Predicción estacional regionalizada de extremos meteorológicos en la península ibérica

Miguel Hernández Calleja - AEMET (Area de evaluación y modelización del clima)

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aemet Agencia Estatal de Meteorología

copernicus Europe's eyes on Earth

Climate Change Service climate.copernicus.eu

ECMWF

ipcc INTERGOVERNMENTAL PANEL ON climate change

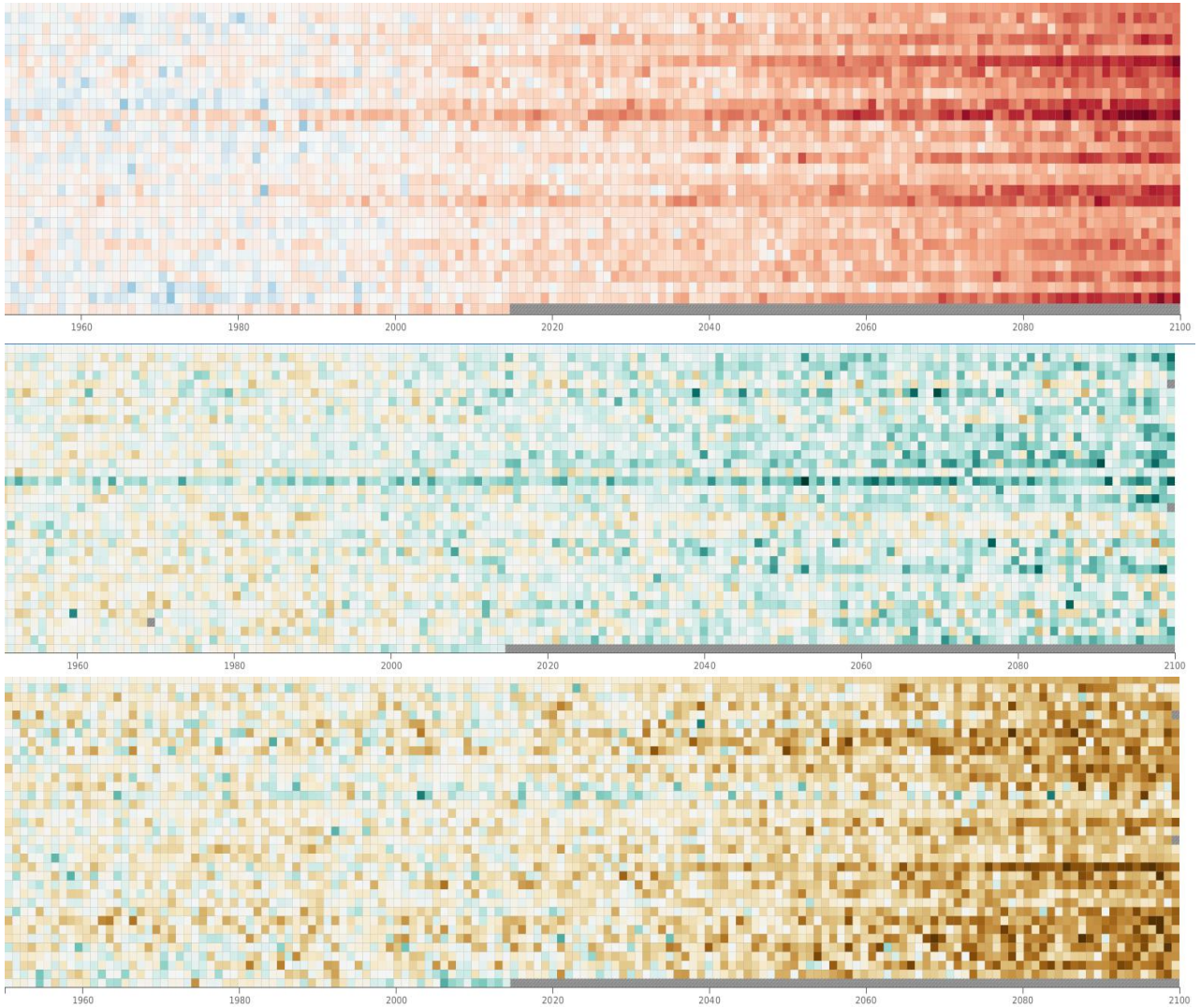
WMO UNEP

MEDITERRANEAN (MED)

Extreme heat
Projections: High confidence of increase
Past trends: Upward trend with high confidence of attribution

Heavy precipitation and pluvial flood
Projections: Medium confidence of increase

Mean precipitation
Projections: High confidence of decrease



Información Requerida

Anticipación

- Proyecciones Climáticas
- Predicción Estacional

Impact Indices

Temperatura: -Tropical Nights -Summer days -TXx -TNx	**Sequias**: -SPI -CDD **Precipitacion**: -RX1day -RX5days

Resolución Espacial

- Regionalización

Verificación de Índices

SEAS5 vs ERA5 (1º Resolution)

Downscaling SEAS5 vs ROCIO_IBEB (0.05º Resolution)

Modelo: SEAS 5 ECMWF. Hindcast 1997-2016.

Observaciones: ERA5 diario 1 grado.

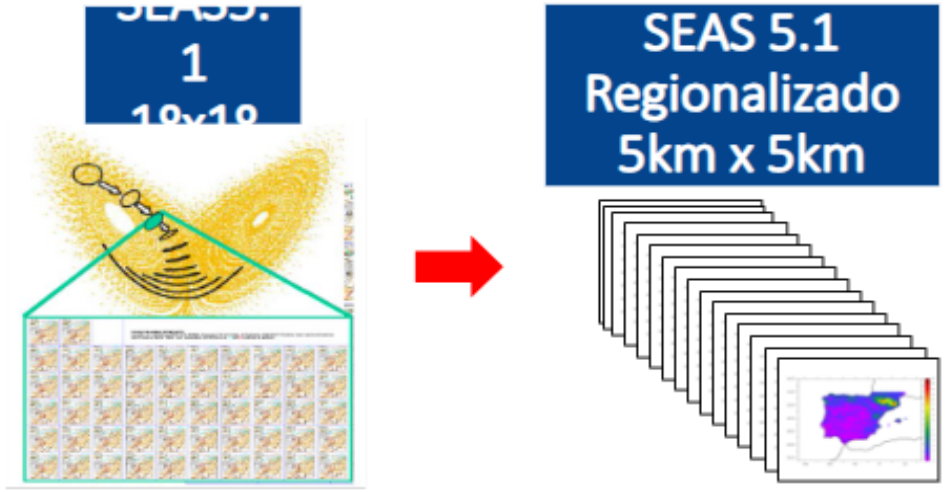
Downscaling: 0.05 grados Metodología basada en análogos(Santos Eduardo Petisco de Lara).

Observaciones: ROCIO_IBEB (Optimal Interpolation Observational Grid for Iberian Spain and the Balearic Islands) 5km.

Índices de verificación: Correlación de Spearman. Area Under the ROC Curve (AUC), evaluación por terciles.

Algoritmo de regionalización de precipitación de AEMET

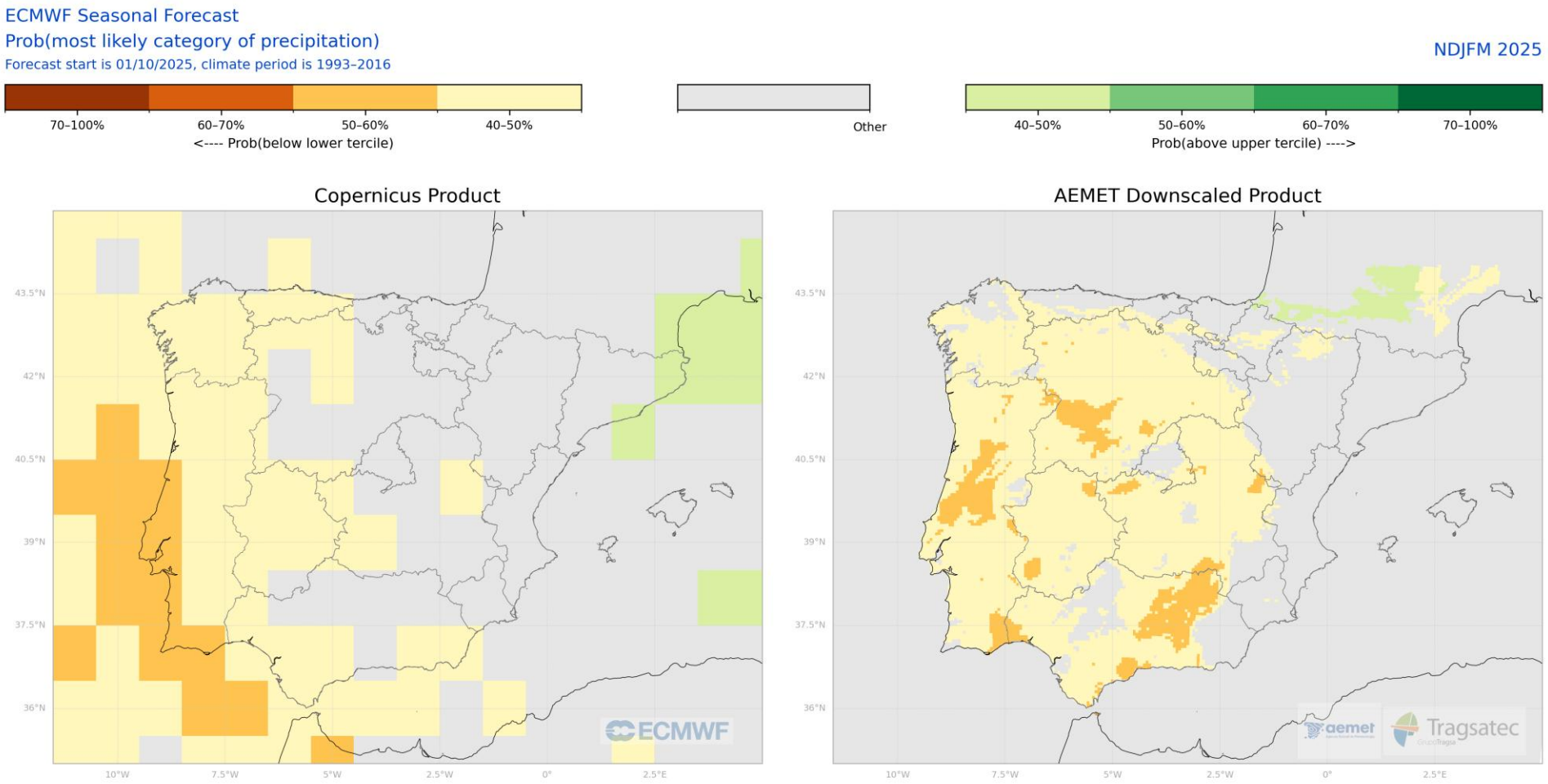
2. ESTIMACIÓN: 1997-2016 (Hindcast) y 2025/2026 (Forecast)



1. **Target day** with its associated synoptic situation (characterized by the geostrophic wind)
2. Synoptic-analogue search within the **reference synoptic database**.
3. We select the **N analogues** whose **distance to the target day is below** a prescribed threshold.
4. **Precipitation estimation**: weighted mean of the precipitation from the N analogues at each grid cell.

Índices JJA → Inicialización del 1 de abril

Índices NDJFM → Inicialización del 1 de octubre



Índices extremos de calor

TXx: Maximum value of the maximum daily temperatures.

Summer Days: Number of days when the maximum temperature exceeds 25ºC.

TNn: Minimum value of the minimum daily temperatures.

Tropical Nights: Number of days when the minimum temperature exceeds 20ºC.

Indices para sequias

SPI: Standard Precipitation Index.

- Fits historical prcp data into a gamma distribution.
- Transforms the distribution into a gaussian normal.
- SPI value represents the number of standard deviations by which the current precipitation anomaly deviates from the long-term mean.
- Can be calculated for agragates of 1, 3, 6 months(agricultural impacts) 12-24 months(hydrological impacts).

CDD: Consecutive dry days.

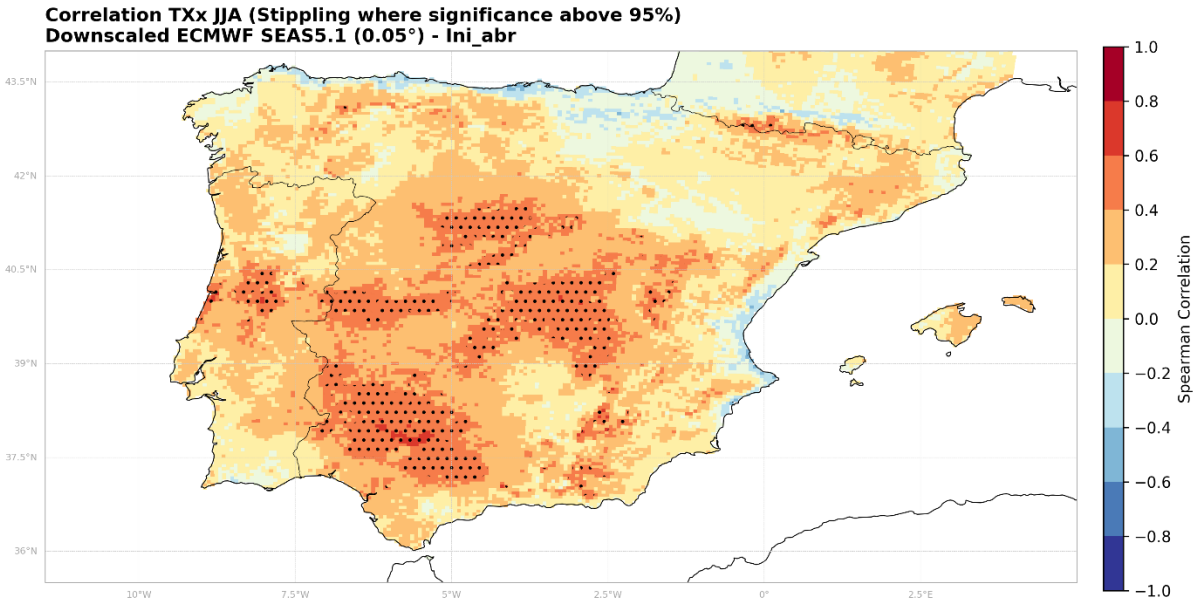
Índices para precipitaciones extremas

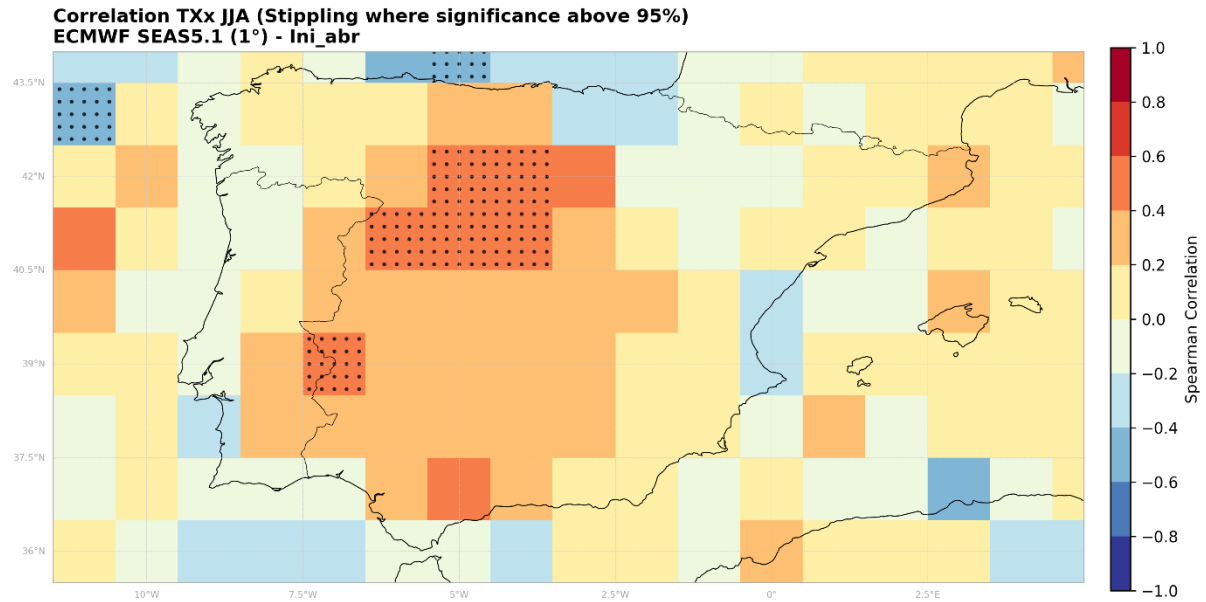
RX1: Maximum precipitation acc in 1 day.

RX5: Maximum precipitation acc in 5 consecutive days.

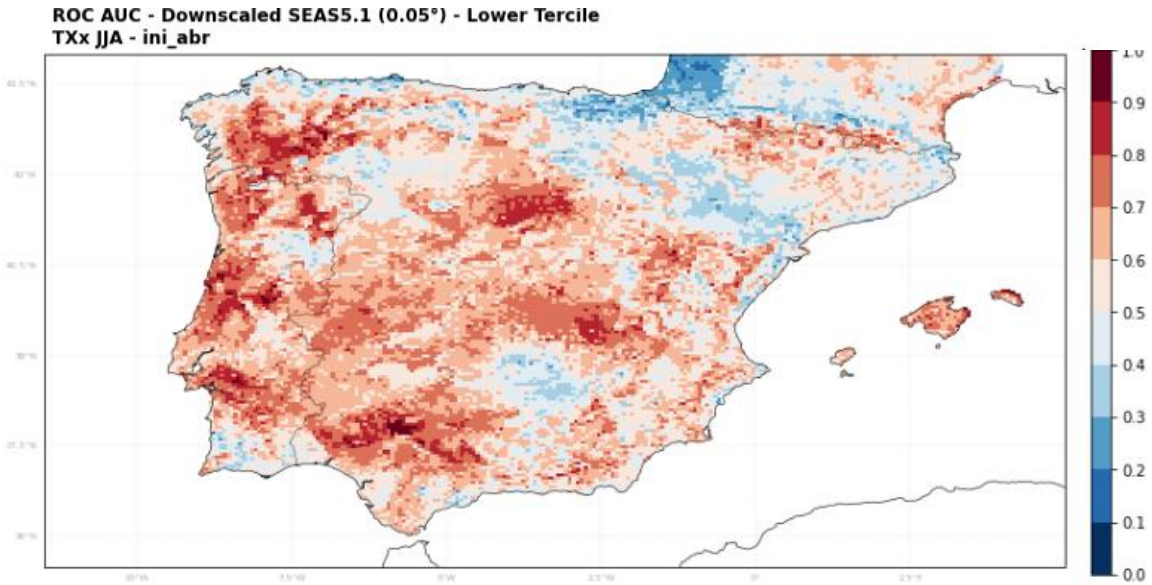
CWD: Consecutive wet days.

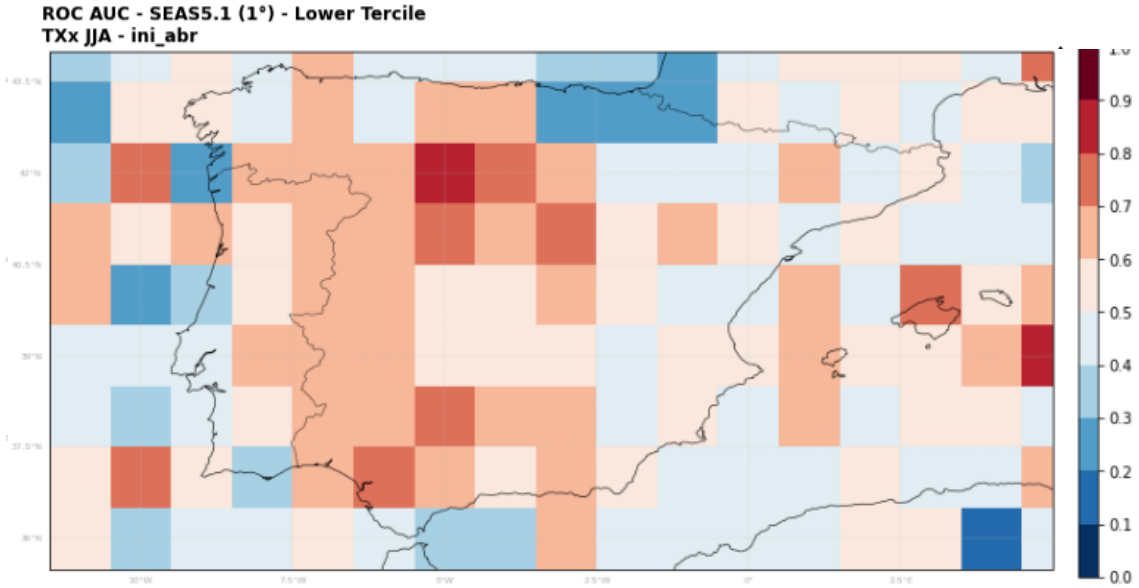
Correlación vs obs - TXx JJA (Máxima de las temperaturas máximas).



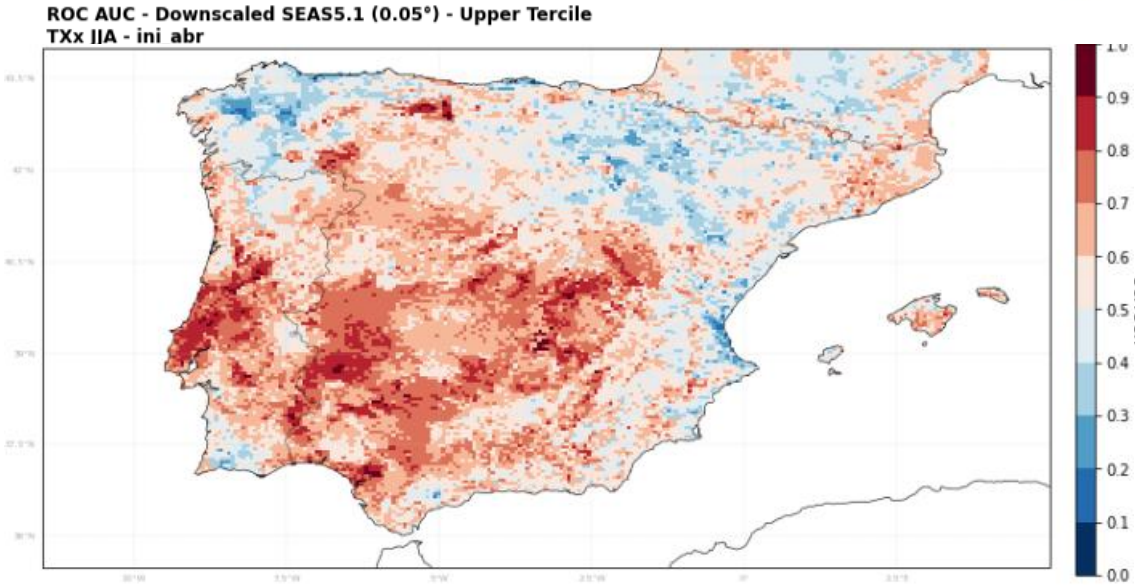


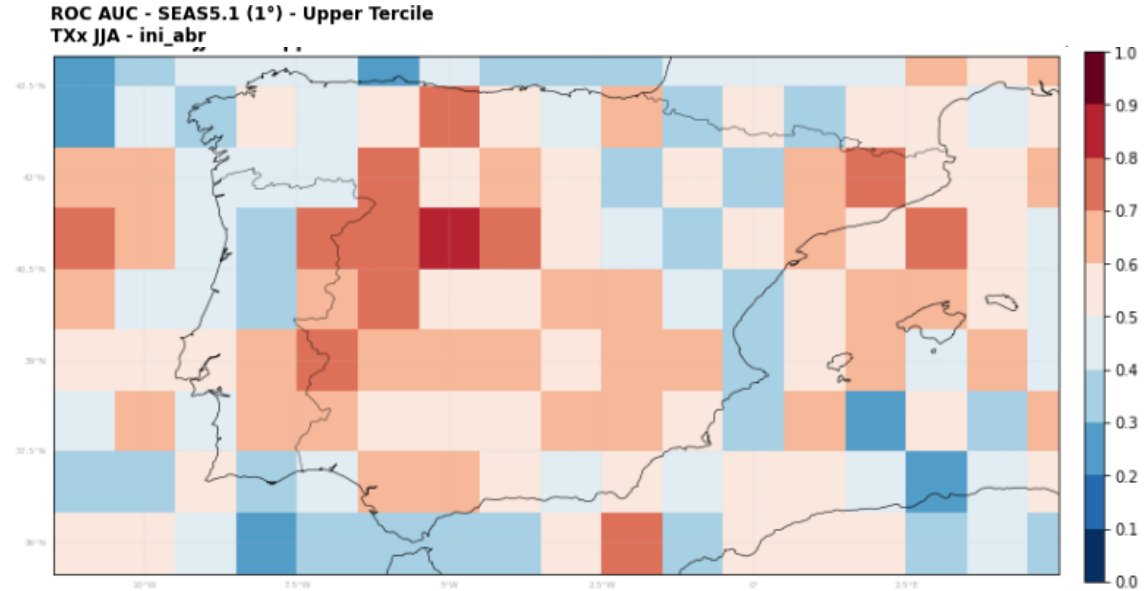
AreaROC. Tercil Inf



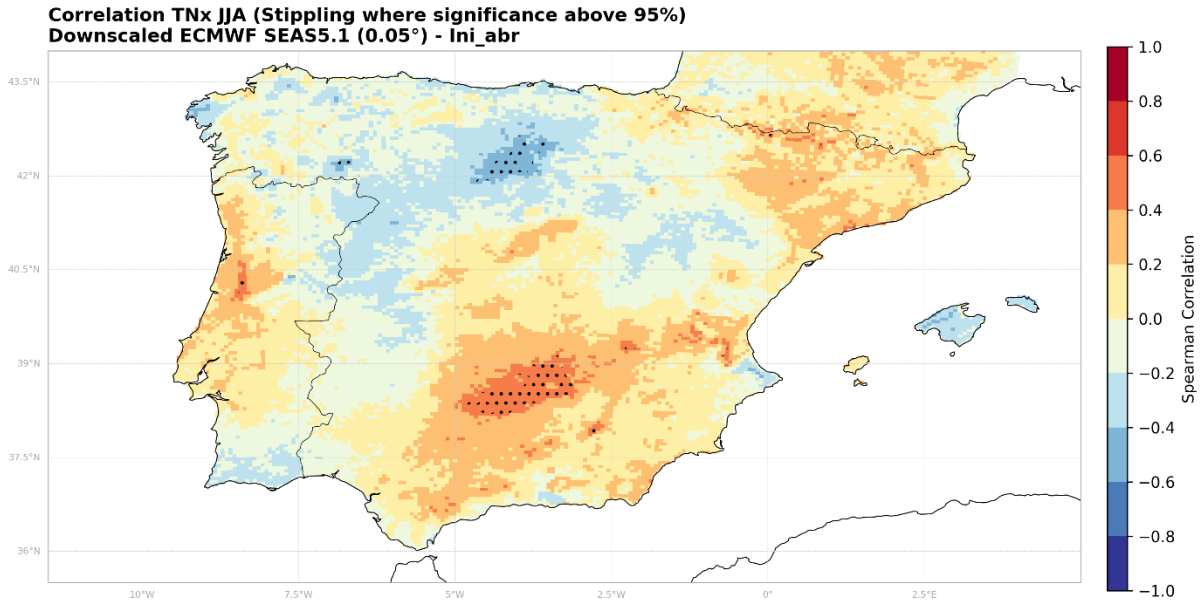


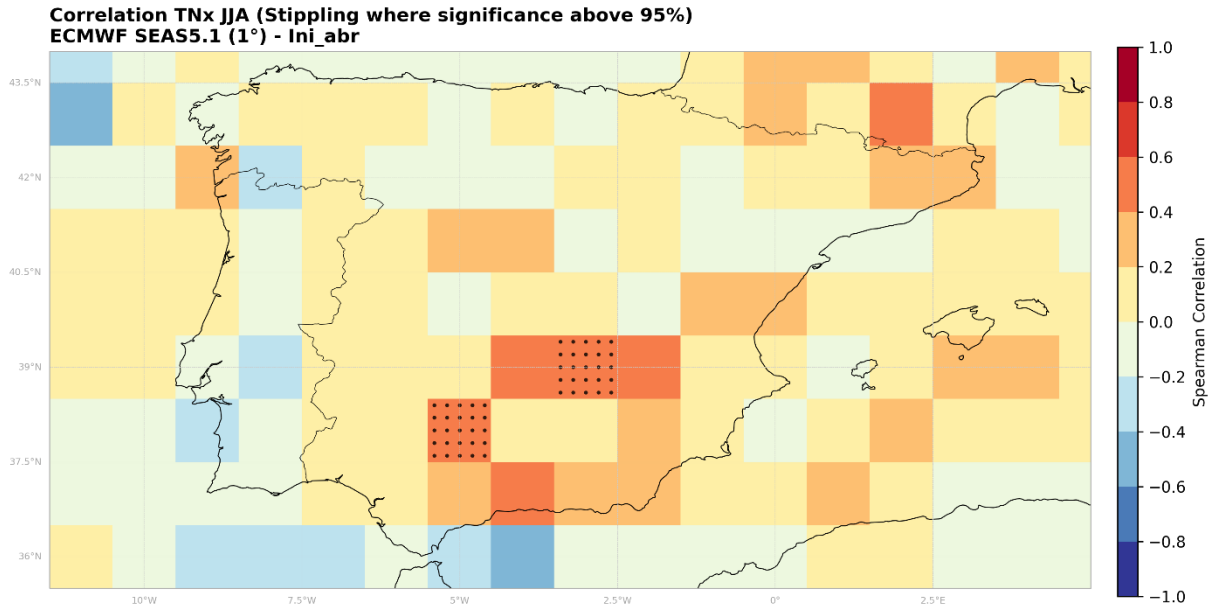
AreaROC. Tercil Sup





Correlación vs obs - TNx JJA (Máxima de las temperaturas mínimas).





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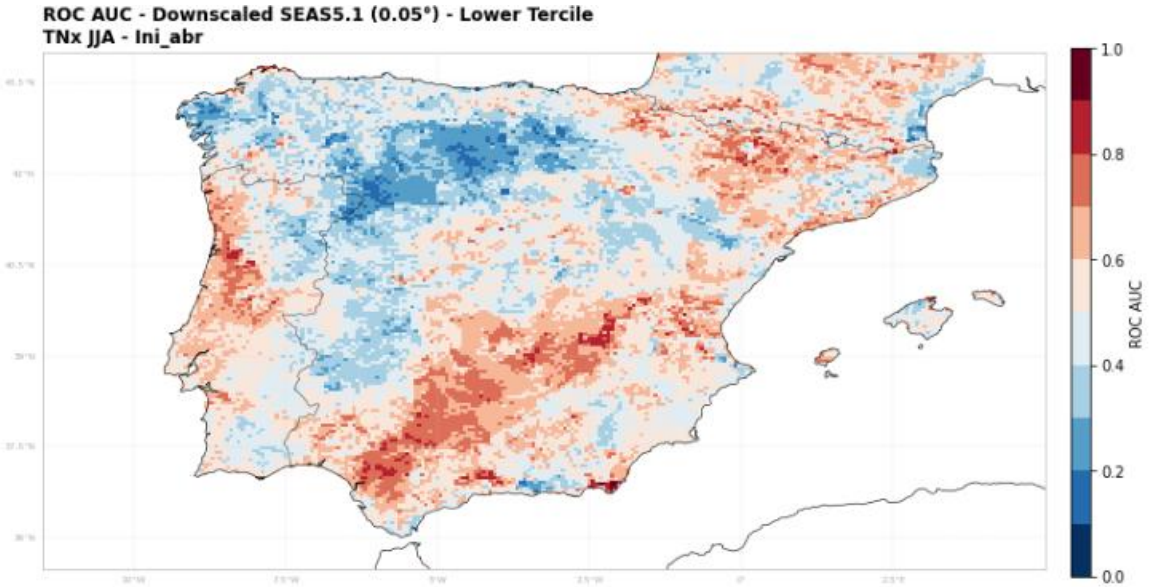

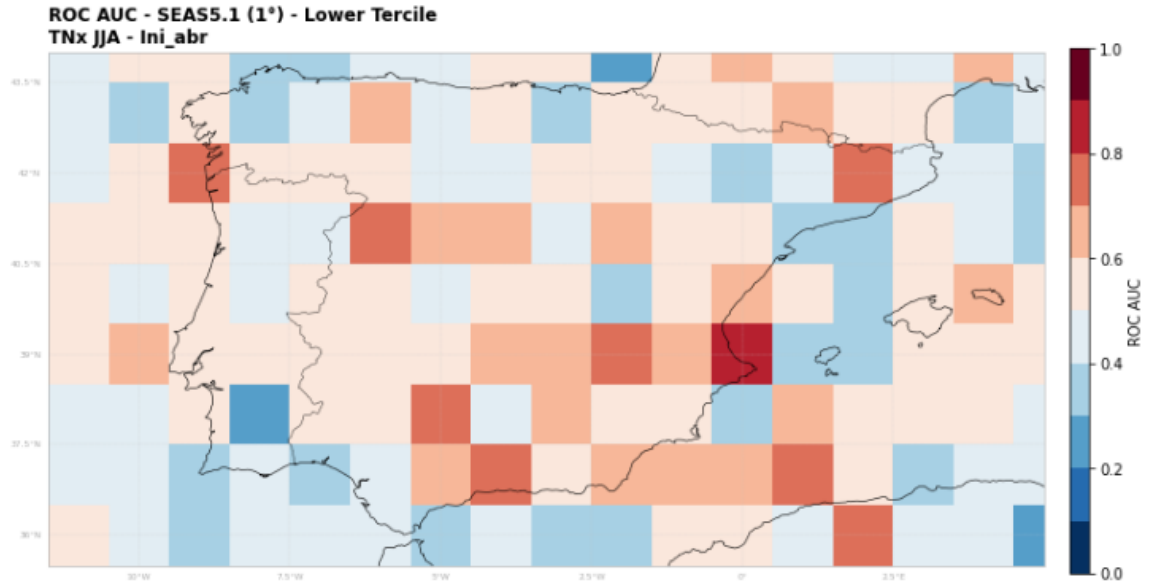

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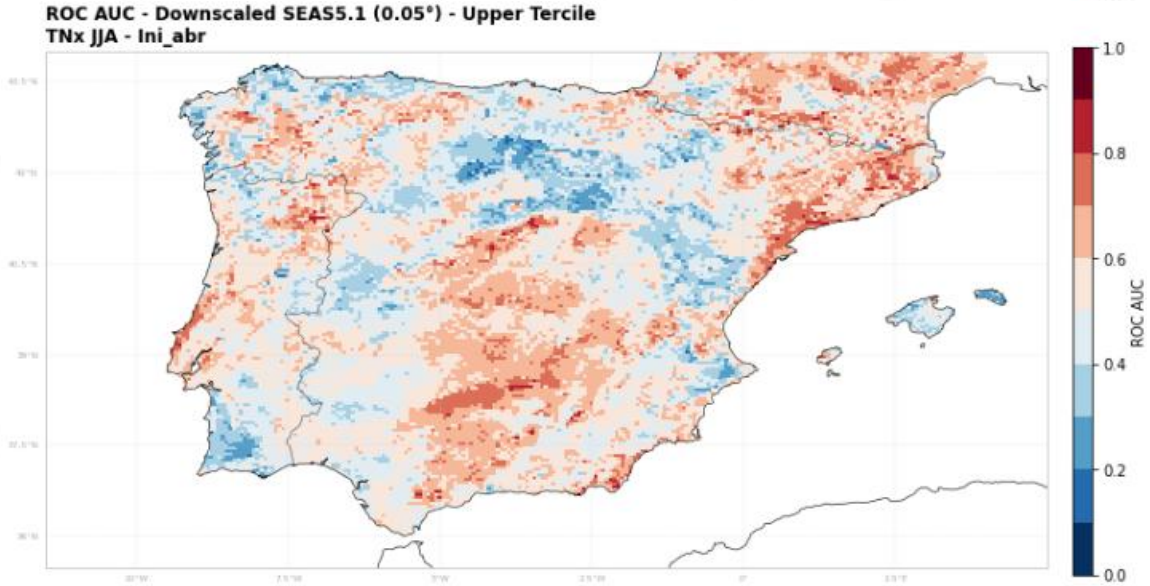
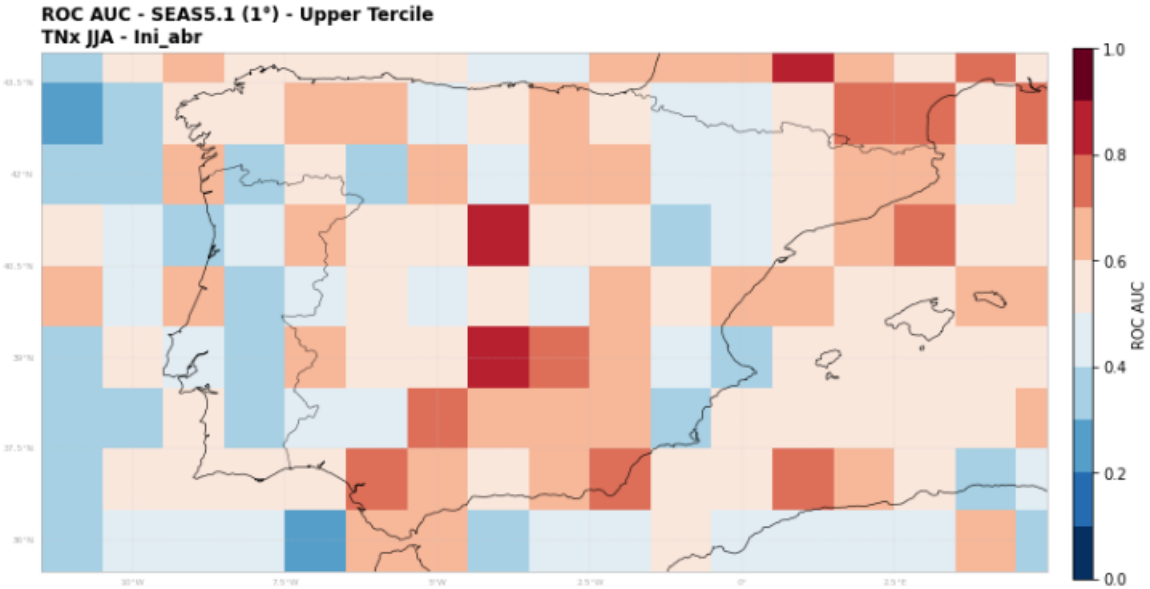
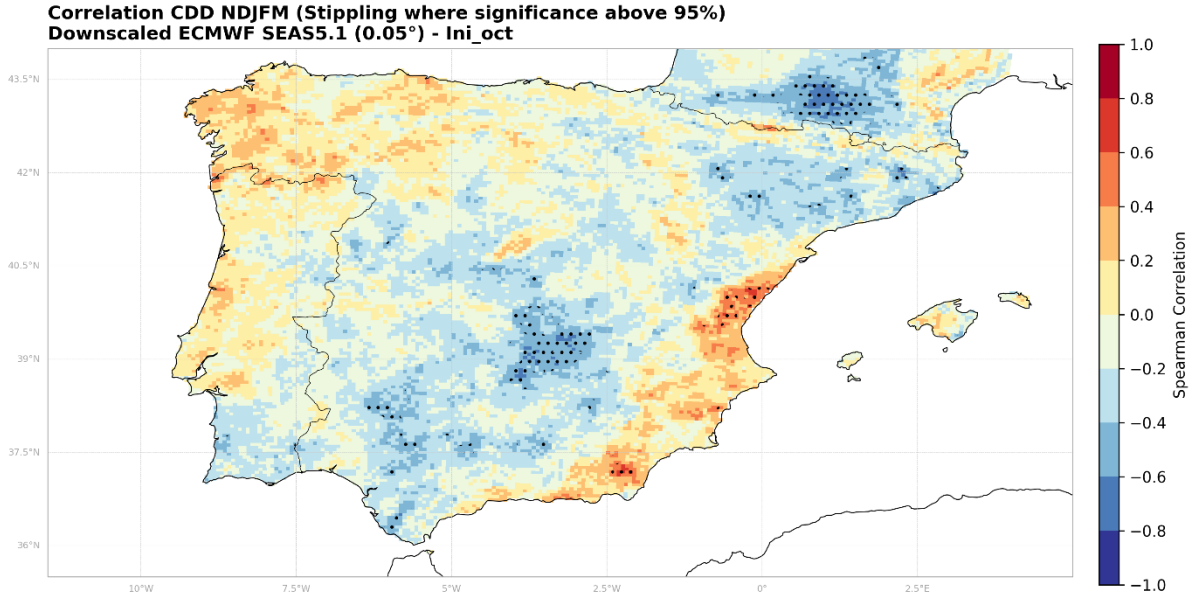
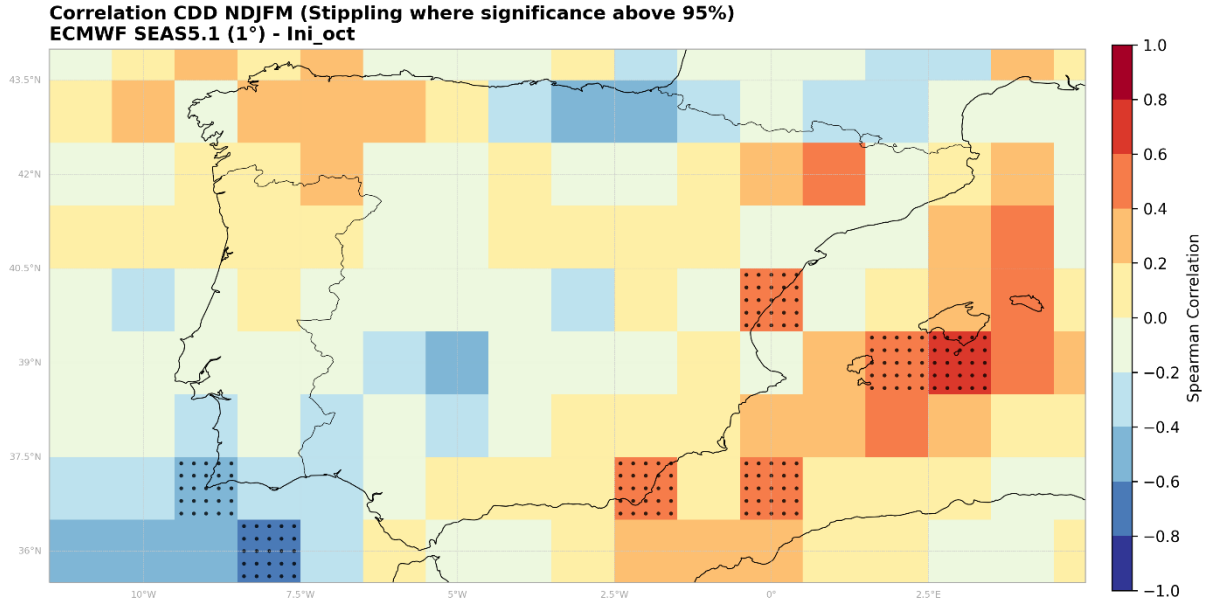




Correlación vs obs - CDD NDJFM (Consecutive dry days)





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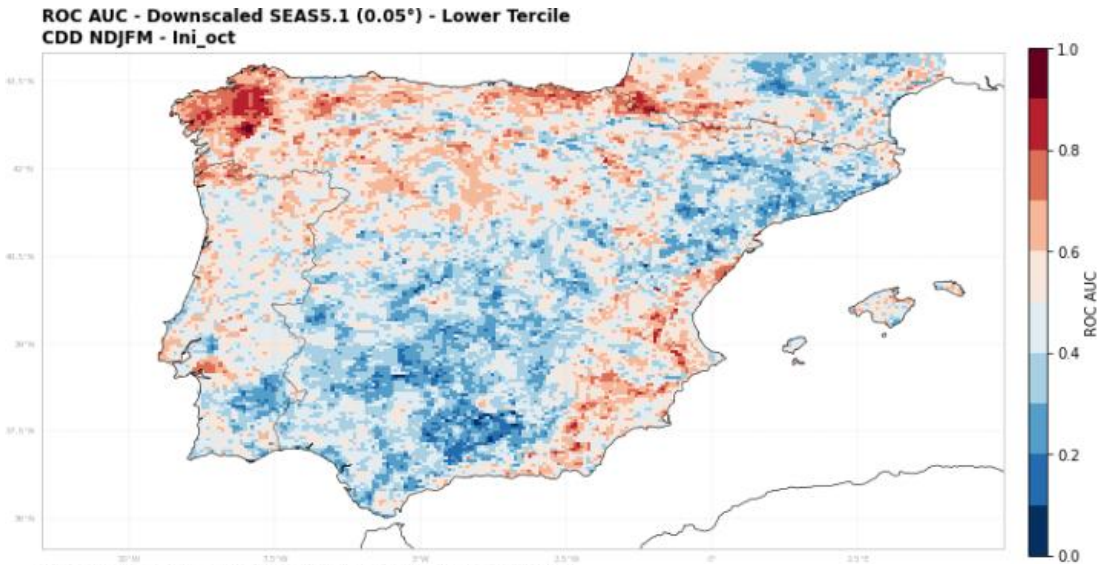

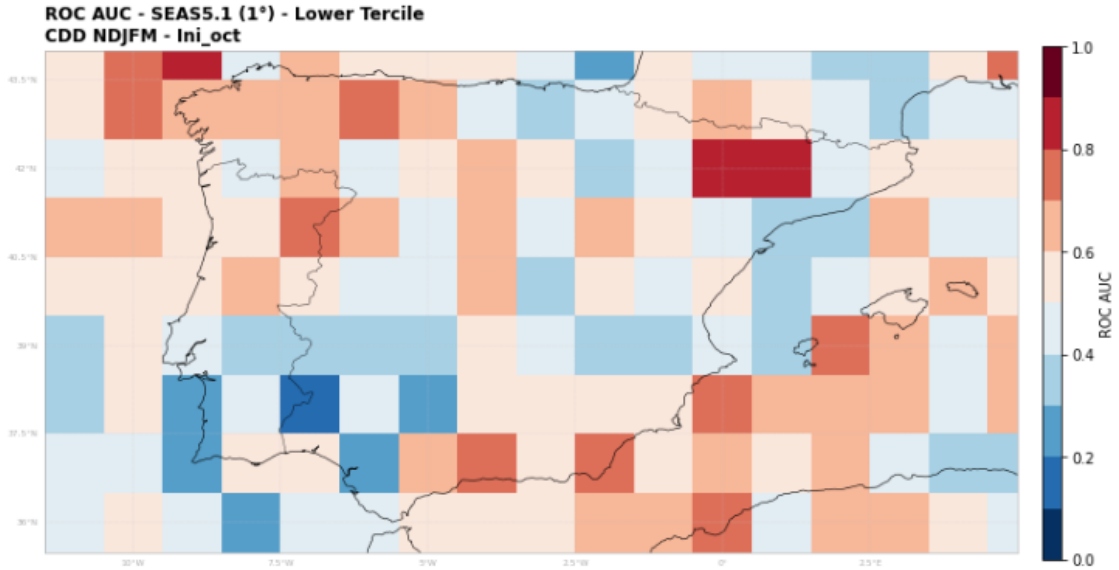

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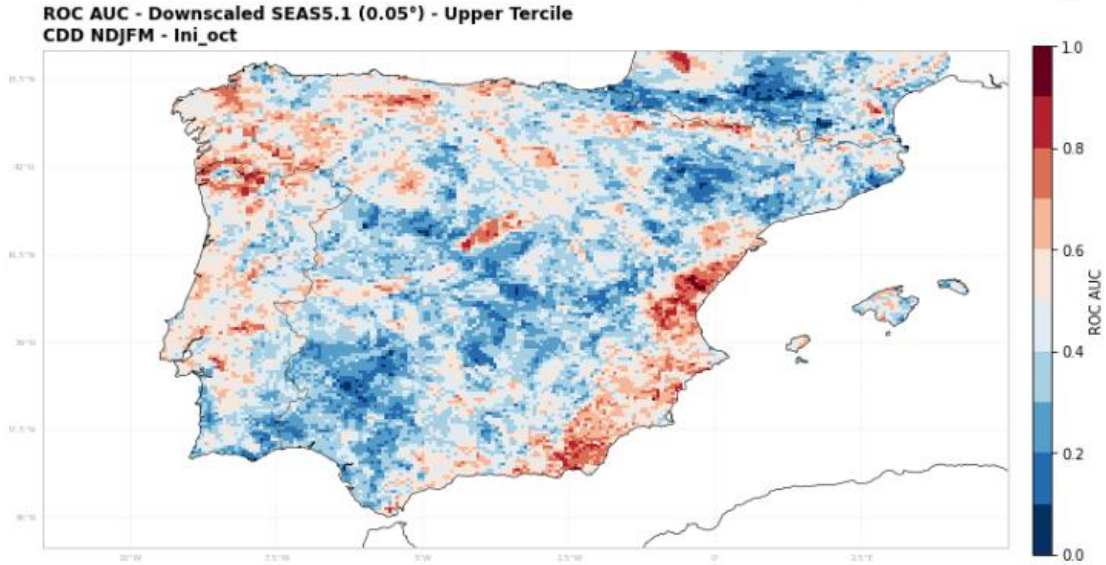
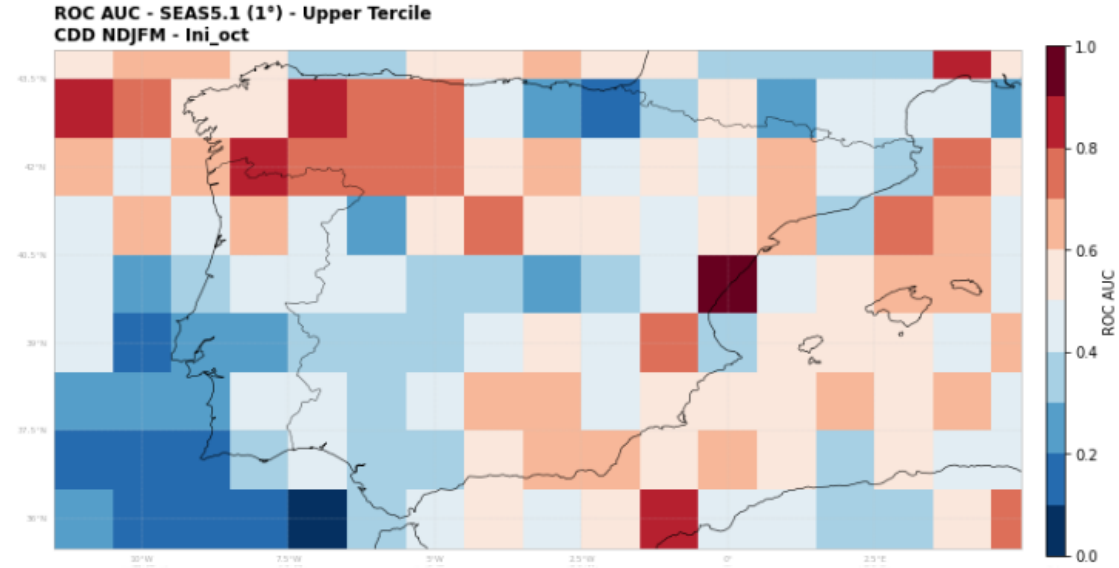
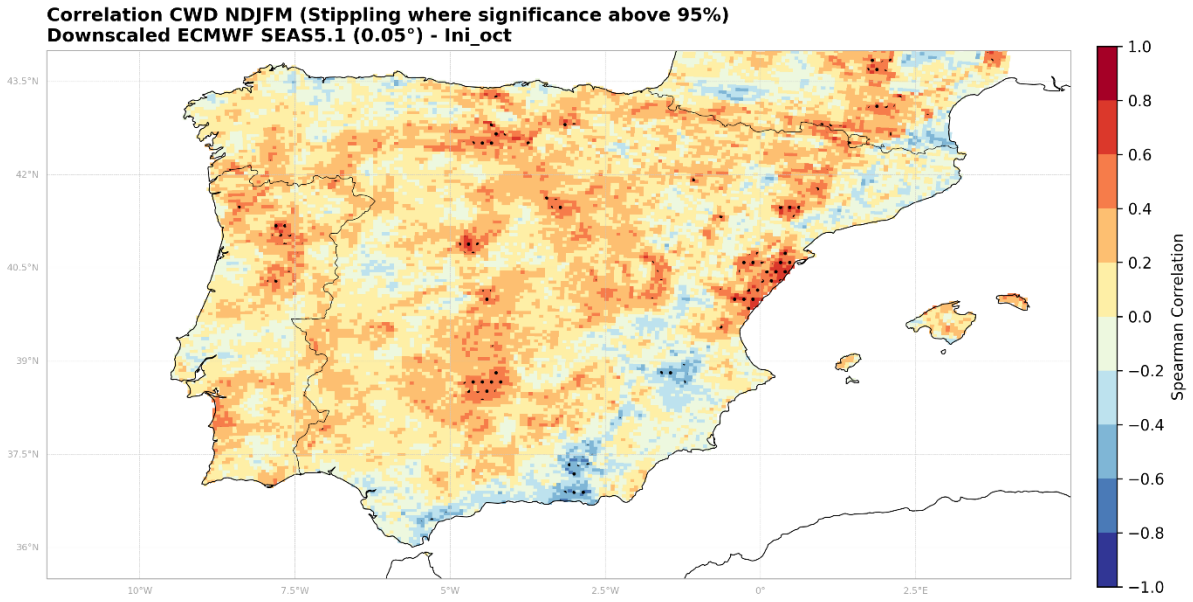
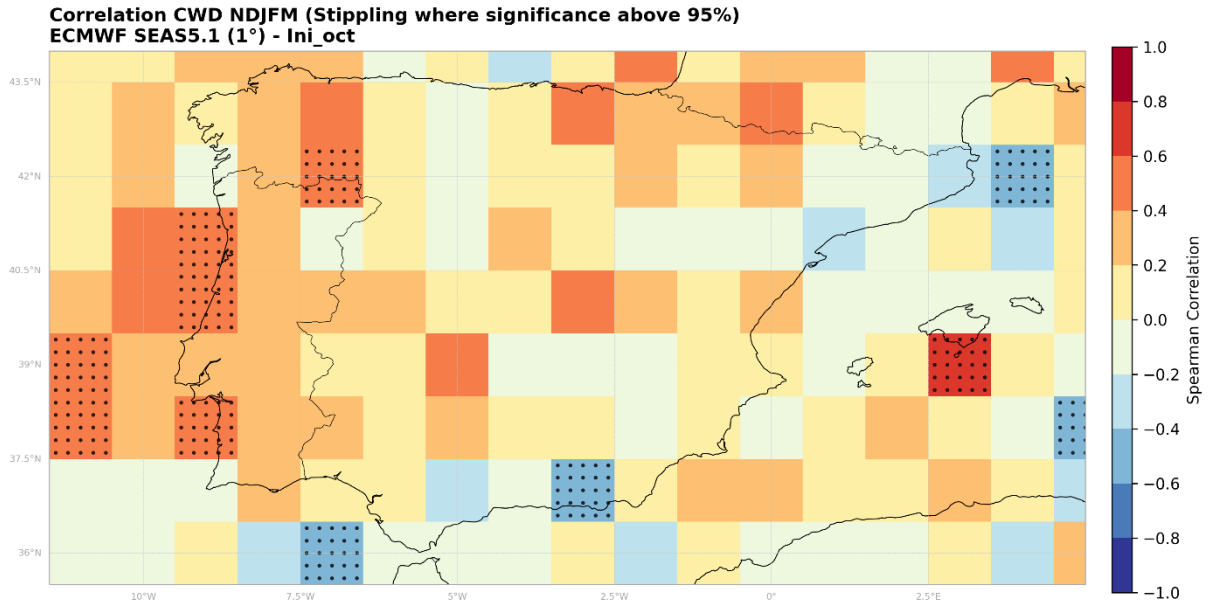




Correlación vs obs - CWD NDJFM (Consecutive wet days)





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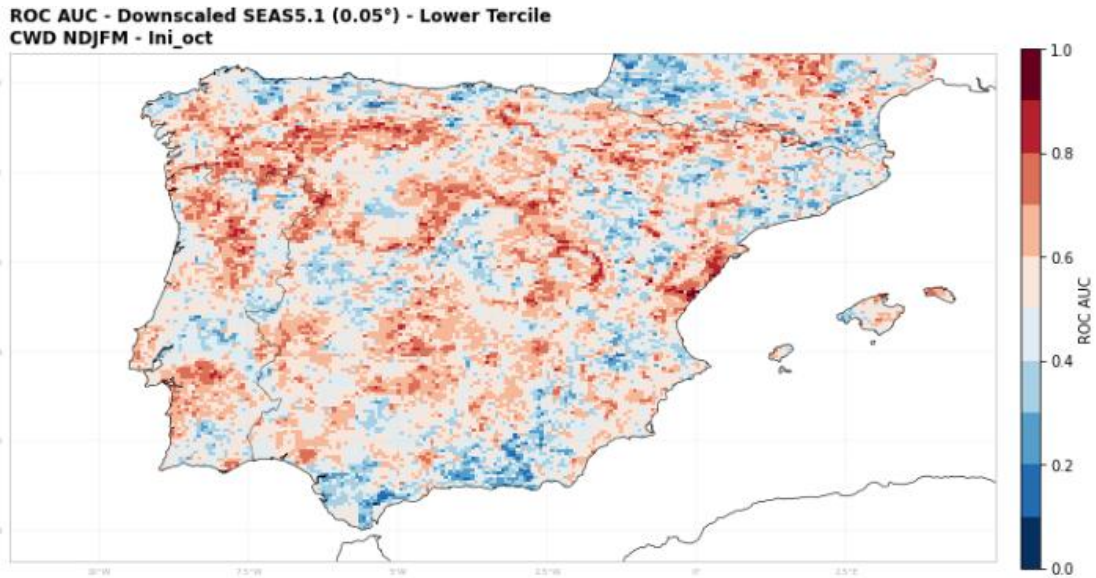

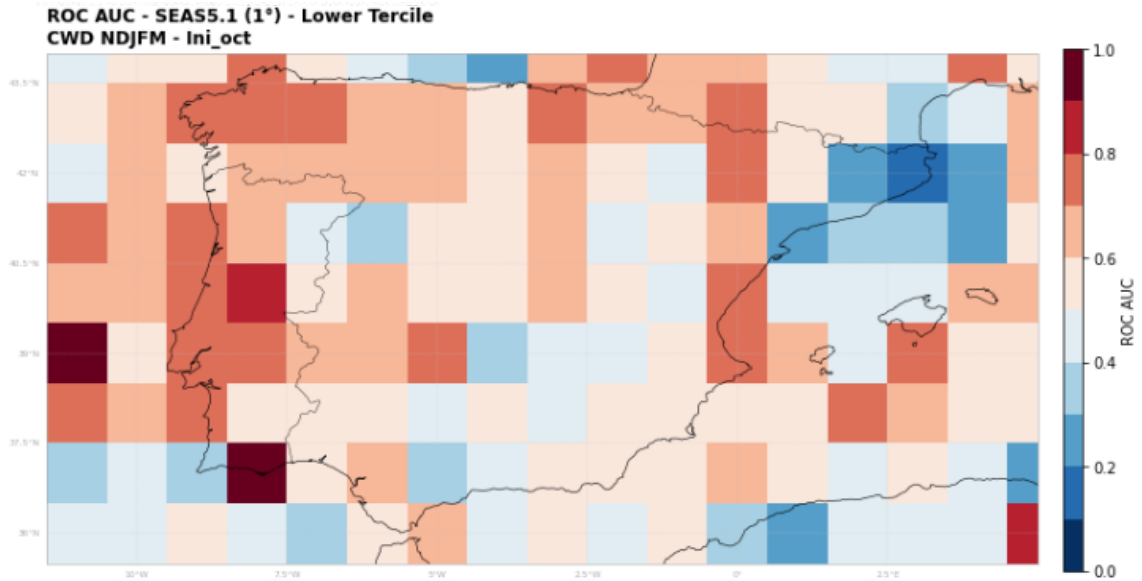

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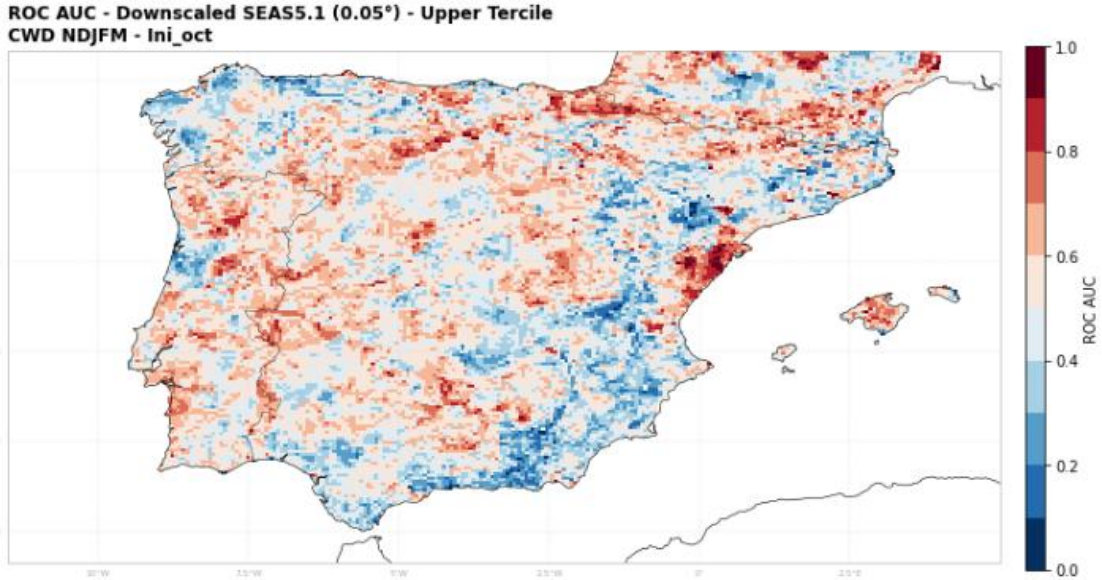

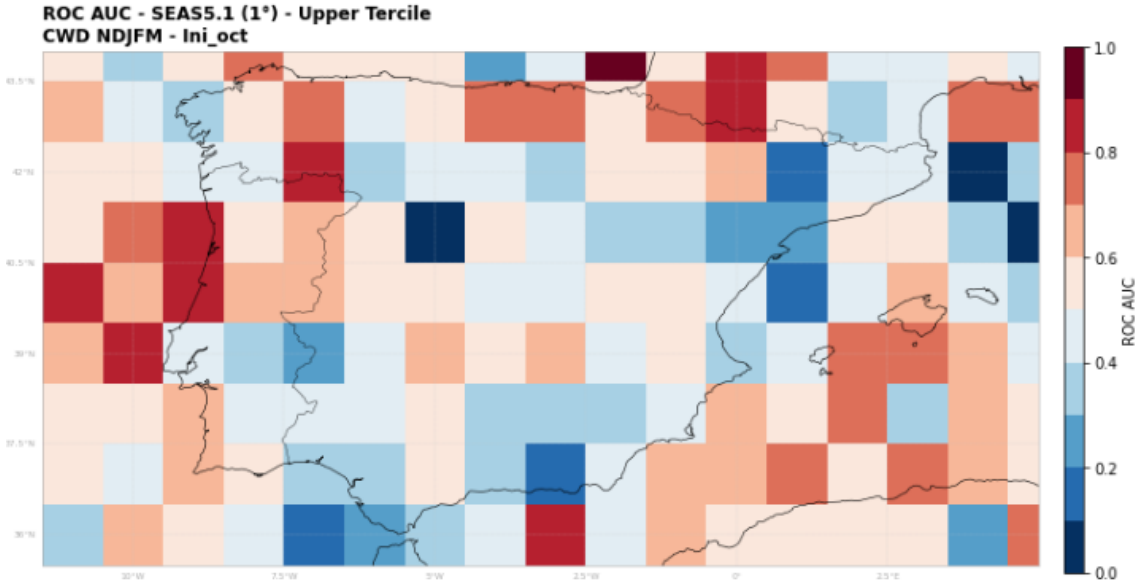

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CDD (Consecutive dry days) JJA

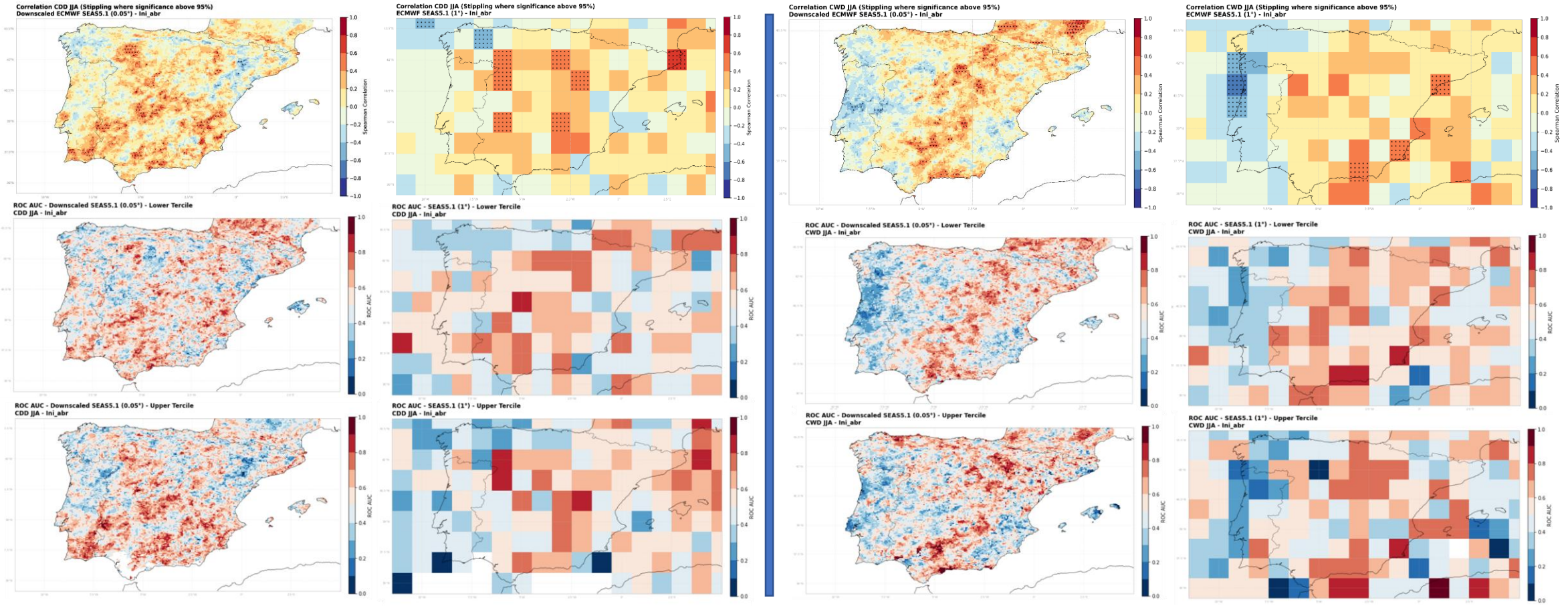
CWD (Consecutive wet days) JJA

Modelo Reg | Modelo Sin Reg | Modelo Reg | Modelo Sin Reg

Correlación

AreaROC. Tercil Inf

AreaROC. Tercil Sup



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SU (Summer days TX > 25ºC) JJA

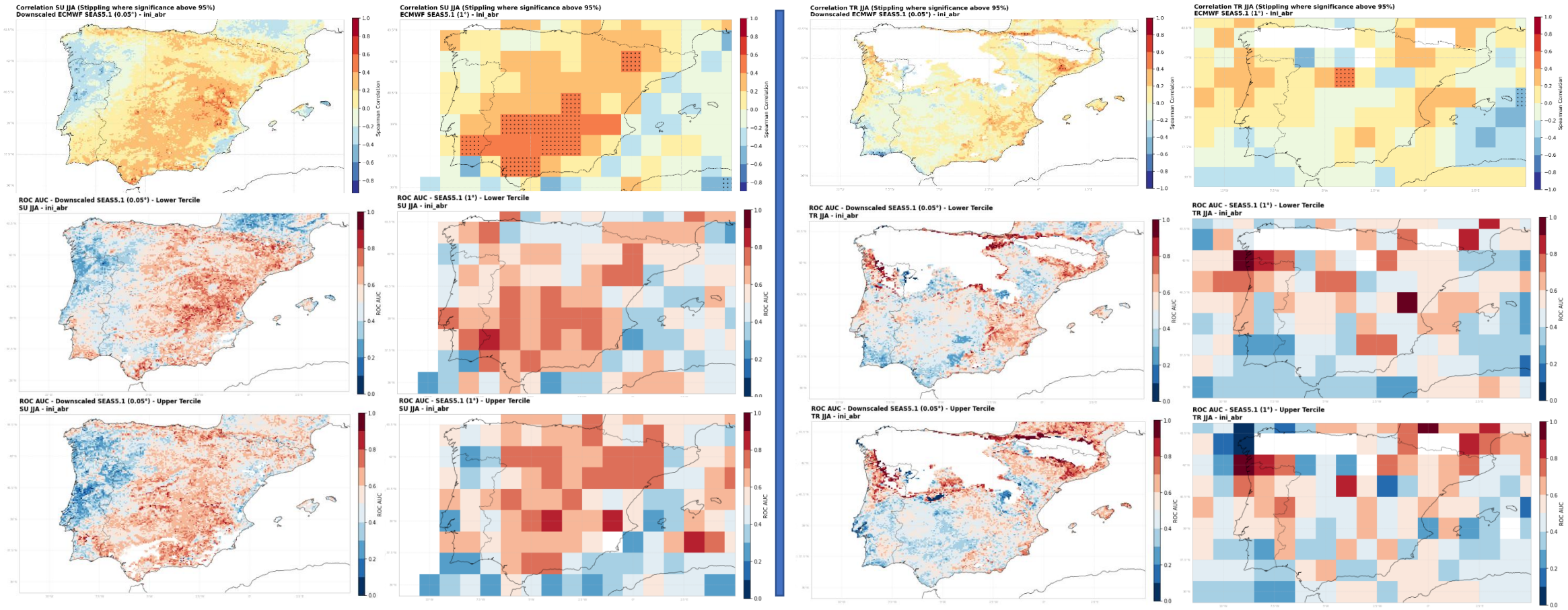
TR (Tropical Nights TN>20ºC) JJA

Modelo Reg | Modelo Sin Reg | Modelo Reg | Modelo Sin Reg

Correlación

AreaROC. Tercil Inf

AreaROC. Tercil Sup



Conclusiones

A partir de las predicciones estacionales de prcp y tmp de SEAS5 se pueden obtener:

Índices de extremos meteorológicos/climatológicos:

- Información especifica para este tipo de eventos, útil para prevención.

Aumento de la resolución espacial de la predicción estacional:

- Permite su uso en modelos de gestión de recursos en sectores como el hidrológico o el agrícola.

Mejora en la pericia de la predicción estacional:

- Para la mayoría de los índices extremos, tanto en cobertura espacial como en valores absolutos.
- La mejora en la pericia depende del área geográfica y del índice y estación contemplados.

Próximo trabajo

-Analizar distintos modelos, inicializaciones y estaciones.

-Estudiar índices de olas de calor más complejos y completos.

-Evaluación del uso de otras mallas observacionales para la regionalización.
(ROCIO_IBEB presenta un sesgo en los valores extremos)

-Completitud con otros índices de verificación.

-Comparar con otras metodologías de regionalización. (MCA, DeepESD, …)

Muchas gracias por su atención

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