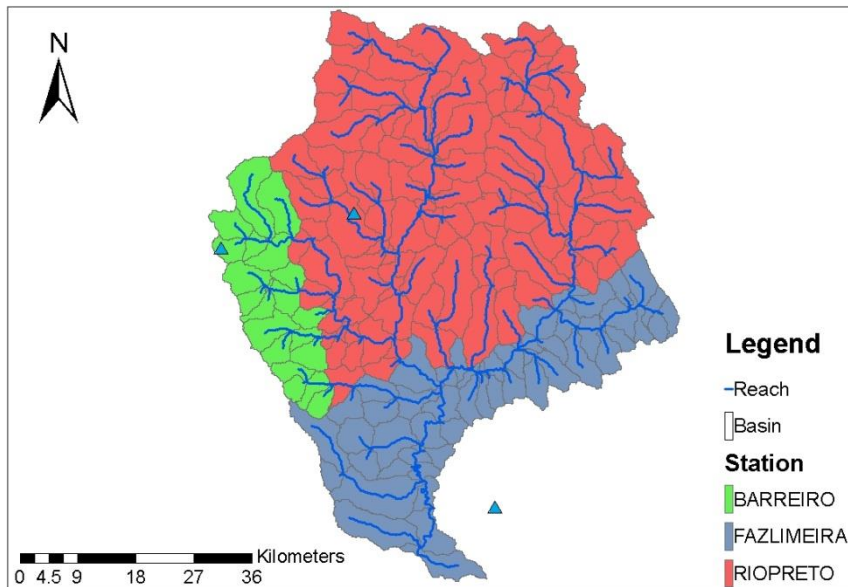
# SWAT model implementation: Inputs

- Topography
- Land Use
- **Soil type** [Joint Research Centre](#)
- Meteorological data



# SWAT model implementation: Inputs

- Topography
- Land Use
- Soil type
- **Meteorological data**



Data source:

ANA (*Agência Nacional de Águas*)

Barreiro:1985-2008

Rio preto:1985-2007

Fazenda limeira:1985-2013

# Model flow Calibration

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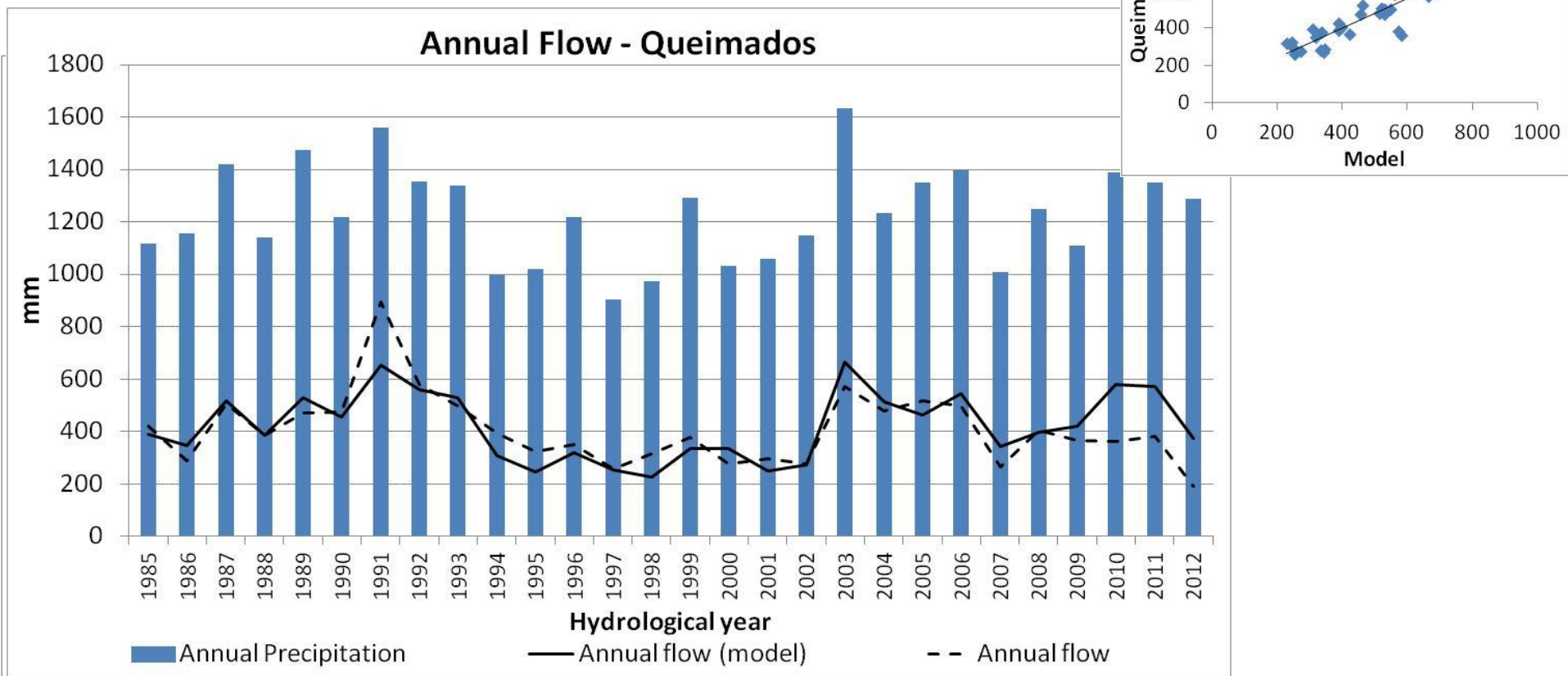


# Model flow calibration

<b>Parameter</b>	<b>Default value</b>	<b>Final value</b>
GW_Delay (days)	1	300
Alpha_BF	0.048	1
Soil depth (mm)	1000	3000
CN2		-30%
CH_N2	0,01	0,15
CH_K2	0	100
Alpha_BNK	0	1

# Model flow calibration

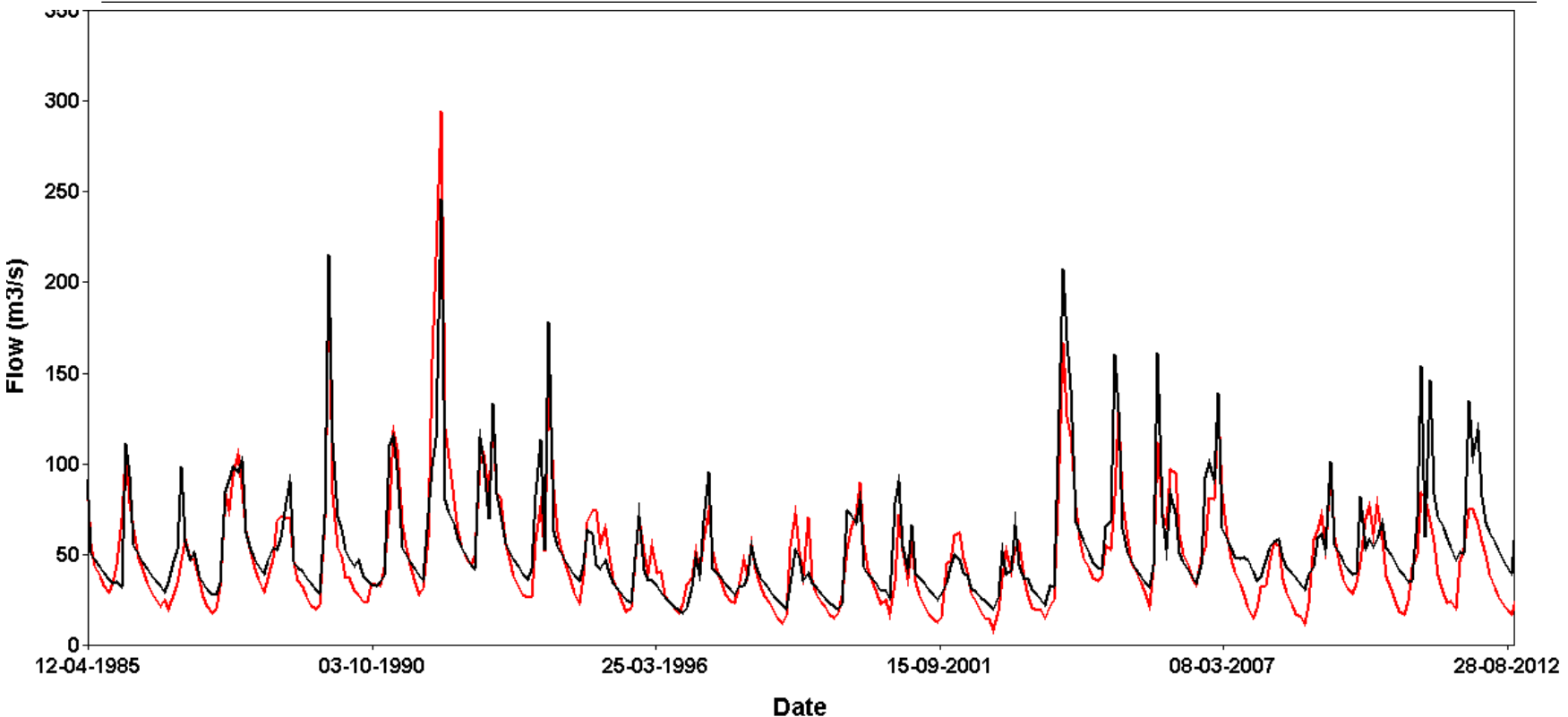
- Queimado – Annual flow: 1985 – 2012 hydrological years



# Model flow calibration

- Queimado – Monthly flow: 1985 – 2012 hydrological years

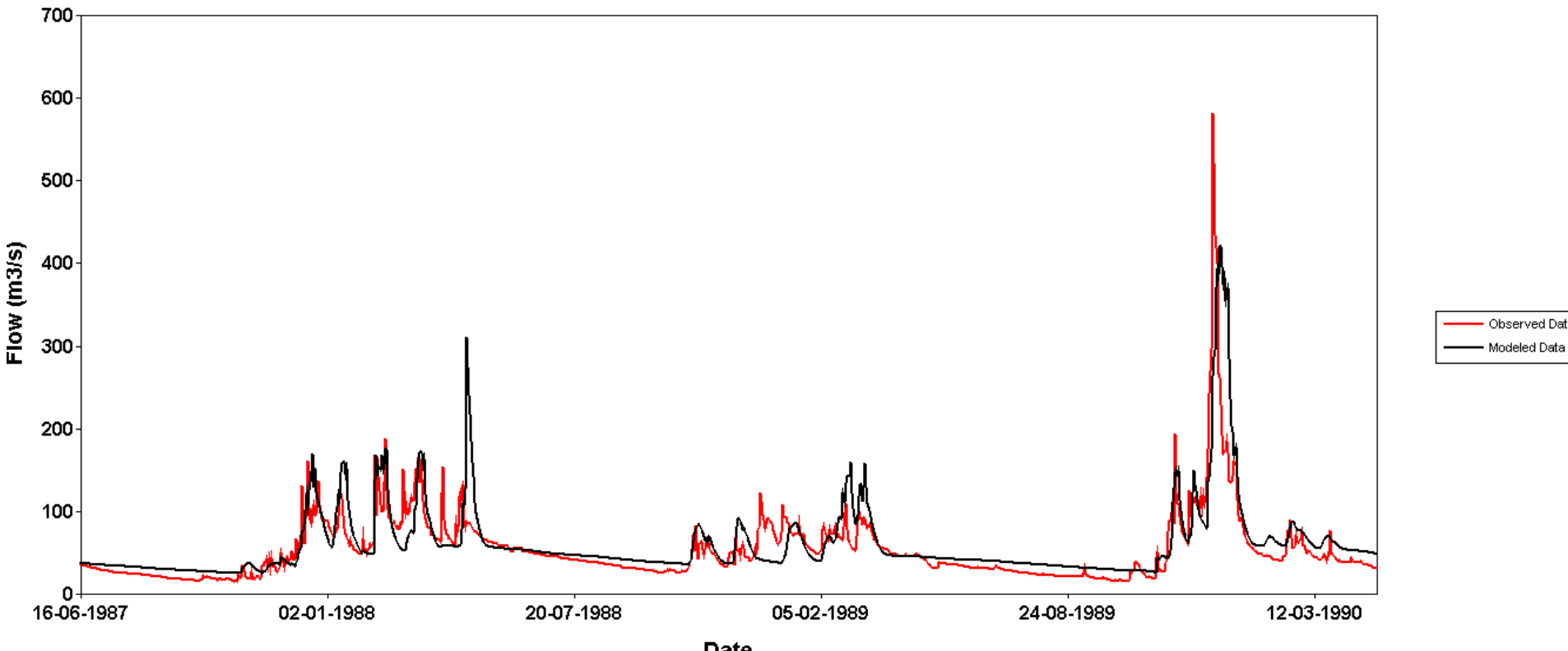
Observed Average	Modeled Average	Bias	RMSE	R2	Model Efficiency
49,07	55,31	6,16	18,94	0,71	0,65



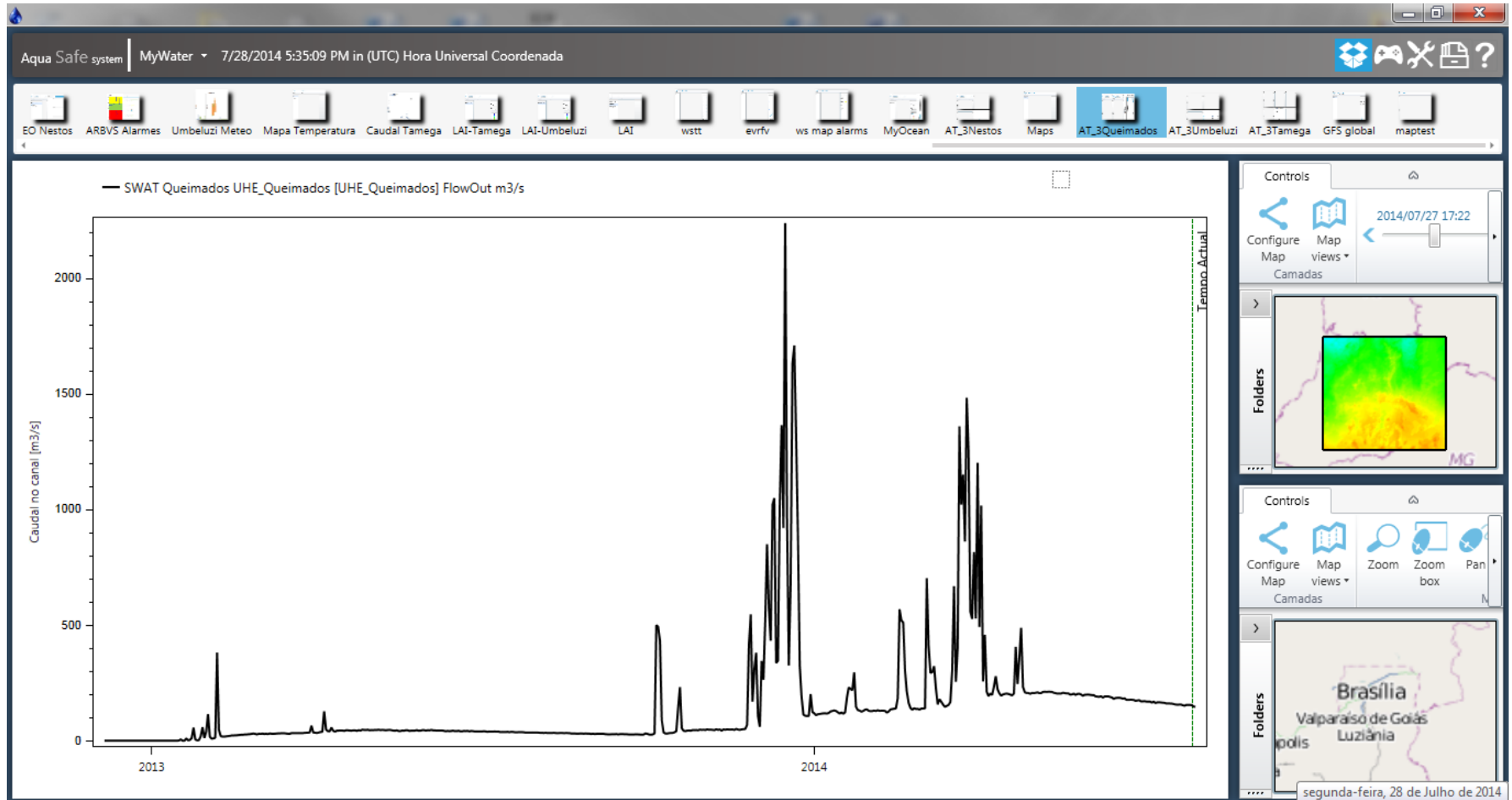
# Model flow calibration

- Queimado – Daily flow: 1985 – 2012 hydrological years

Observed Average	Modeled Average	Bias	RMSE	R2	Model Efficiency
49,15	55,2	6,12	29,09	0,53	0,37



# A flow forecast system for hydroelectric production - Queimado





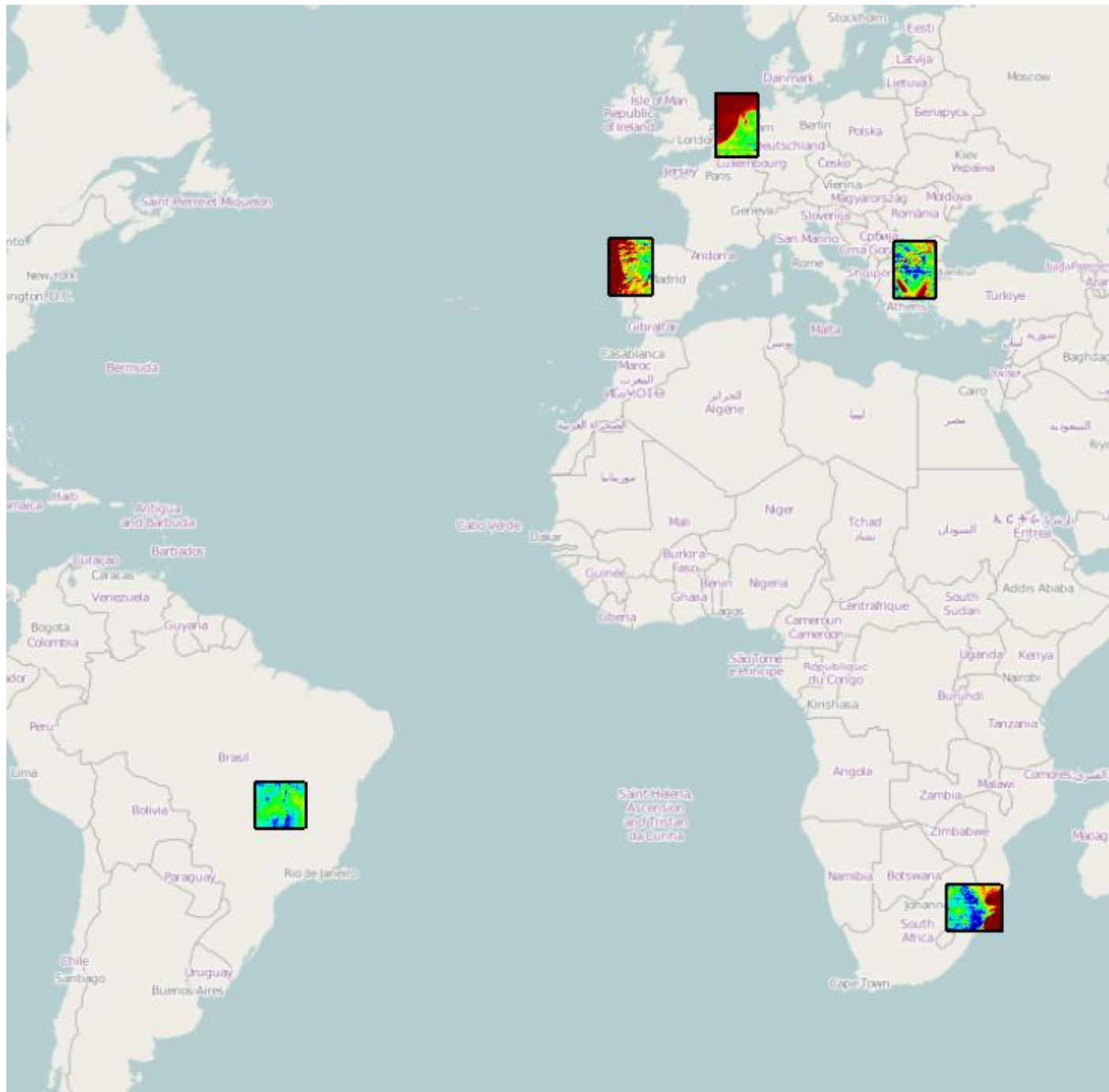
# CPTEC Weather forecast models

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# CPTEC ETA model for MyWater

- For MyWater CPTEC was running ETA model
- 5km horizontal resolution
- CPTEC's global model for boundary conditions
- Model runs every 12h for 3 day forecasts.

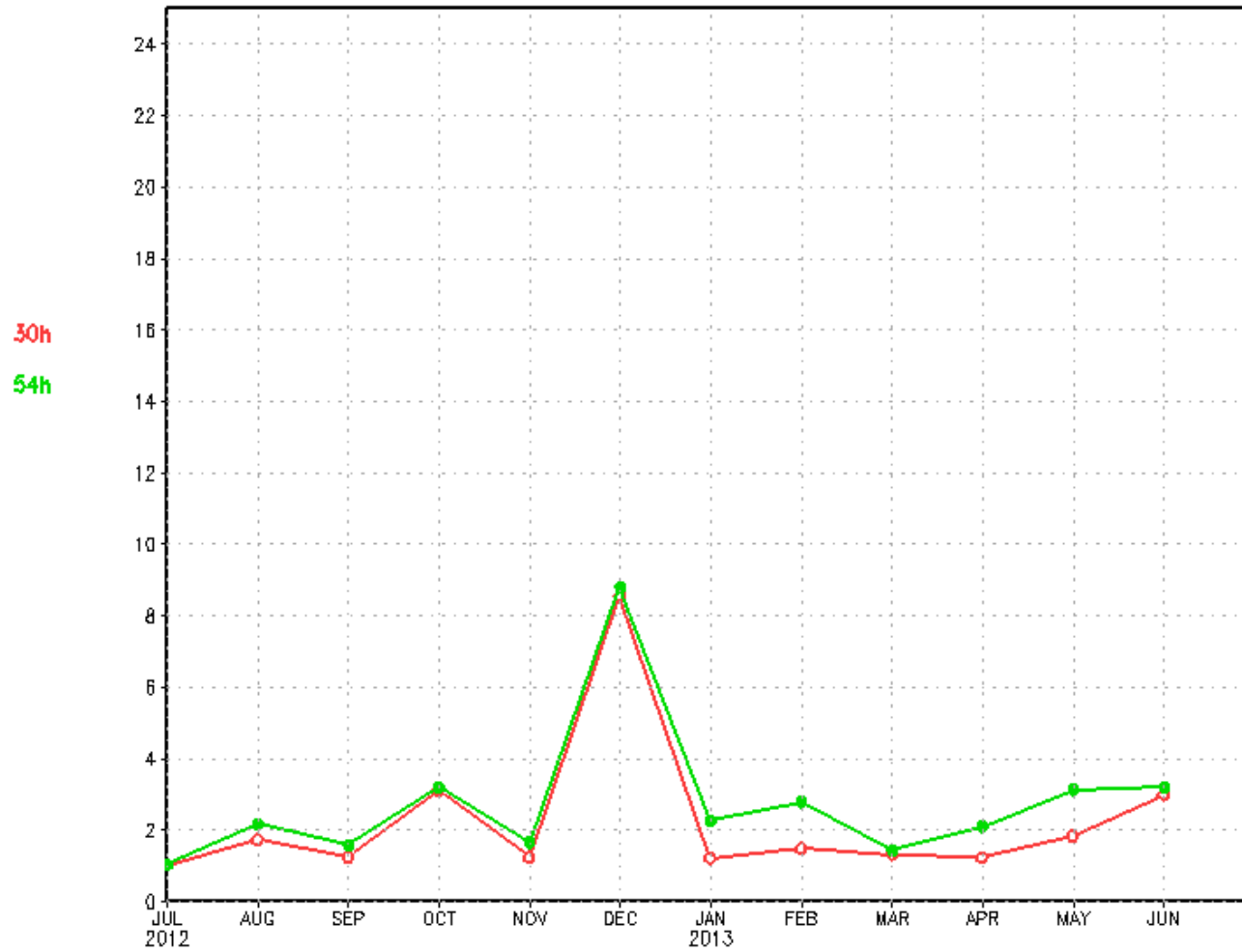


# Monthly Mean Precipitation RMSE

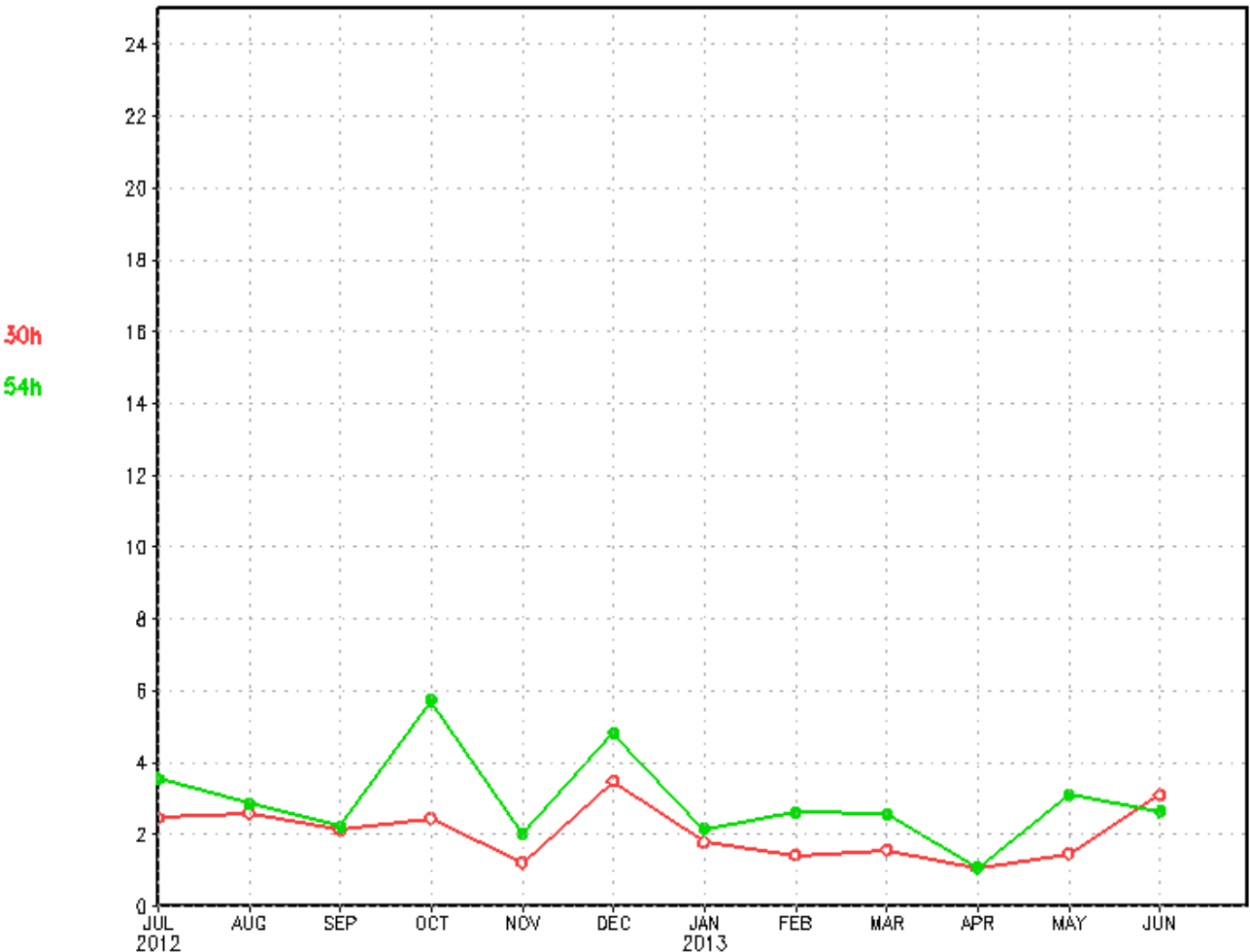
For the 5 test areas, the monthly  
mean value for the RMSE – The  
expected error

July 2012 to June 2013

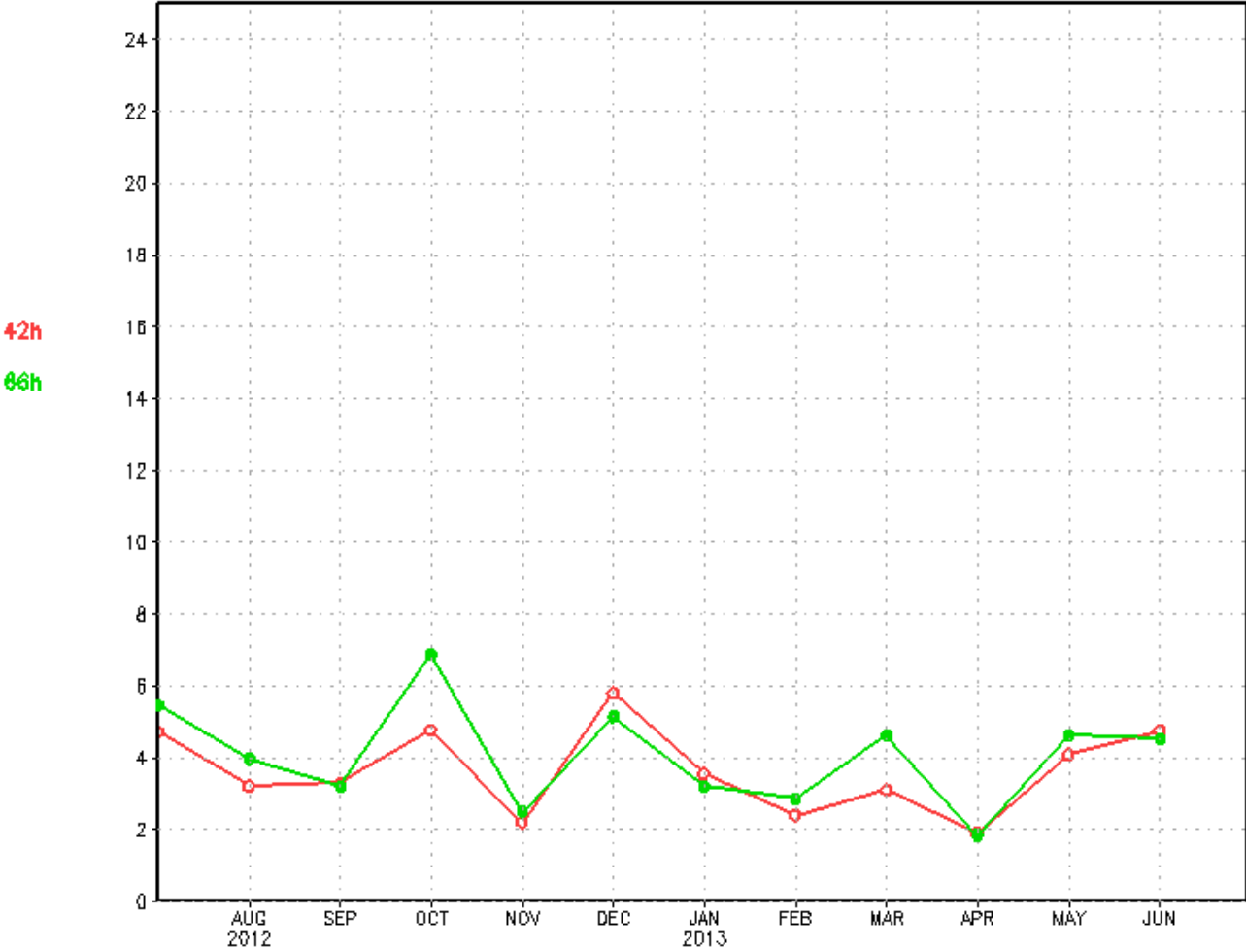
Greece (00Z) – Monthly Precipitation RMSE (mm)



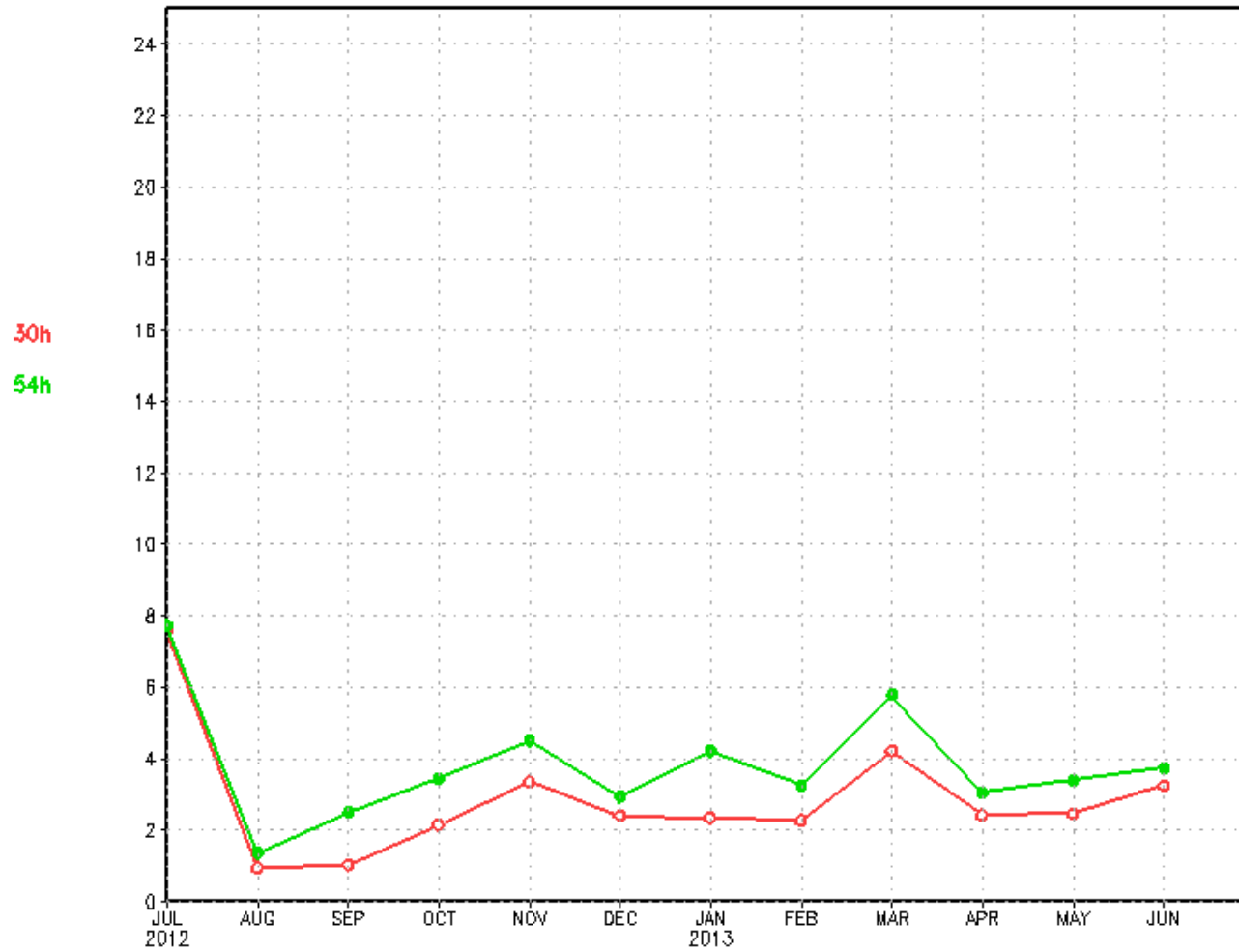
# Netherlands (00Z) – Monthly Precipitation RMSE (mm)



# Netherlands (12Z) – Monthly Precipitation RMSE (mm)

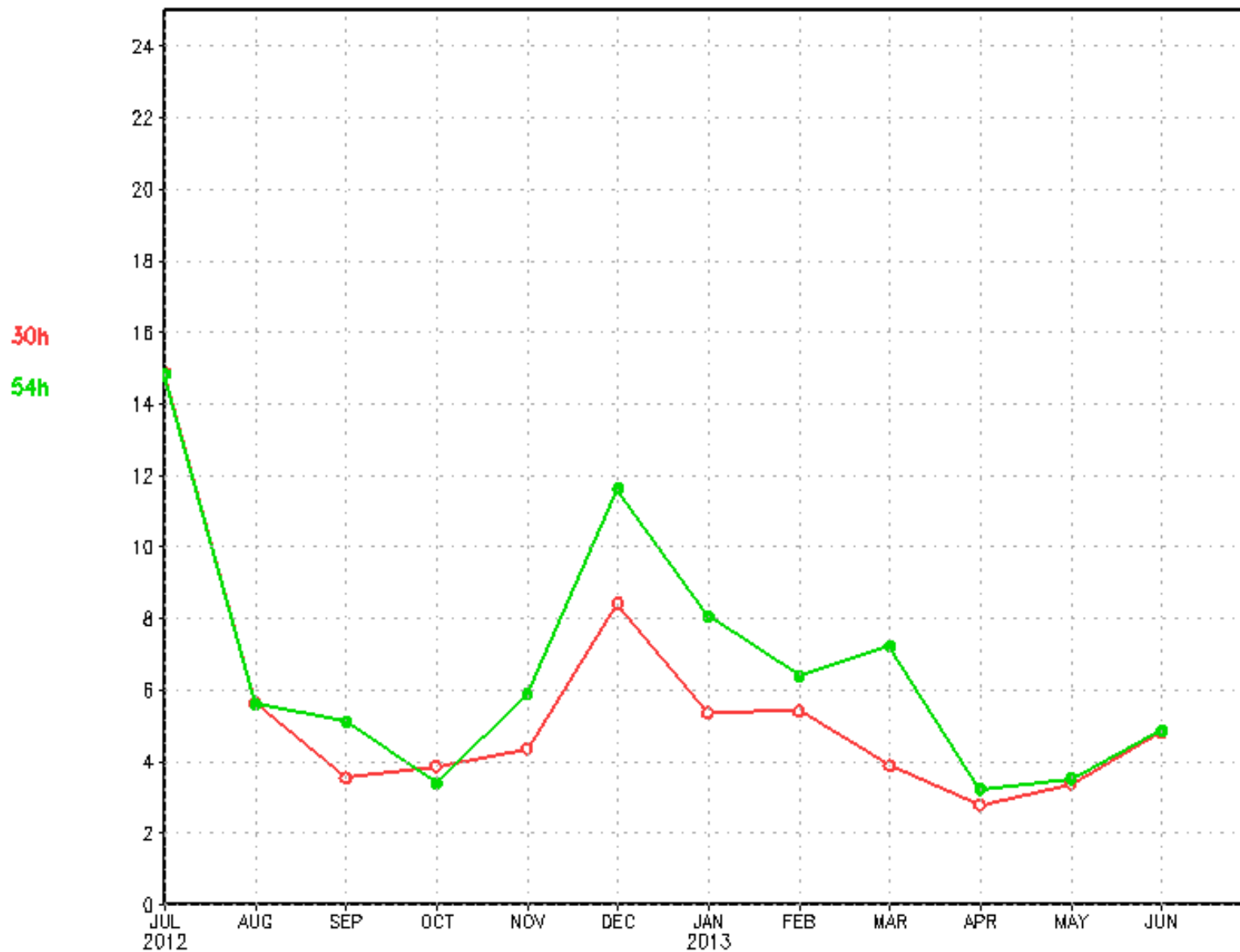


Portugal (00Z) – Monthly Precipitation RMSE (mm)

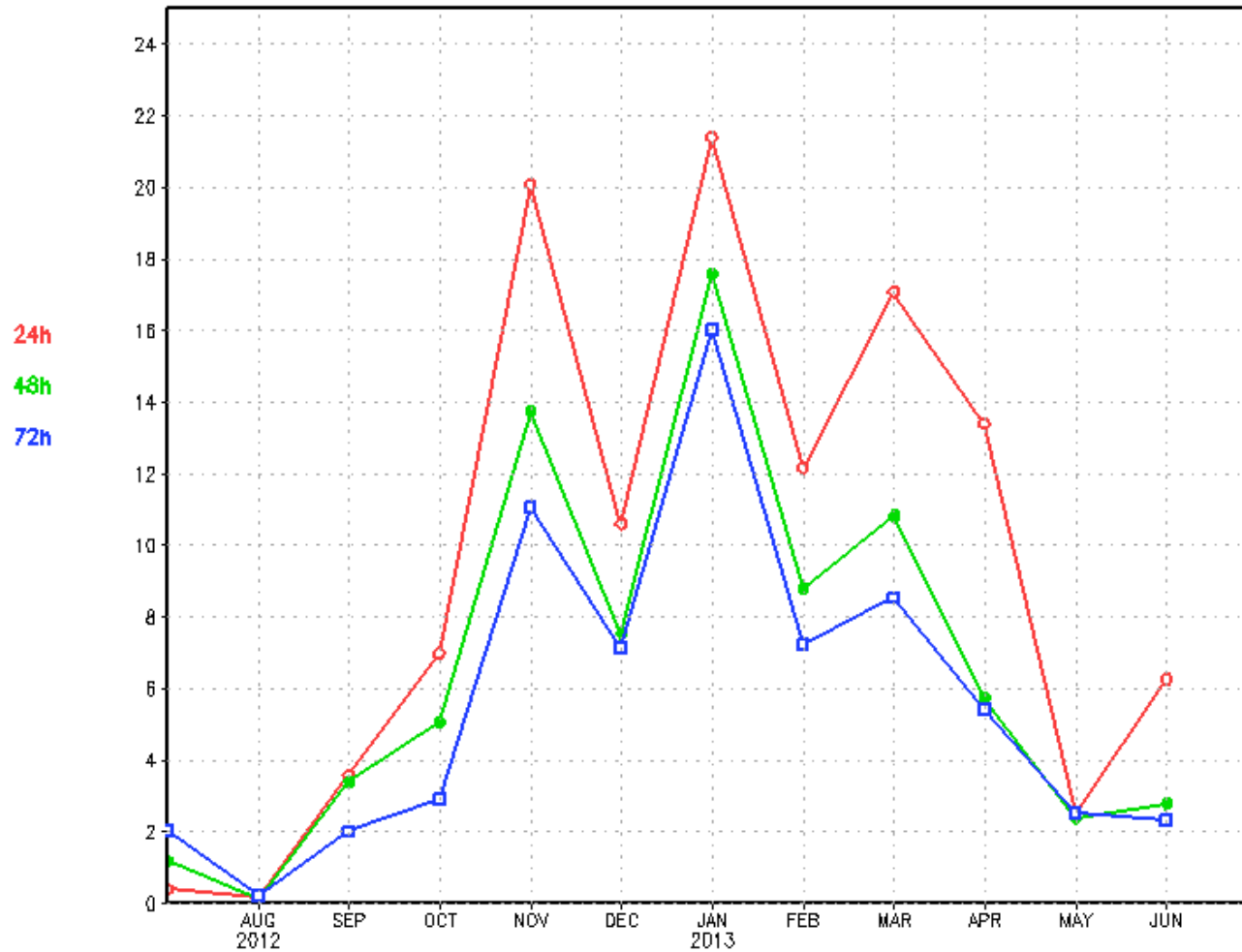




# Africa (00Z) – Monthly Precipitation RMSE (mm)



Brazil (12Z) – Monthly Precipitation RMSE (mm)



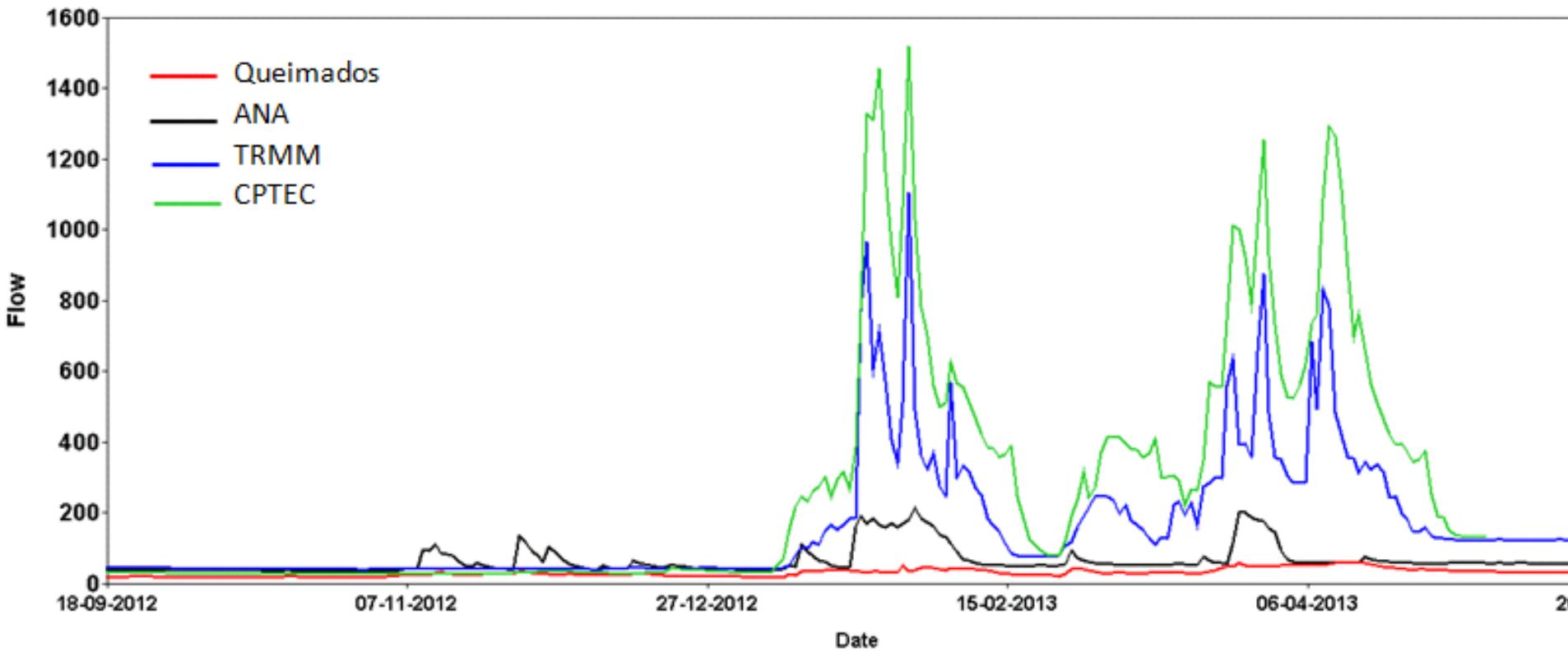
# Precipitation uncertainty and bias removal

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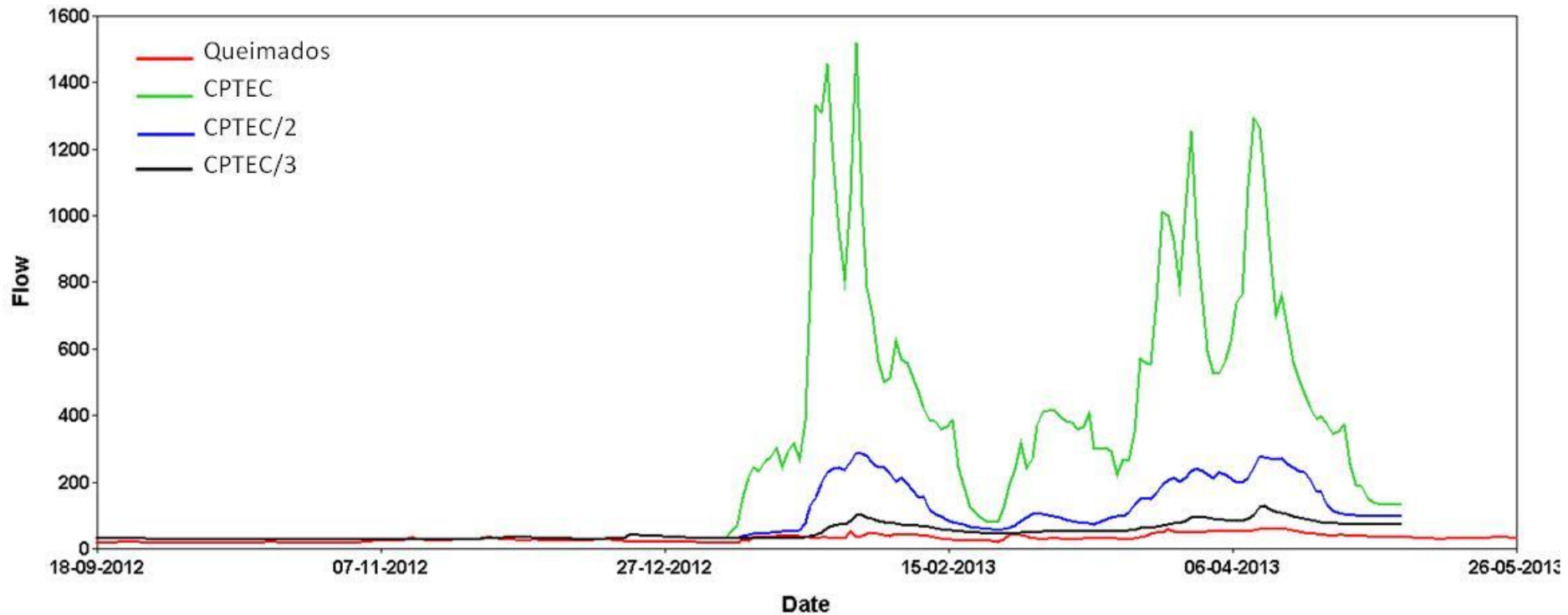
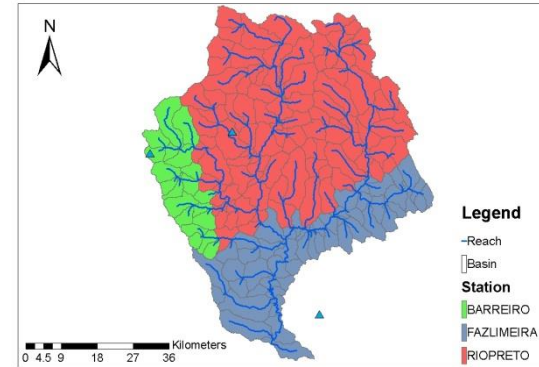
# Precipitation uncertainty

- Flow obtained with different precipitation data:
  - ANA (data used in calibrated run)
  - TRMM (2011-2013 years)
  - CPTec (2013 year)



# Precipitation bias removal

- CPTEC tests



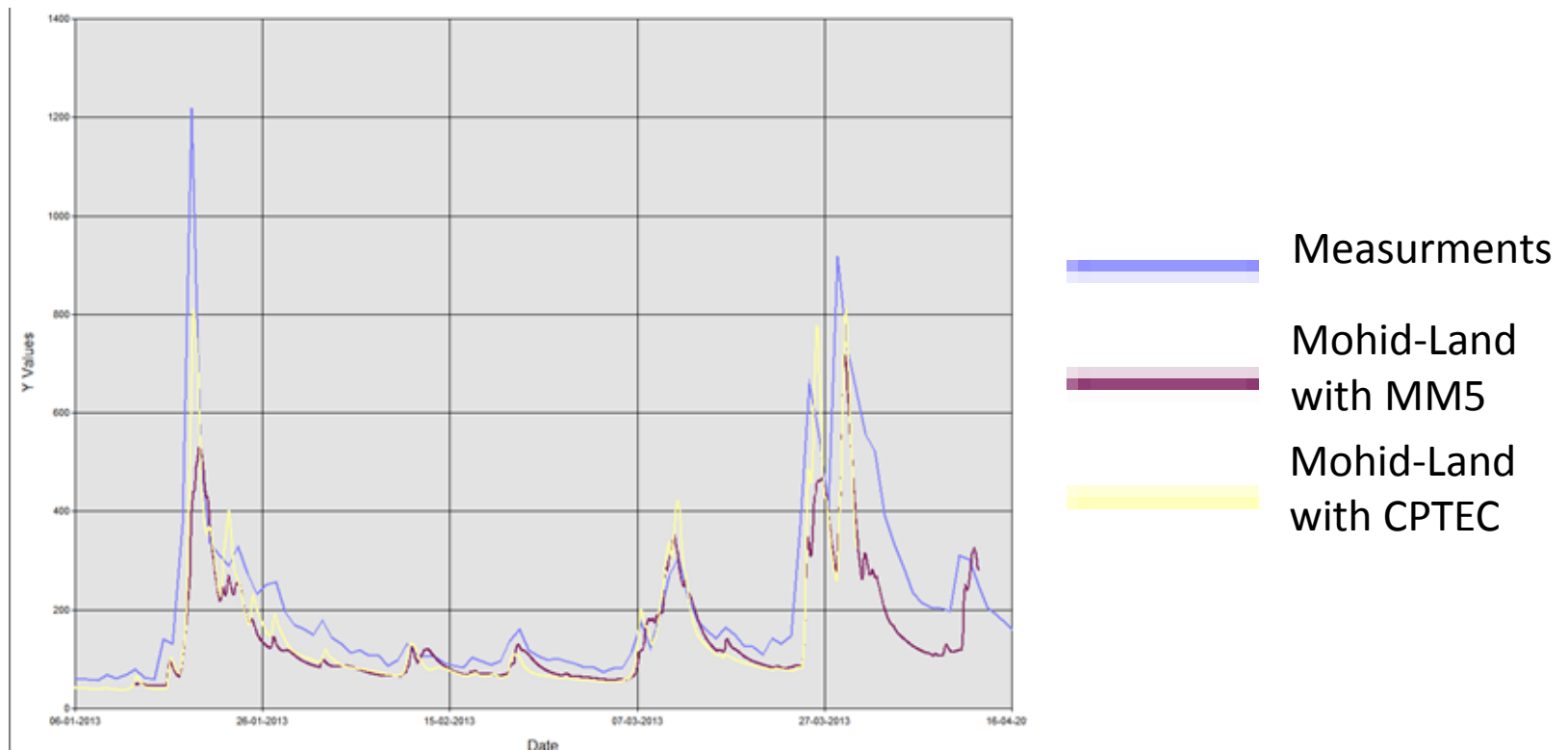
# Mohid Land application in Tamega

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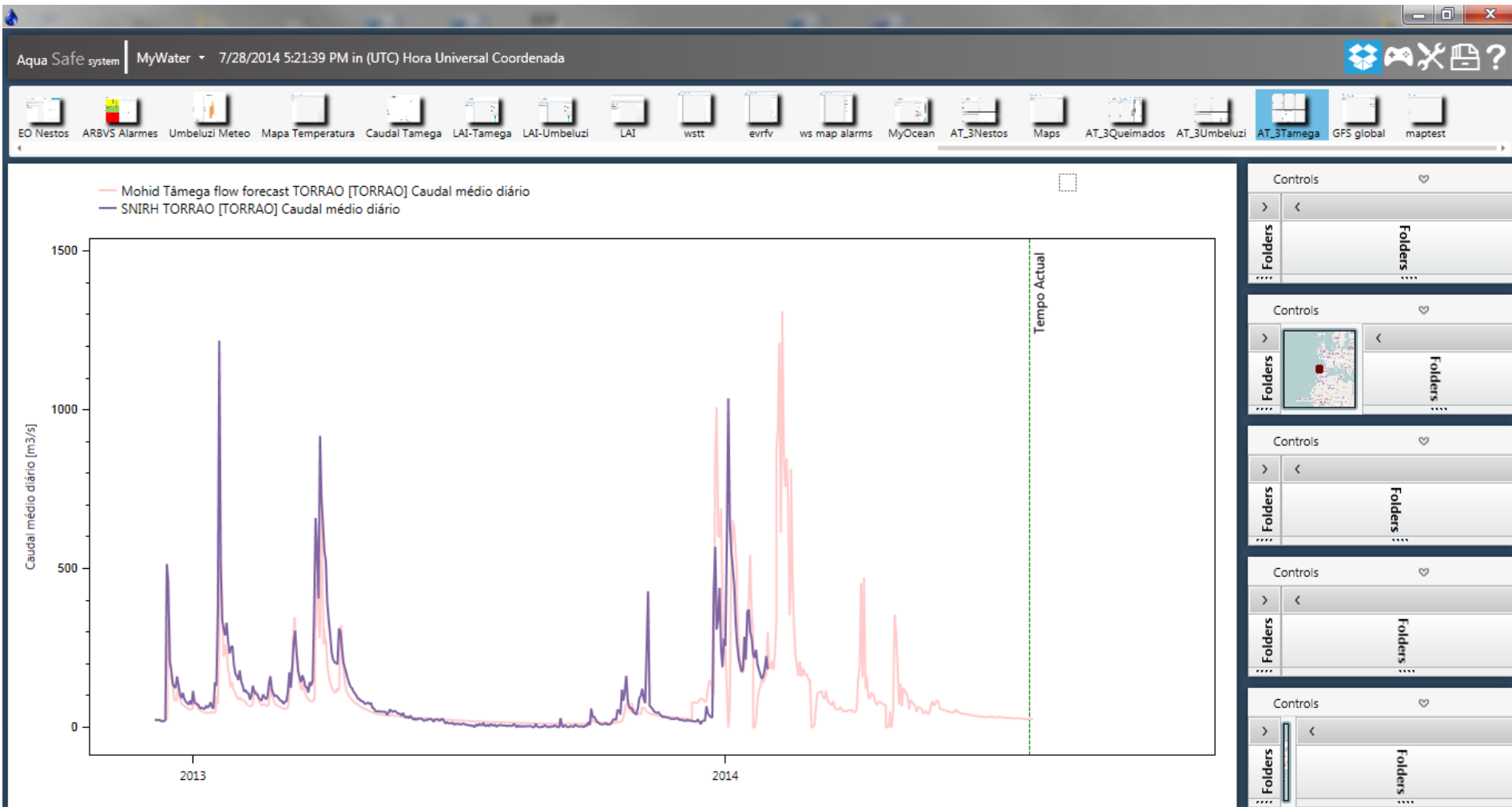


# Tamega

- Tamega watershed in Portugal using CPTEC model generated good results with 24h forecast and the MM5 24h forecast



# A flow forecast system for hydroelectric production - Tamega





# Conclusions

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# Conclusions

- SWAT is useful to predict flows
- In the case of Queimados to apply a bias correction to precipitation is needed to improve SWAT flow results.
- Precipitation from ETA CPTEC/INPE model needs a bias removal of more than 50% to get reasonable forecast flows in Queimado
- For Tamega watershed an average bias removal in the precipitation of 10% would be sufficient (in this case using Mohid Land, but SWAT expected to be similar)
- Modeling results of Queimados an Tamega were shown to the local power production companies and they were interested on the results