

# Comparison and validation of gridded precipitation datasets for Spain

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## Introduction

- Land-surface models (LSM) are interesting due to their physically based approach, which allows us to understand the physical processes involved.
- The quality of LSM simulations depends on model structure, physiographic data and **meteorological forcing**.
- Precipitation** is a key variable, which is difficult to analyze or to interpolate due to its high spatial and temporal heterogeneity. This has a very strong impact on the resulting simulations.

Thus, the quality of the precipitation forcing dataset is a key issue in large scale hydrological simulation based on land-surface models.

## Objective

In this study two precipitation datasets (SAFRAN and Spain02) are compared to the observations.

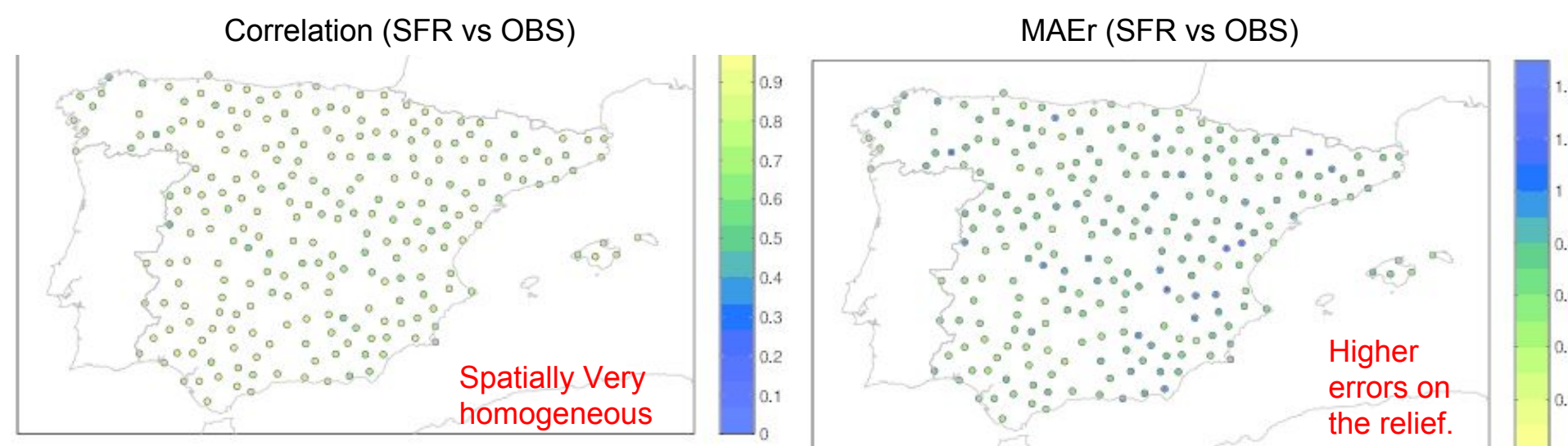
## Datasets

- SAFRAN** (Durand et al., 1993, 1999; Quintana-Seguí et al. 2008) uses an optimal interpolation algorithm in order to analyze all necessary variables to force a LSM.
  - P, T, W, RH, C. Downward radiation is simulated.
  - Implemented in Spain by Quintana-Segui et al. (2016).
    - Inputs: Observations from AEMET's network.
    - Outputs: 5 km grid. 1h time step.
  - The dataset was published to the HyMeX database.
- Spain02** (Herrera et al. 2012, 2015) is a series of gridded datasets of daily precipitation and temperature. It has several versions. In this study we use the the area representative version based on thin plate splines using the relief as a co-variable. It has a resolution of 0.11°.
  - Spain02 is the reference gridded dataset of precipitation in Spain.
- ERA-Interim** (Dee et al., 2011) is the ECMWF global reanalysis. It has a resolution of 0.75°. It was included in the comparison to show how global, but coarse, products compare to local high resolution products.

## Period

- 1995-2006: Validation of SAFRAN with independent data.
- 1980-2010: Comparison of SAFRAN and Spain02 to all available data (it was not possible to prepare a good independent dataset for both products, as they were created separately).

## Validation of SAFRAN with independent data



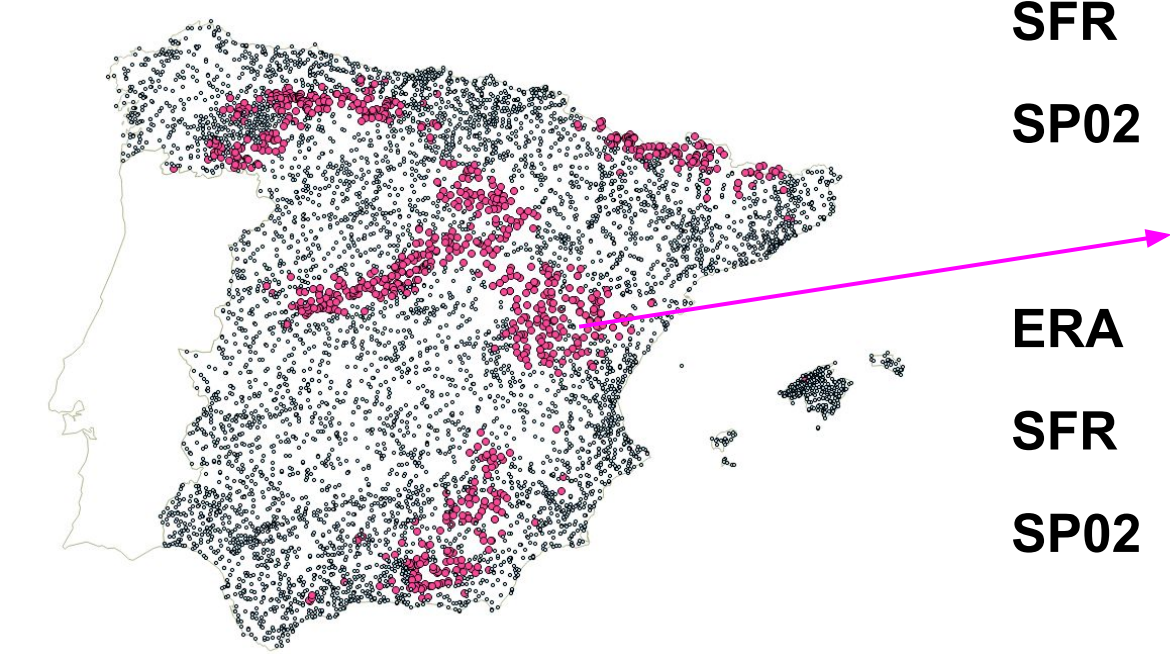
Correlation and MAEr on the independent pluviometers (not used to perform the analysis).

	Correlation			MAEr		
	Mean	Q25	Q75	Mean	Q25	Q75
Independent observations.	0.82	0.75	0.86	0.62	0.54	0.75
Dependent observations.	0.82	0.77	0.87	0.62	0.53	0.72

## Comparison of SAFRAN, Spain02 and ERA-Int.

### Temporal similarity

AEMET stations used for the comparisons.  
Pink stations are located at altitudes > 1000 m.



	Correlation			MAEr		
	Mean	Q25	Q75	Mean	Q25	Q75
All stations						
ERA	0.26	0.14	0.43	1.30	1.14	1.44
SFR	0.82	0.77	0.87	0.62	0.53	0.72
SP02	0.82	0.75	0.87	0.62	0.49	0.75
> 1000 m.						
ERA	0.21	0.04	0.36	1.23	1.11	1.43
SFR	0.82	0.75	0.86	0.64	0.55	0.77
SP02	0.82	0.75	0.88	0.61	0.49	0.76

- Almost identical results between SAFRAN and Spain02.
- There are no significant differences between all the stations and those at higher altitude.

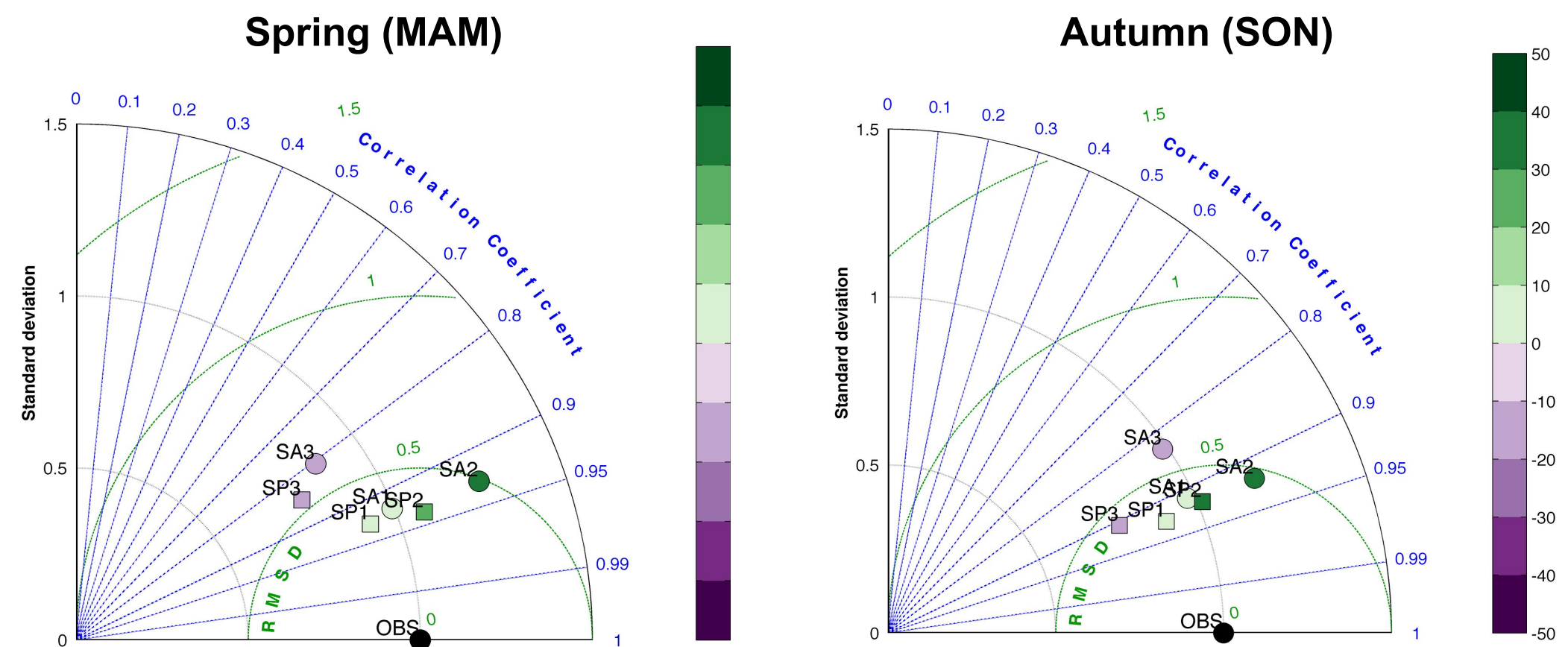
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## Comparison of SAFRAN, Spain02 and ERA-Int.

### Spatial similarity

	Relative Bias	Relative Std. Dev	Relative Centred RMSE	Correlation	Relative Bias	Relative Std. Dev	Relative Centred RMSE	Correlation
Consecutive Dry Days				0.85	Number of Rainy days (P>1mm)			
ERA	-0.01	1.28	0.69		0.39	1.66	1.06	0.79
SFR	0.04	1.04	0.49		0.40	1.27	0.50	0.93
SP02	-0.03	0.91	0.50	0.87	0.30	1.18	0.41	0.94
Consecutive Wet Days				0.64	Number of days of P>10mm			
ERA	0.26	1.08	0.89		-0.31	0.71	0.78	0.64
SFR	0.44	1.47	0.75		-0.04	1.08	0.40	0.93
SP02	0.27	1.27	0.55	0.91	0.05	1.06	0.34	0.95
Total Precipitation				0.92	Number of days of P>20mm			
ERA	-0.16	0.81	0.80		-0.57	0.25	0.94	0.38
SFR	0.01	1.00	0.39		-0.22	0.94	0.46	0.89
SP02	0.04	0.97	0.34	0.94	-0.09	0.94	0.40	0.92
Max. Precip in 1 day				0.	Max Precip in 5 days			
ERA	-0.29	0.26	1.04		-0.27	0.26	1.01	0.
SFR	-0.18	0.96	0.59		-0.07	0.94	0.54	0.
SP02	-0.15	0.78	0.46	0.	-0.06	0.85	0.42	0.
Mean precipitation of a wet day				0.76				
ERA	-0.40	0.16	1.03		-0.40	0.16	1.03	-0.
SFR	-0.26	0.68	0.66		-0.26	0.68	0.66	0.76
SP02	-0.18	0.67	0.59	0.82	-0.18	0.67	0.59	0.82



Taylor Diagrams which compare three indices (1 = PRCPTOT; 2 = R1; 3 = RX1DAY) for both SAFRAN and Spain02.

## Conclusions

- ERA-Int is good at dry and wet spells.
- SFR and SP02 have difficulties with wet spells.
- SP02 has a better number of rainy days (R1).
- SP02 is better with extreme precipitation events.
- In general, SP02 is better than SAFRAN, but differences are small.
- SAFRAN is a very complete product, whose precipitation is comparable to, even if it is not as good as, Spain02's.

## Next steps

- Use SAFRAN to force different LSMs (SURFEX and LEAFHYDRO) in Spain in order to study drought processes (FP7 earth2Observe project).
- Use a river routing model (Eau-dyssée and RAPID) in conjunction with SAFRAN and SURFEX in order to simulate river flows in Spain.
- Use these simulations in order to validate hydrometeorological extremes in RCMs.
- Share the whole SAFRAN dataset with the community.

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