SECLI FIRM

The Added Value of Seasonal Climate Forecasting for Integrated Risk Management

SECLI-FIRM a presentation of CS5 and the first results

Kristian Nielsen 13. Nov. 2020

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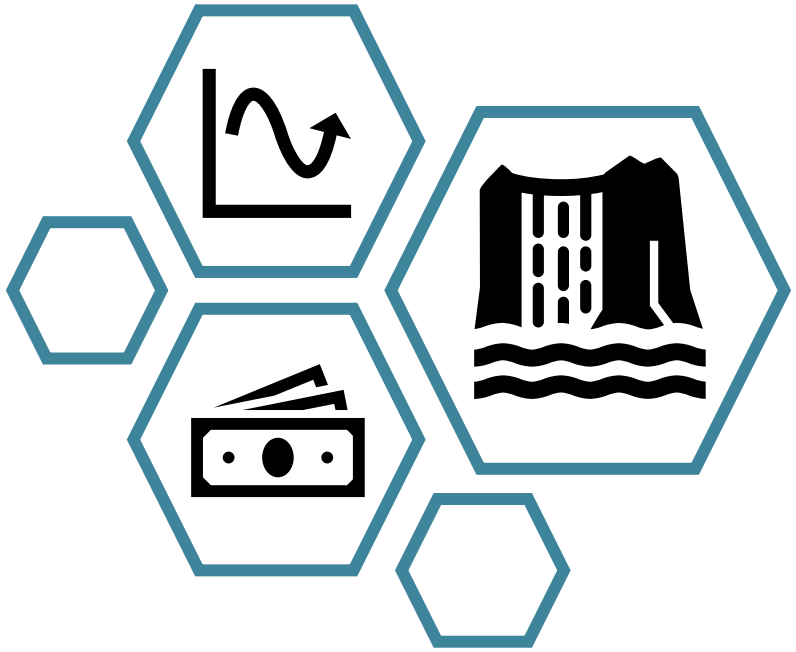
The Added Value of Seasonal Climate Forecasting for Integrated Risk Management

Summary of CS5 task: Improve an existing deterministic forecast of river flow for specific damns chosen by Celsia by implementing the use of seasonal forecast data. This also allows for easy implementation into existing econometric models that internally handles uncertainties.



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Different approaches to achieve most skill full forecast

Direct forecast

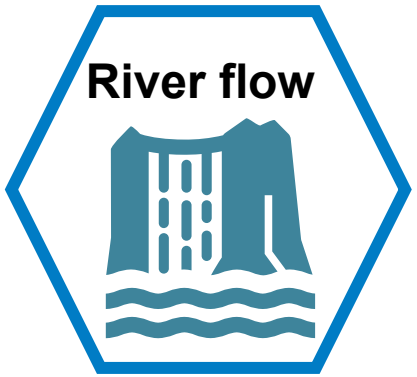
Using the predicted forecast of precipitation for each grid point within/covering the catchment area of the dam.

Teleconnection forecast

Utilizing the global teleconnection patterns between sea surface temperature (SST) anomalies and river flow.

Random forest

Making use of trained RF models together with observed SST anomalies to predict future flow.



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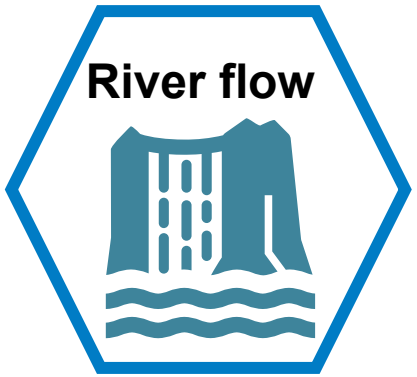

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Teleconnection patterns

Sea Surface Temperatures

Estimation of teleconnection patterns between observed SST (ERA5) and observed individual river flow (Celsia/IDEAM stations)

Removing statistical insignificant areas (95%) and areas of "inconsistence".

Forecasting river flow from the correlation with the forecasted SST in the estimated areas.

River flow

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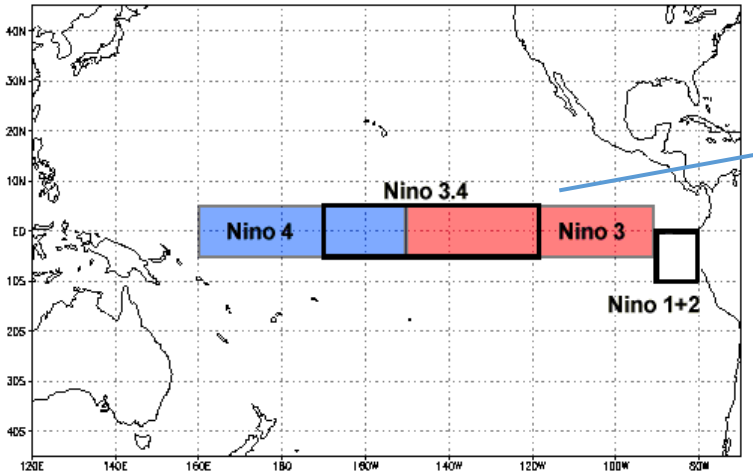
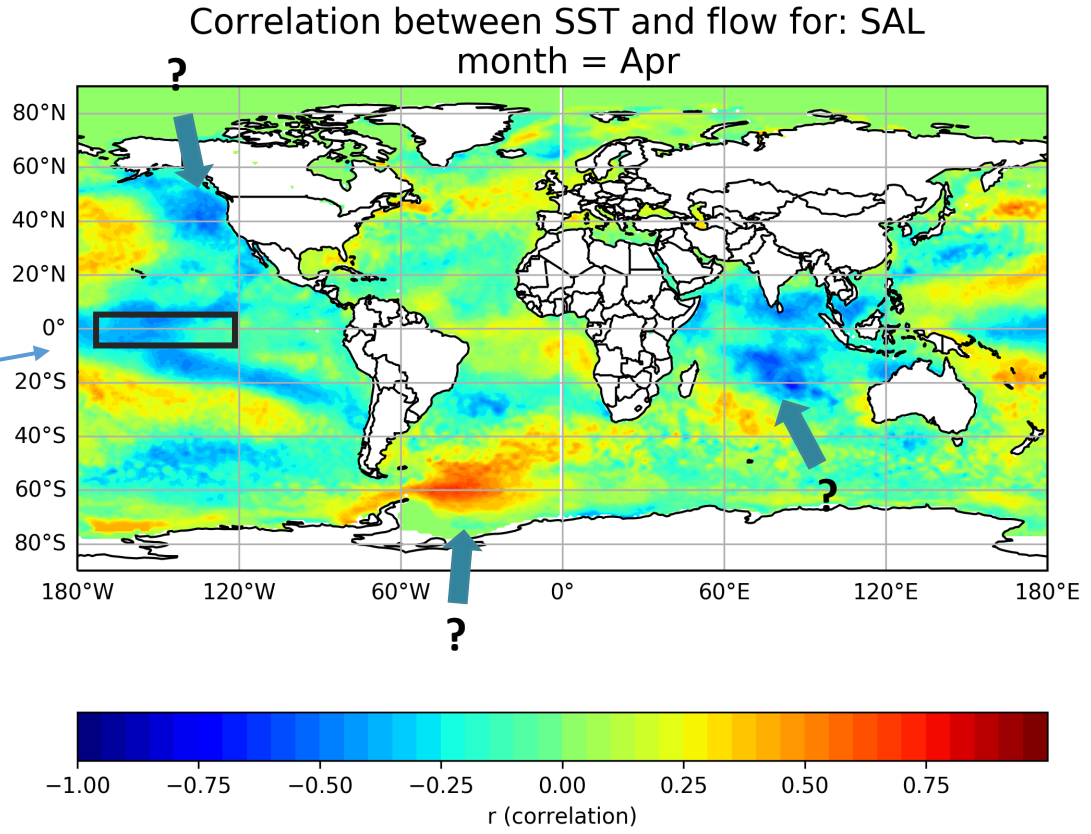
Testing the use of global information on SST anomalies compared to defined areas in order to improve the forecast.



Source: https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst/



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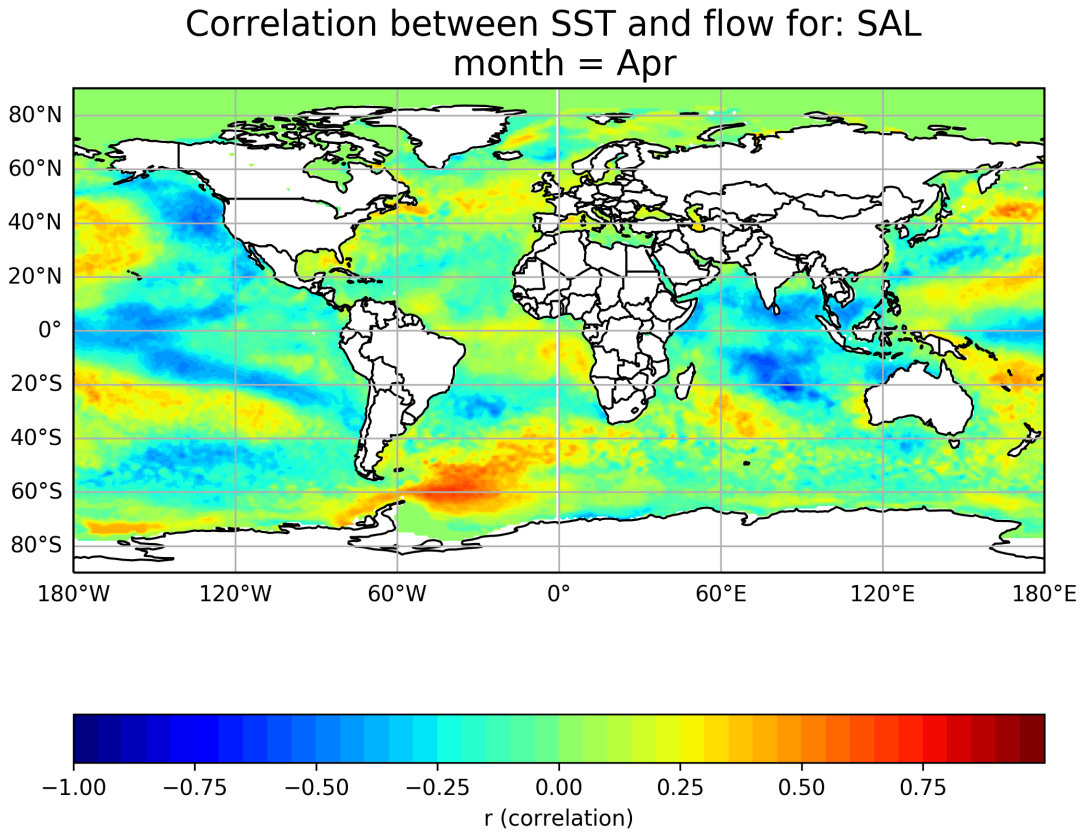
- The **correlation between monthly river flow and SST anomalies** are found for each grid point. This is done for all months of the year. Using crossreference of the period 1993-2016 leaving out the forecasted year.
- The plot shows an example for Apr 2009.



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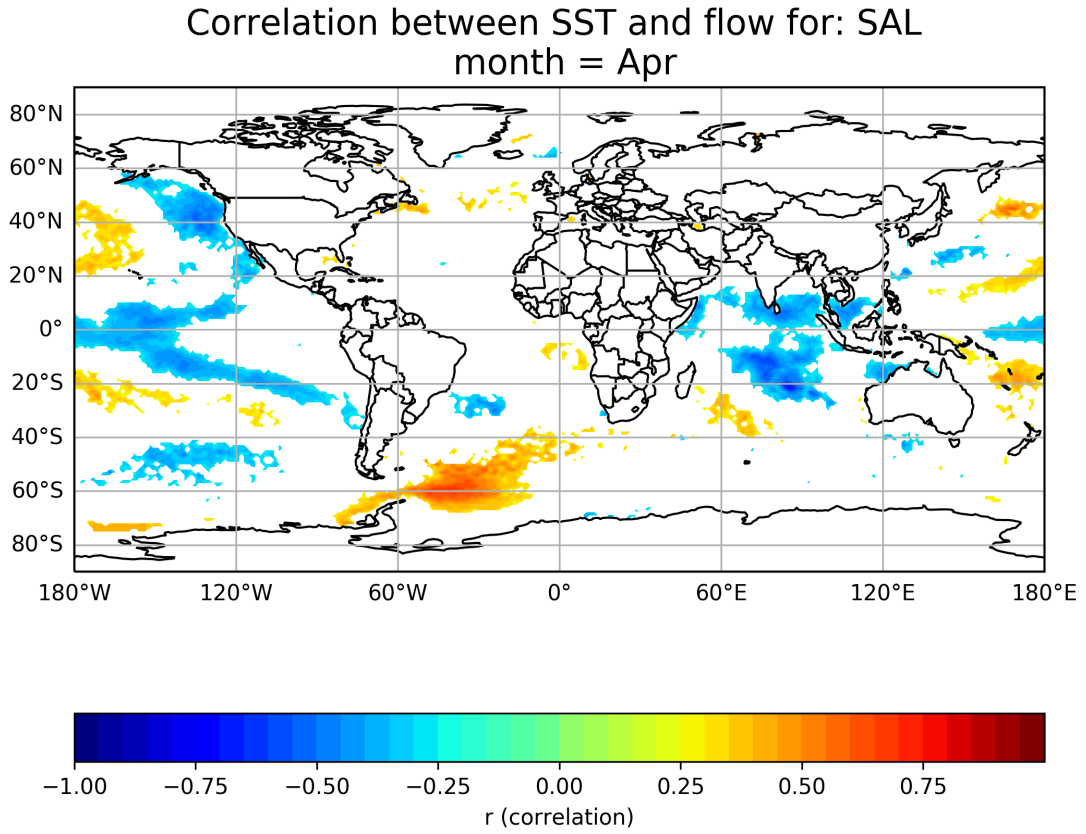
Leaving out the nonsignificant points (95% threshold) in order to optimize the selection of points and obtain the strongest correlations of each month.



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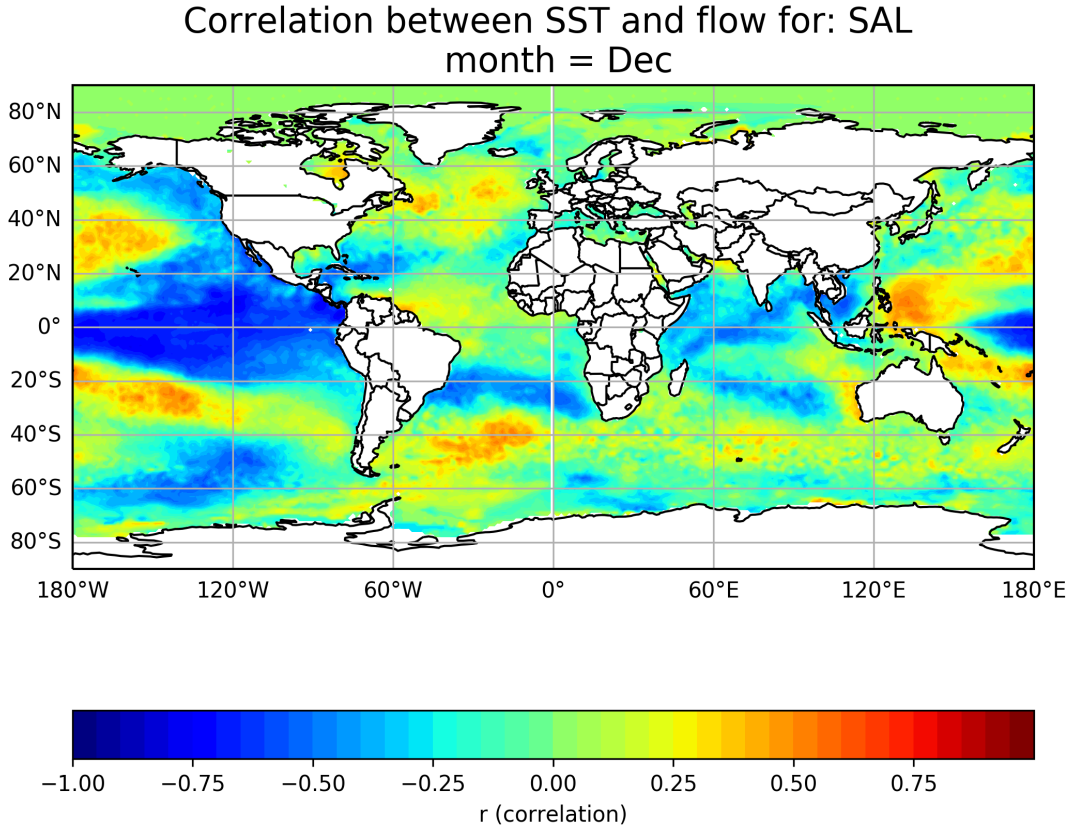

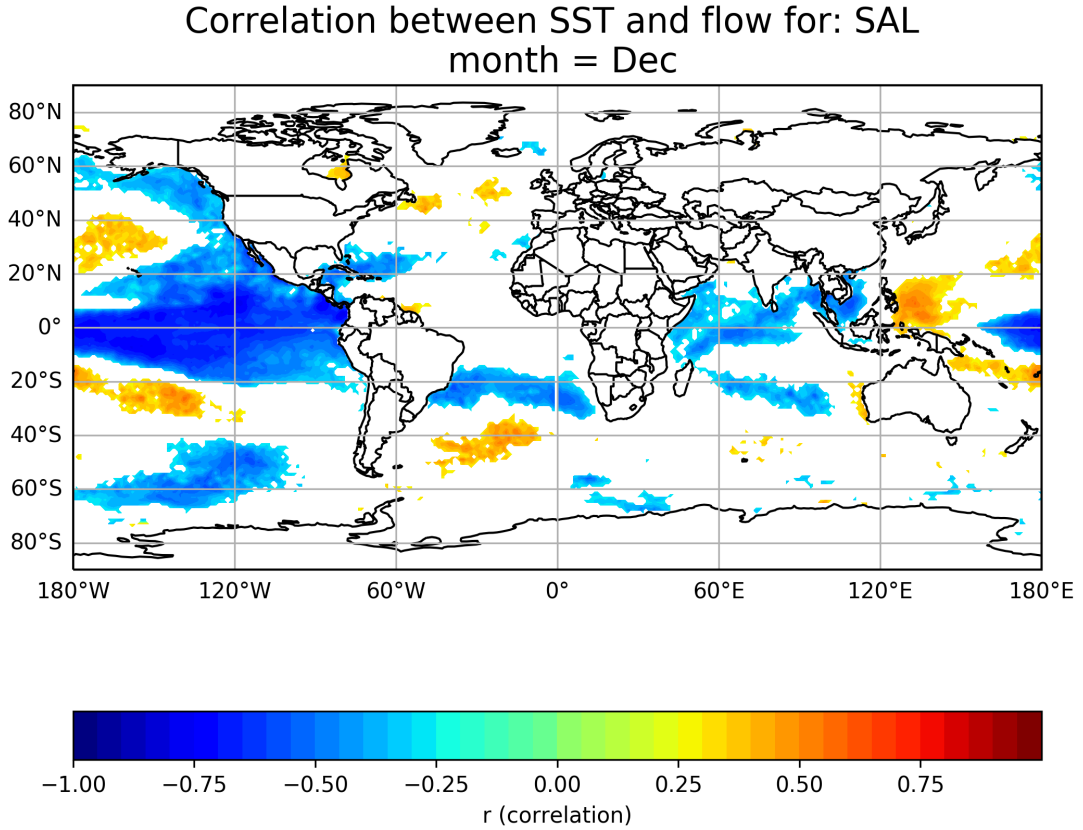

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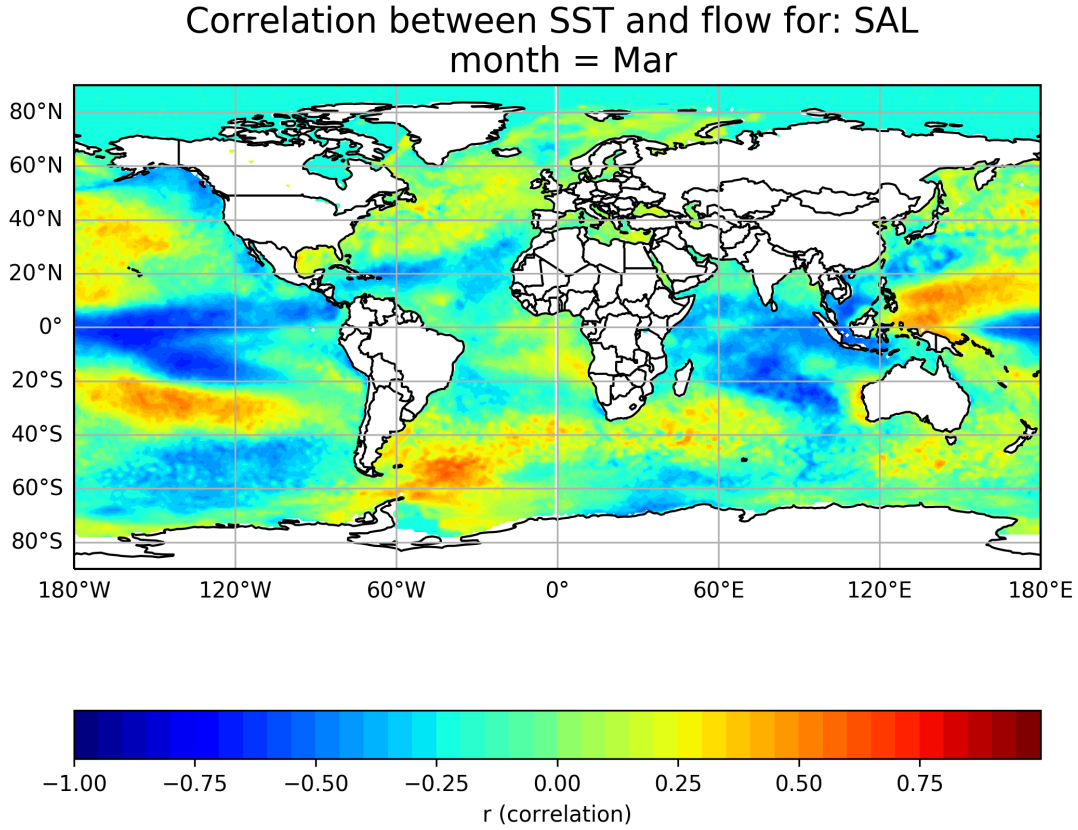

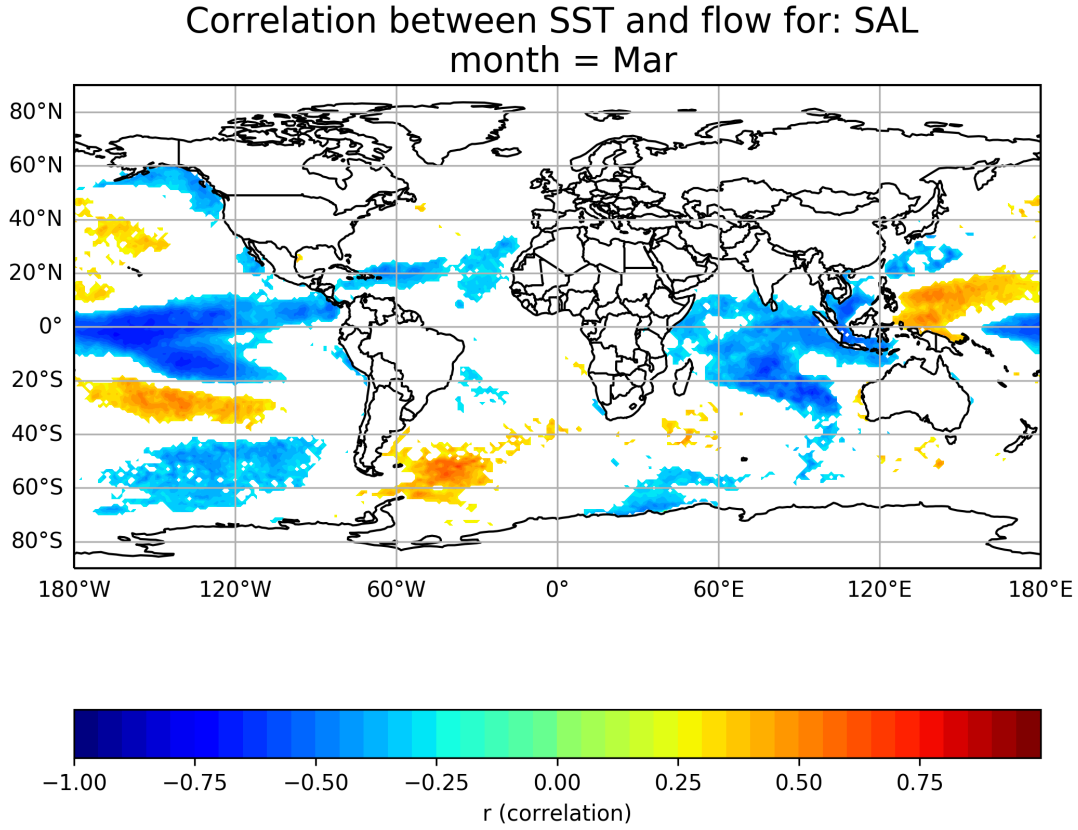

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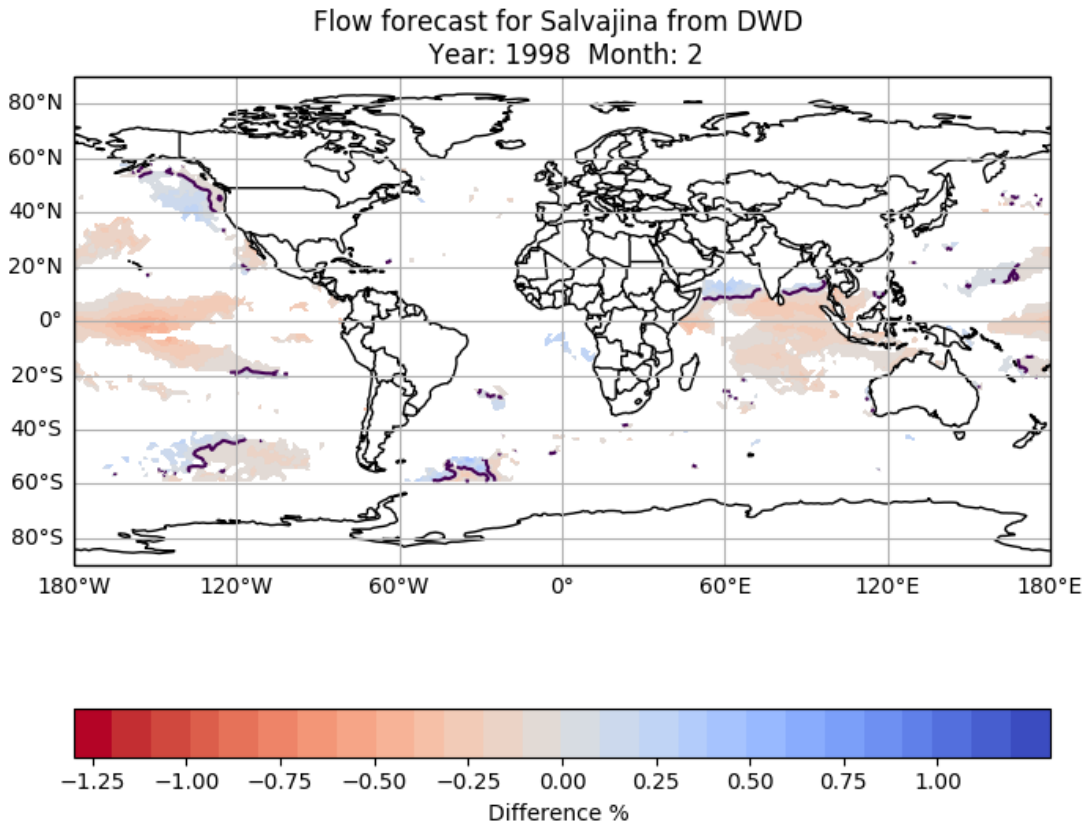
- Using forecasted SST for each point with each point specific correlation with river flow to predict future flow.



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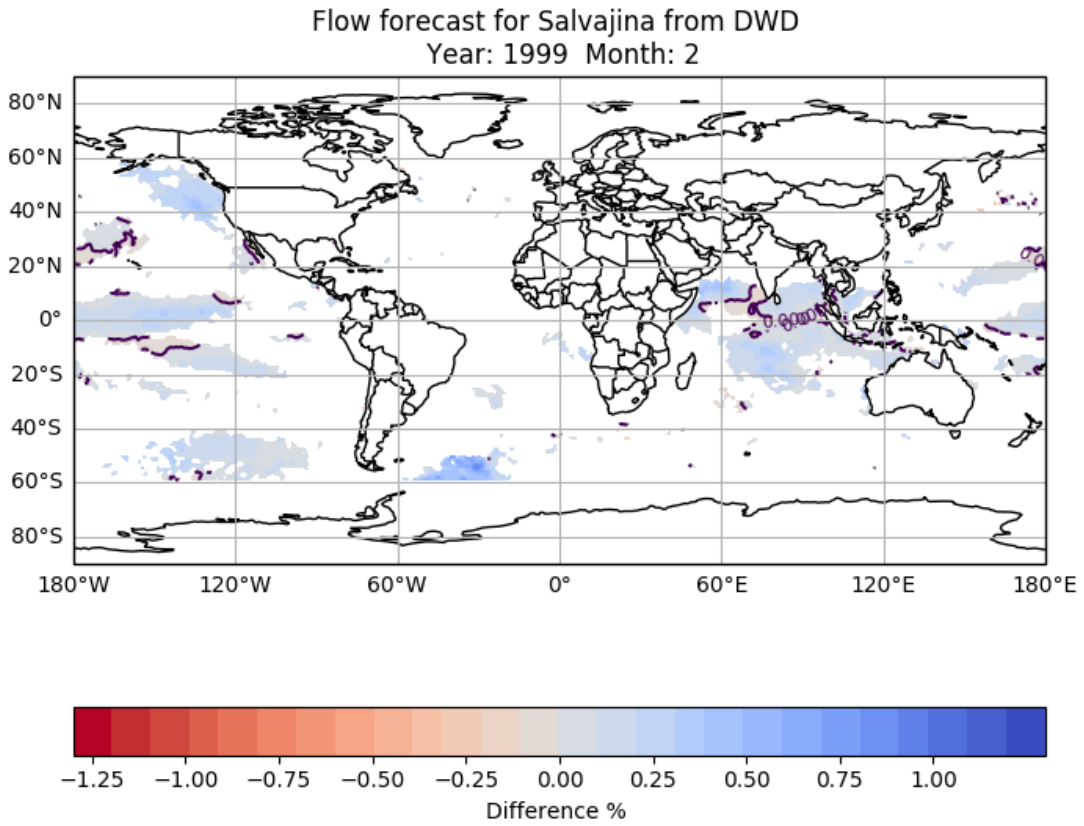

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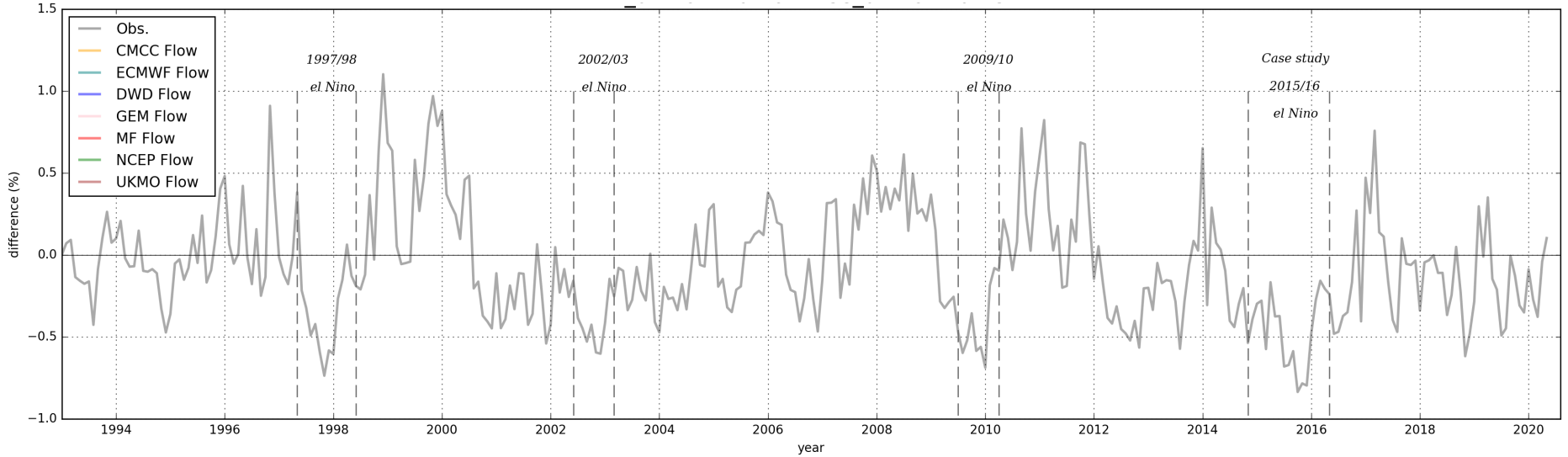
Observed flow (SALVAJINA) and MME forecasted flow from correlation with SST obtained from monthly teleconnections pattern



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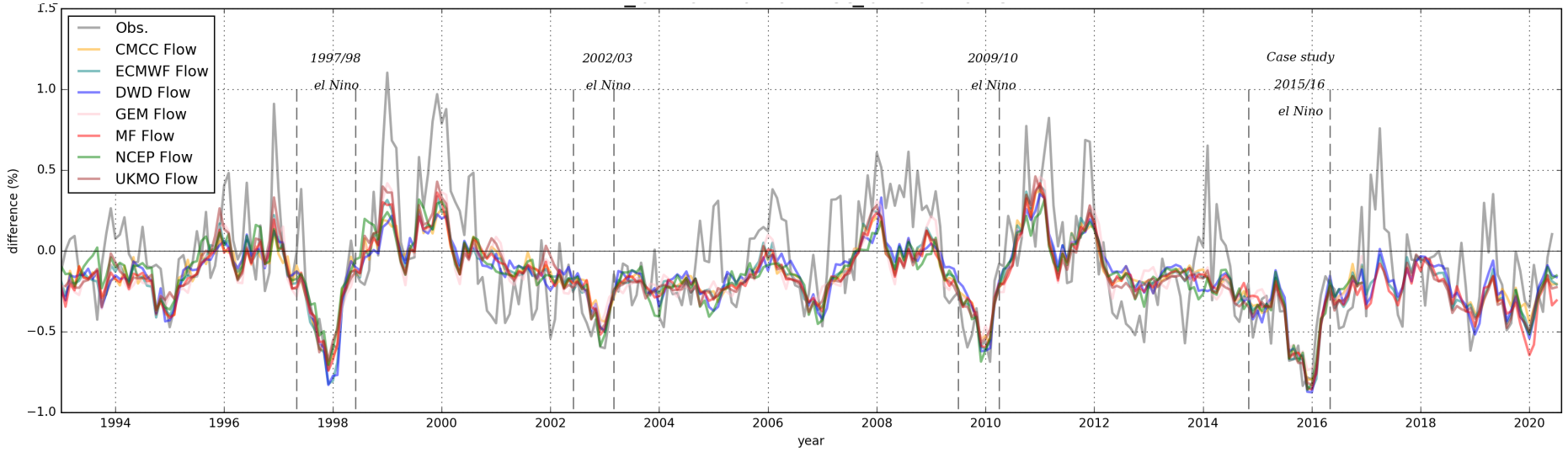

	CMCC	ECMWF	DWD	GEM	MF	NCEP	UKMO
Corelation(R)	0.73	0.77	0.73	0.74	0.76	0.75	0.77
RMSE	0.25	0.24	0.27	0.26	0.25	0.25	0.27

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Comparison of the methods

The comparison is carried out between observed and forecasted anomalies (%).

Method	R	R_2	RMSE
Teleconnections	0.78	0.61	23
Random forest	0.65	0.43	26
Direct forecast	0.62	0.39	31

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Final steps...

- Add "the best" from each method in order to further improve skill
- Estimate the added value by running a test case scenario with Celsia

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Thank you for your attention...!

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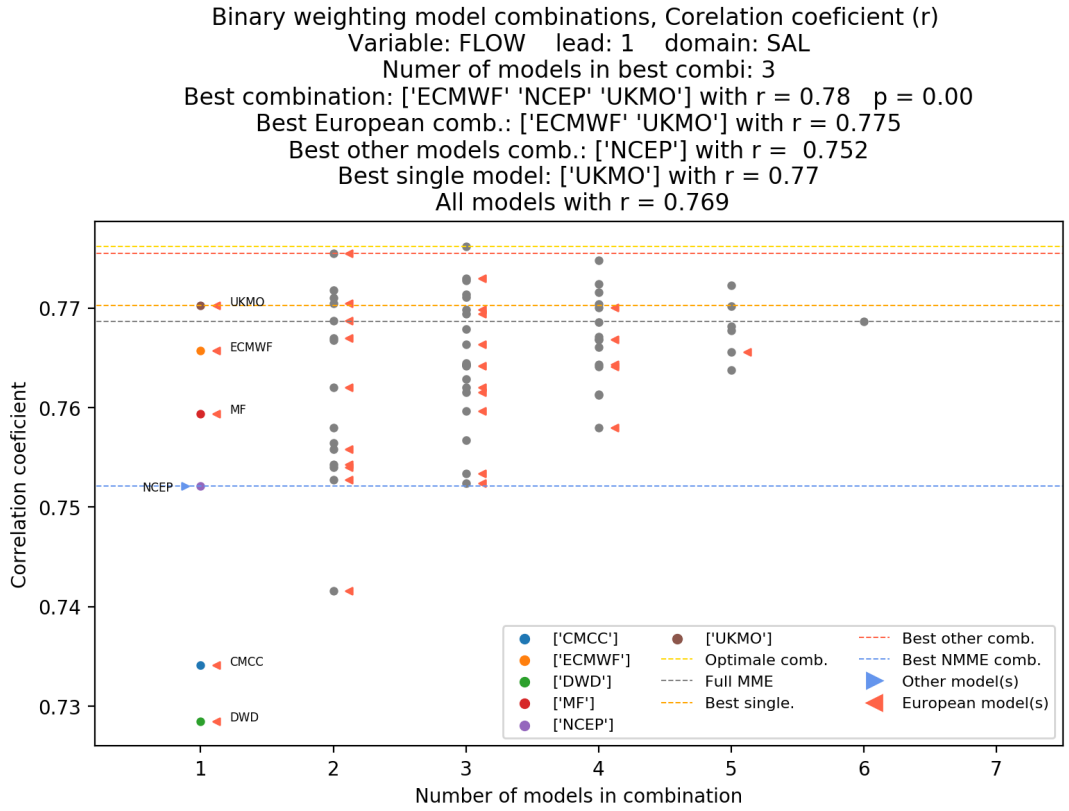
The Added Value of Seasonal Climate Forecasting for Integrated Risk Management

Estimation of the best model combination by testing all combination.

This method finds combinations better than any single model (grey dots over the yellow line).

Hower ever the improvement is relatively small due to similar forecast from all models with only small differences.



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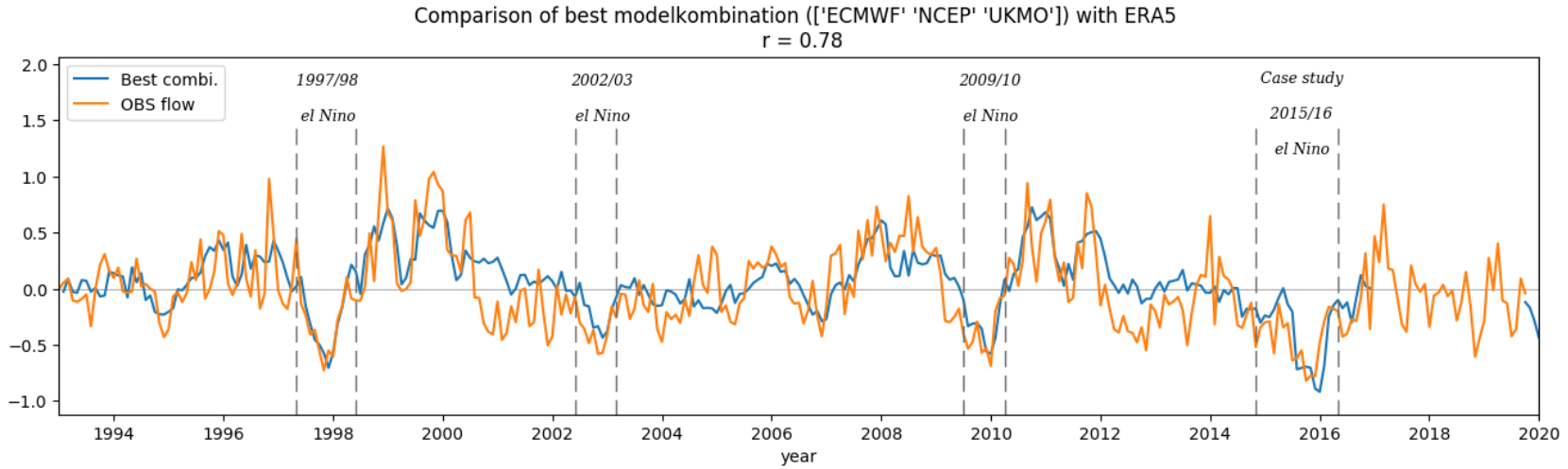
Estimation of the best model combination by testing all combination.

Plot of the best combination and observations. The missing data from 2016-2020 is due to missing data in one or more of the individual model in the combination. All three models are producing regular monthly forecast currently.



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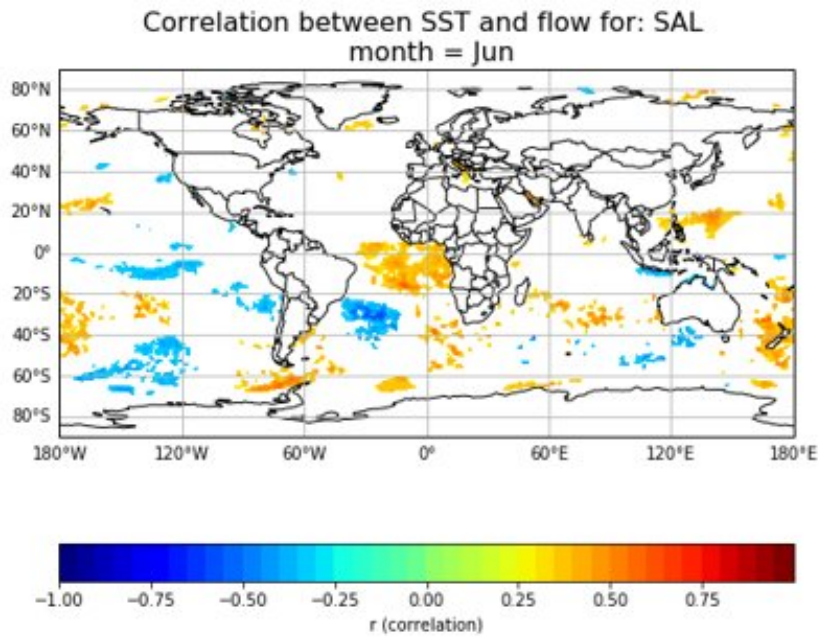
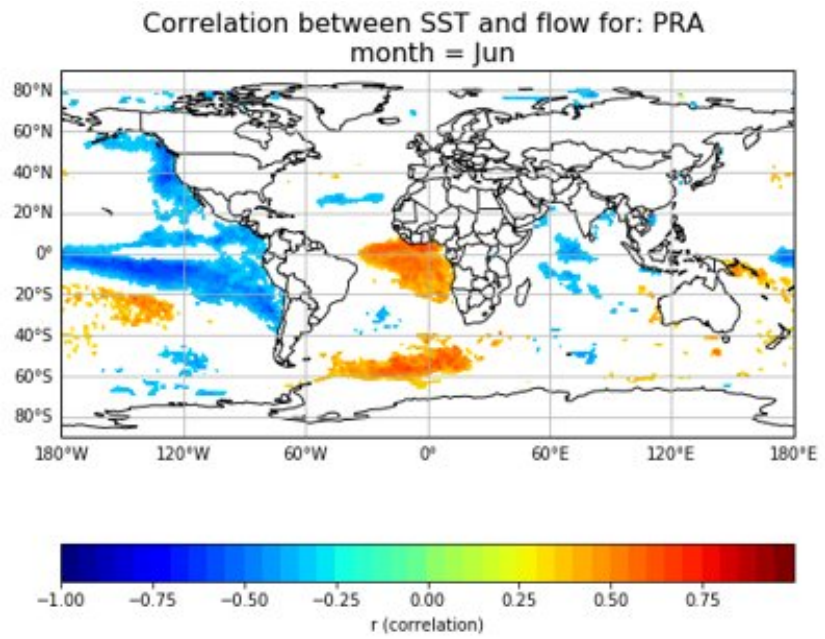
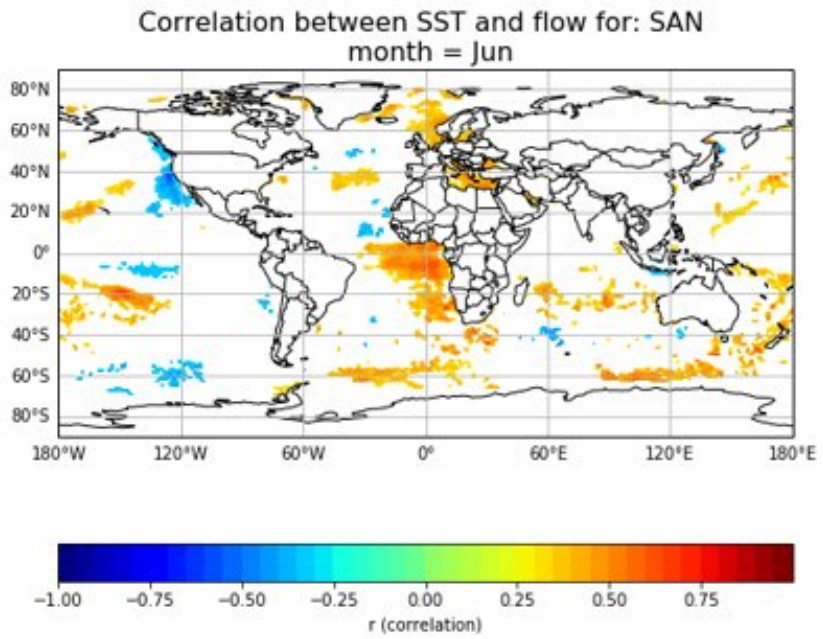
Monthly teleconnection patterns is carried out for the different rivers independently (Salvajina, Prado, San Marcos)







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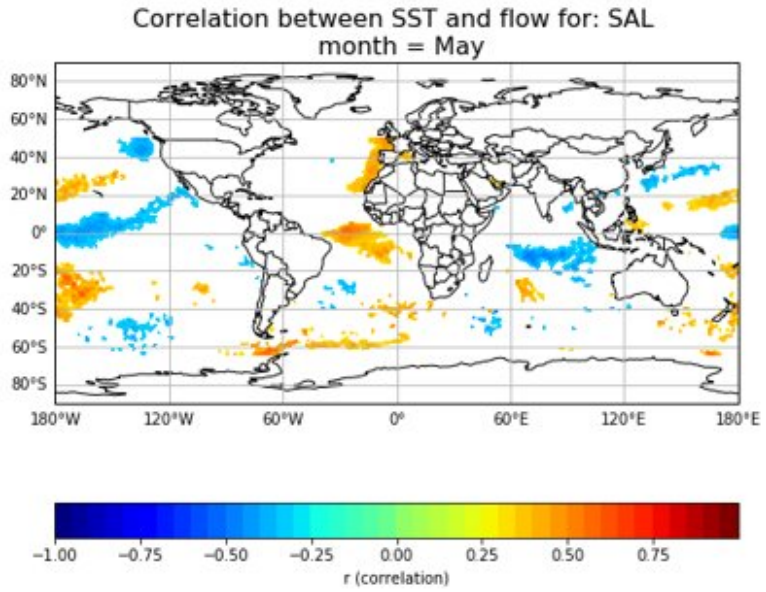

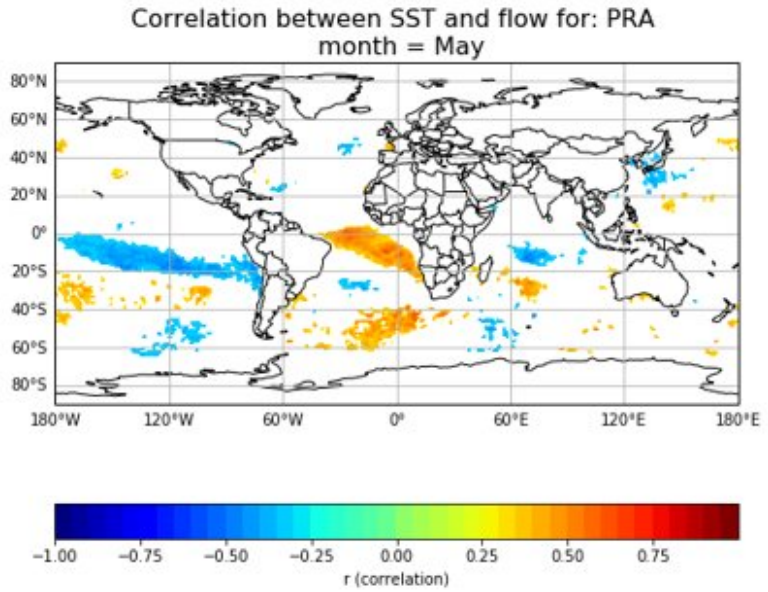

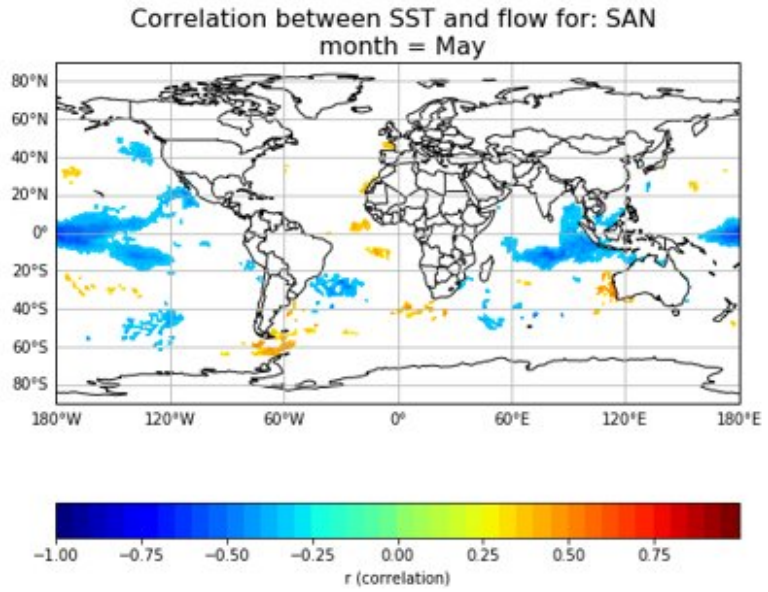

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