Salient Predictions: Validation Summary

Seasonal weather forecasts worth their salt

Overview

Salient Predictions (SP) produces state-of-the-art sub-seasonal to seasonal (S2S) weather forecasts from 3 weeks to 12 months. SP models use deep learning algorithms trained on an array of historical climate datasets focused on ocean and land surface properties.

Available Products

SP provides temperature and precipitation forecasts at up to 1/4° spatial resolution using a 50 member probabilistic ensemble. Individual models are trained and optimized for three separate actionable timescales, providing forecasts for wider periods at greater lead-times, which take into account the underlying predictability of S2S weather:

- Sub-seasonal: weeks 1, 2, 3, 4, 5
- Seasonal: months 1, 2, 3
- Long-range: months 1-3, 4-6, 7-9, 10-12

Sub-seasonal and Seasonal forecasts are updated weekly on Sundays, and Long-range forecasts are updated monthly on the 15th of every month. SP forecasts are global, broken down into 7 major regions: North America, South America, Europe, Africa, Asia, South Pacific, and Russia.

Our most accurate forecast is a skill-weighted blend of SP AI models and existing dynamical models including the NOAA GEFSv12 and ECMWF SEAS5 ensembles. This system captures the unique advantages of both SP's machine learning approach and physics-based models. Raw outputs (including the full ensemble) for SP, ECMWF, and GFS models are also provided.

Forecast data are served in gridded NetCDF format through an API. Forecasts can also be visualized with a browser tool, or through downloadable .png images.

Validation Details

Model validation has been performed using a 30-year hindcast experiment for the period 1990-2019. The ERA5 reanalysis product is used as the ground-truth dataset. A 1990-2019 climatology is used to calculate seasonal anomalies.

For hindcast validation with machine learning models, careful experiment design is used to ensure that the models are not validated on data that has been used in training. This is done by training separate model ensembles for validation on 5-year chunks of the historical record. For the 30-year hindcast presented here, six sets of model ensembles have been used to reconstruct the full hindcast.

Two primary validation metrics are shown here, with many additional available on the SP API:

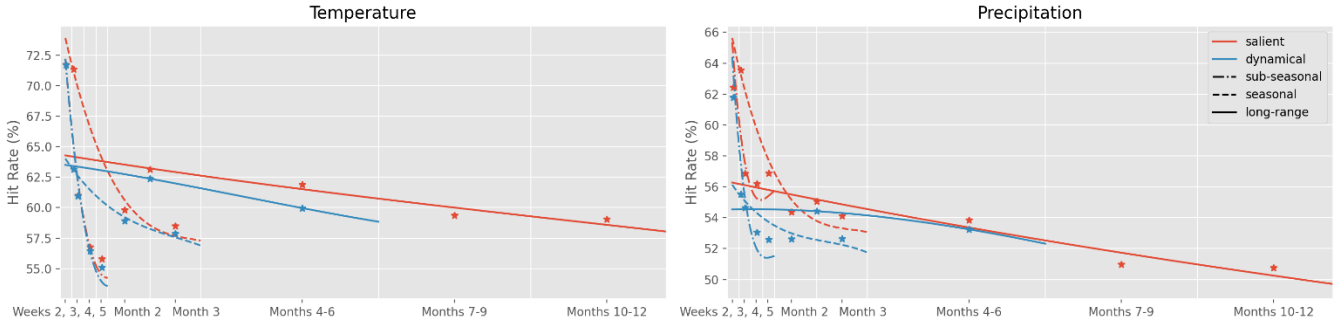
- Hit Rate: binary accuracy based on correctly forecasting the sign of the anomalies, calculated as: $\frac{hits}{misses}$
- Mean Absolute Error (MAE) Reduction: The improvement in MAE relative to a reference forecast of climatology, calculated as: $\frac{MAE_{climatology} - MAE_{forecast}}{MAE_{climatology}}$

Validation metrics are shown below for each region, comparing the skill of the SP Blend model with the ECMWF and GFS forecasts. Skill is shown across different timescales out to 12 months, with a wider window used at longer leads. SP models generally have the largest skill improvements for precipitation and at longer lead-times, but this varies by region. On average, seasonal weather patterns are more predictable in the tropics than at higher latitudes.

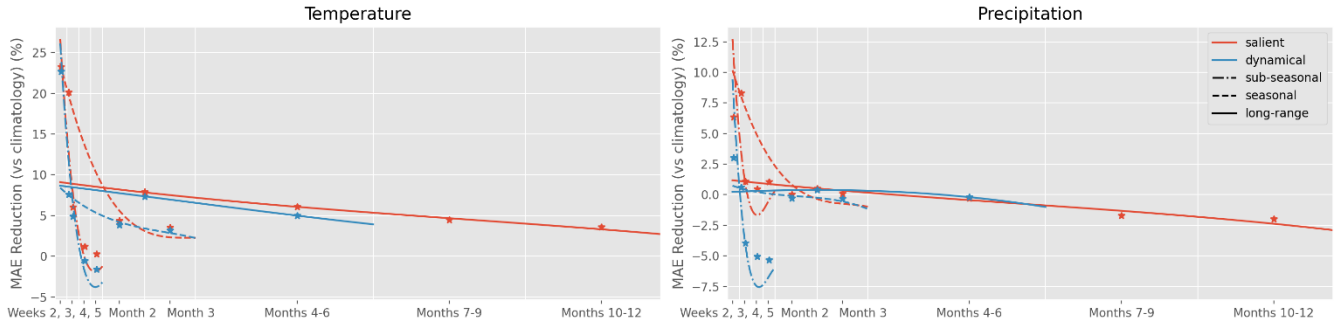
Outputs from the full hindcast experiments, including raw data, time-series summaries, and additional validation metrics, are available on the SP API.

North America

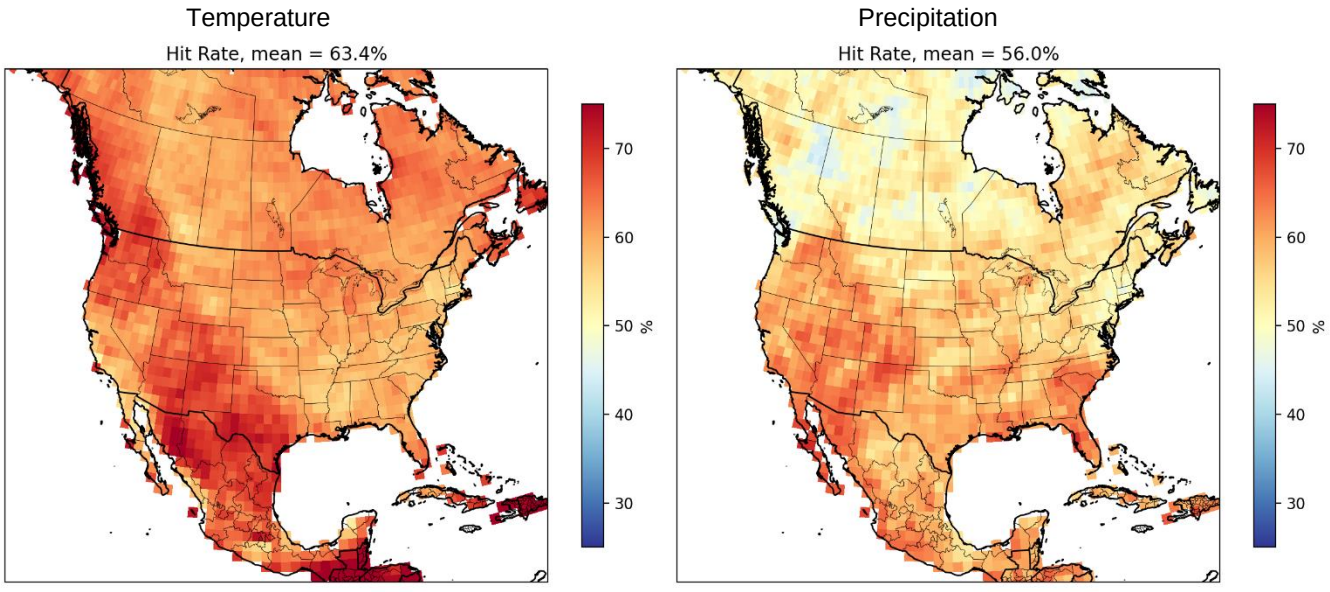
Hit Rate:



MAE (reduction from climatology):

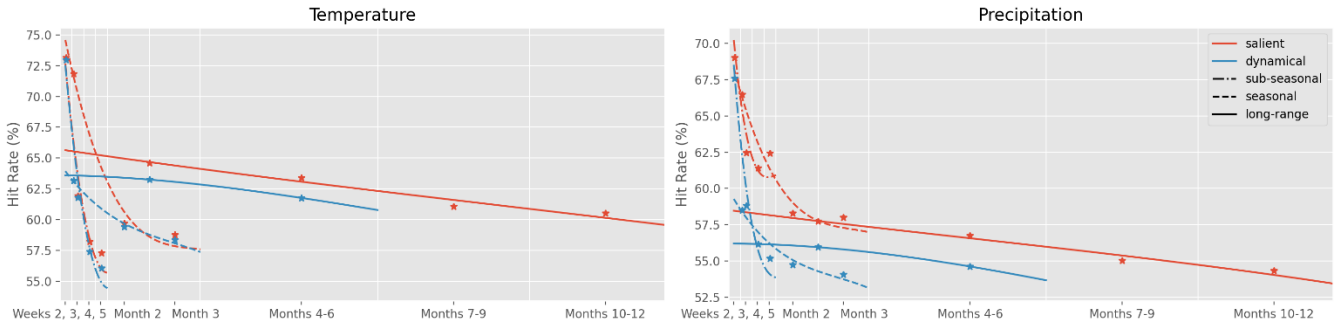


Hit Rate Maps (Long-range forecasts, month 1 – 3):



Asia

Hit Rate:



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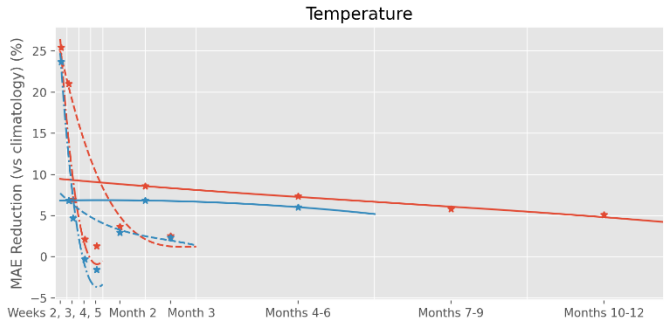

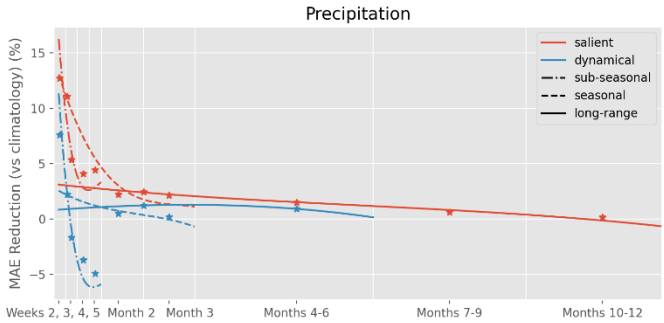

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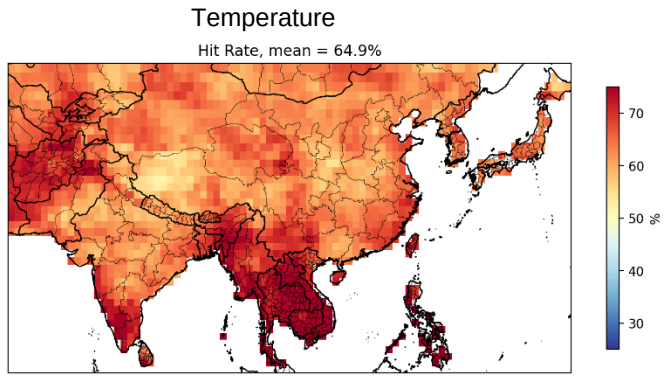
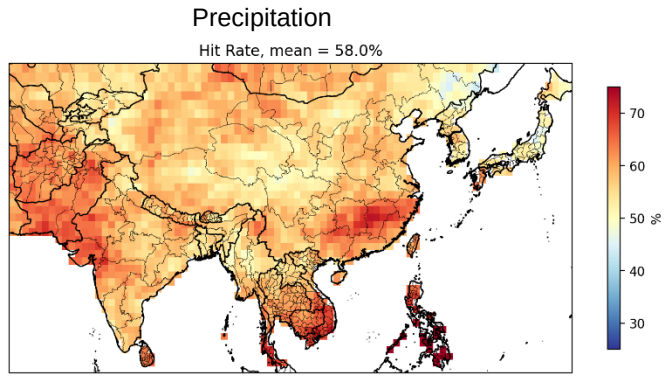
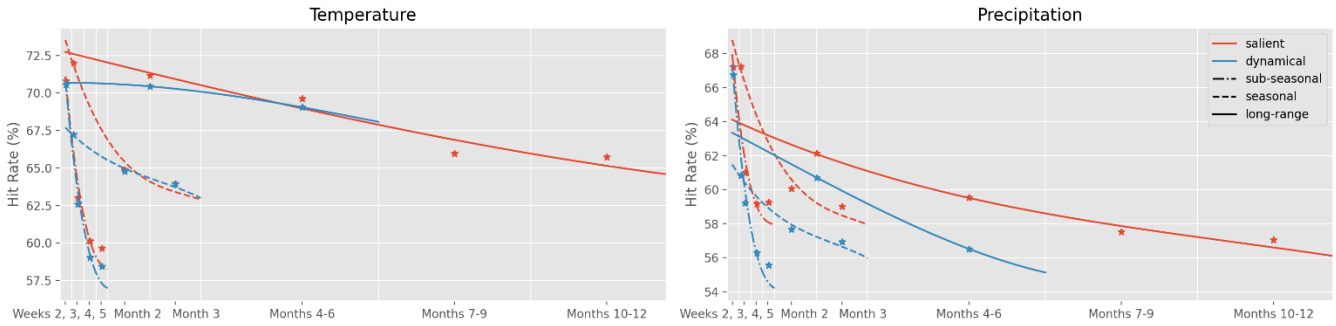




South America

Hit Rate:



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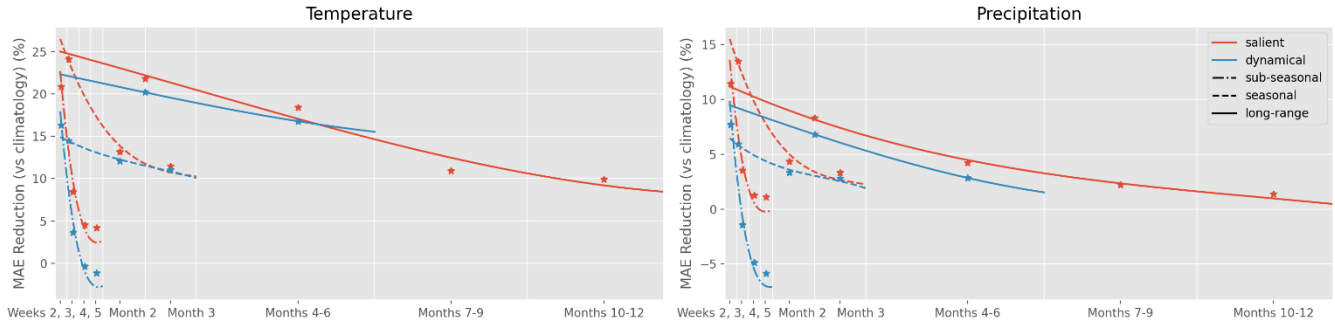

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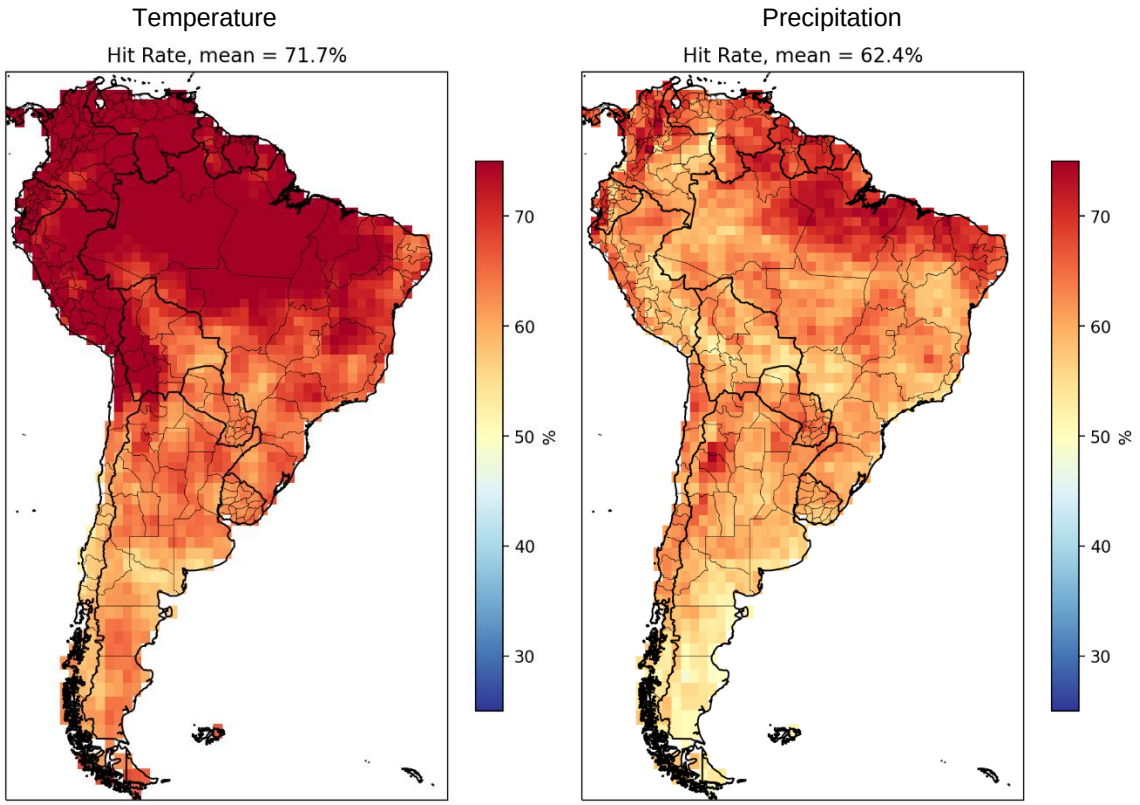
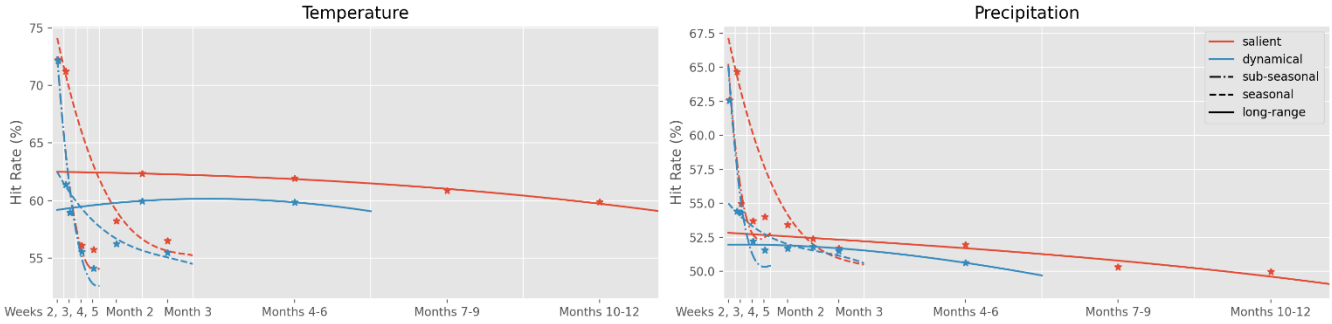


Europe

Hit Rate:



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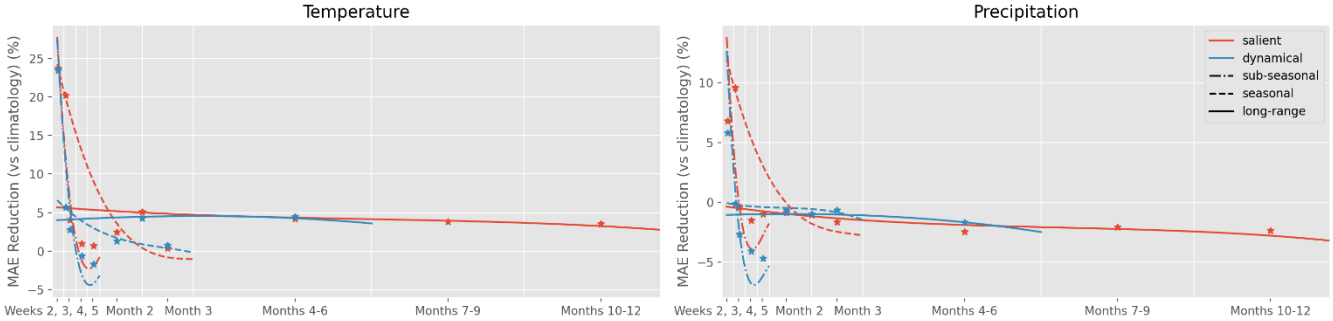

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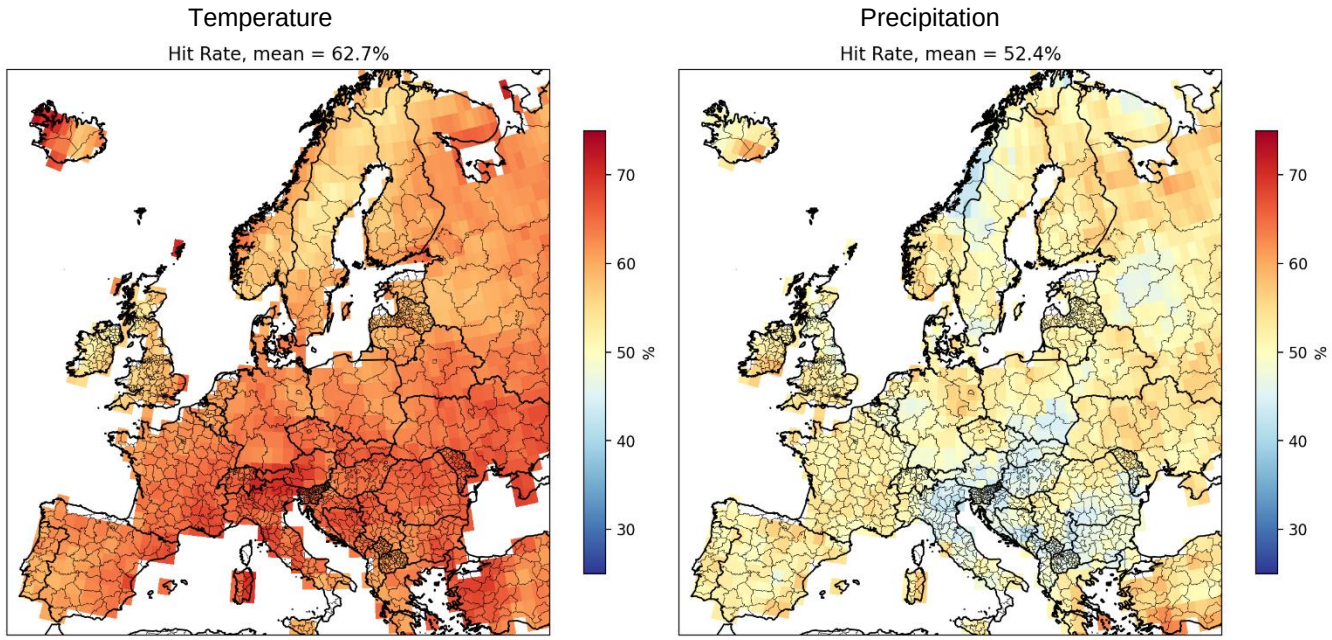
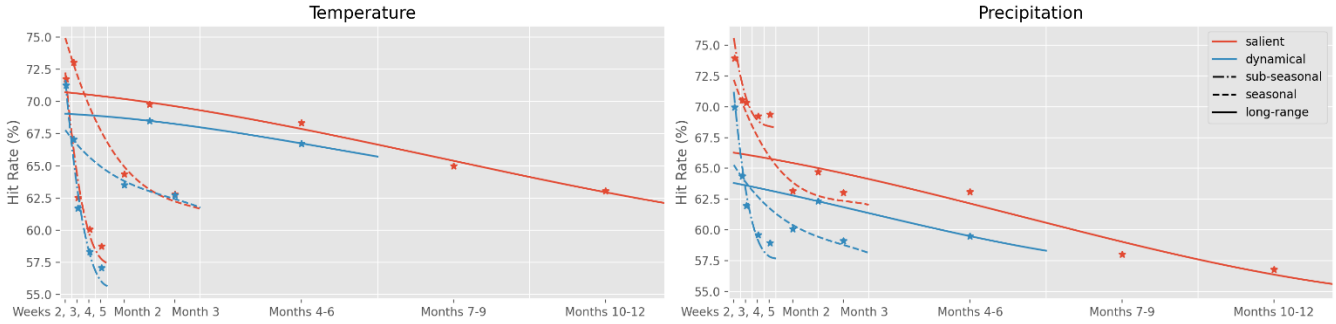


South Pacific

Hit Rate:



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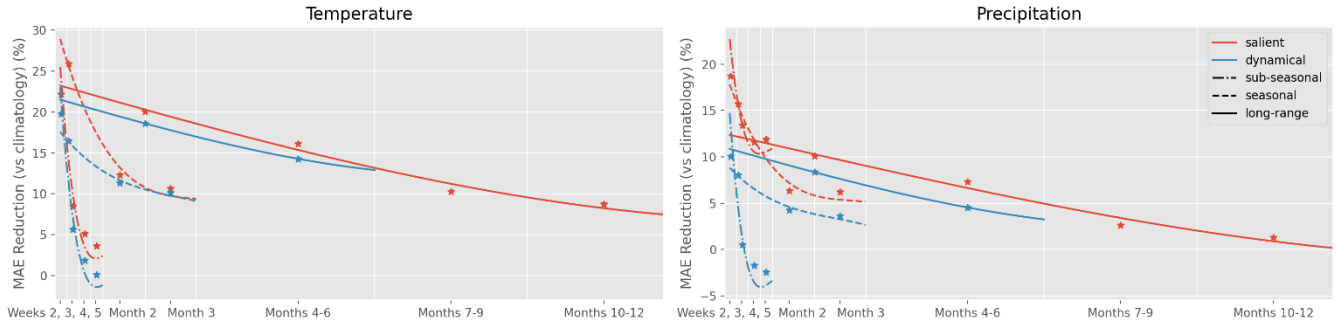

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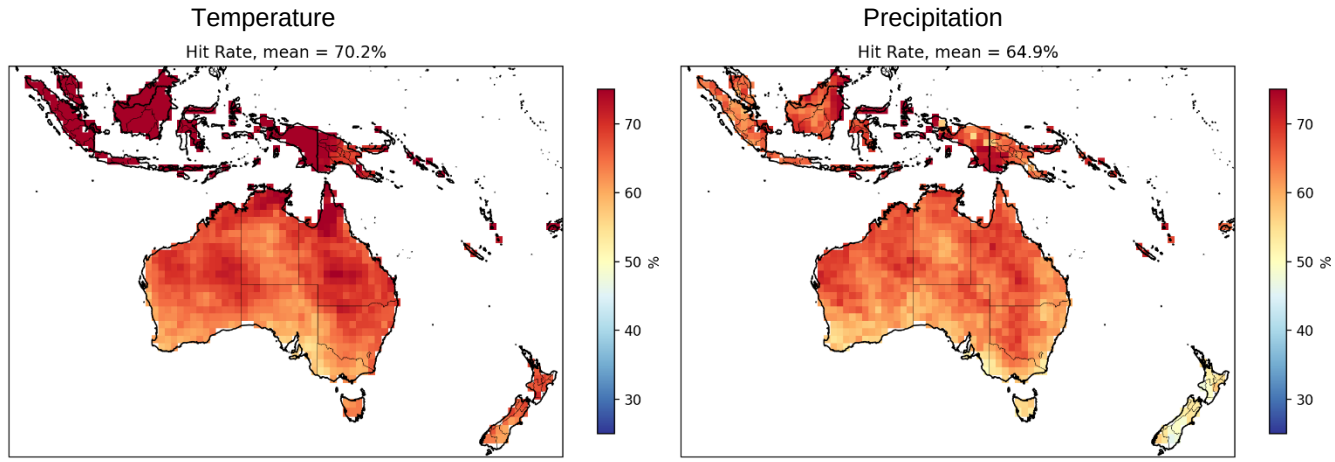
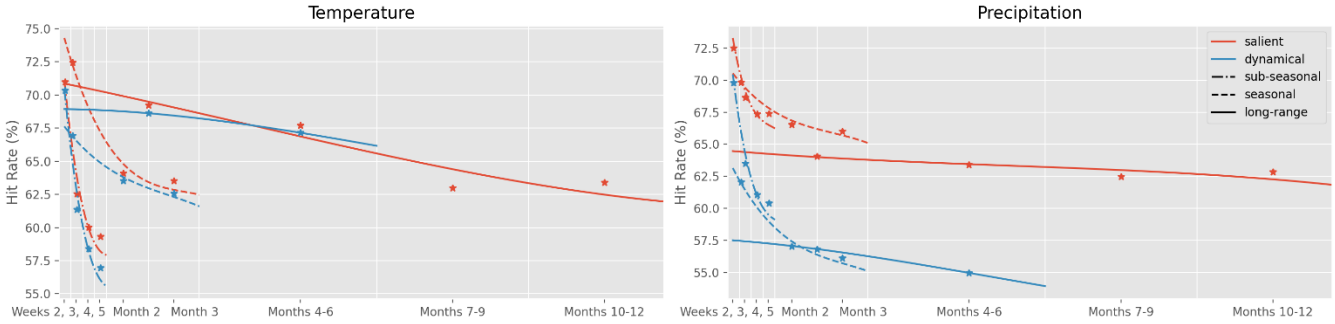


Africa

Hit Rate:



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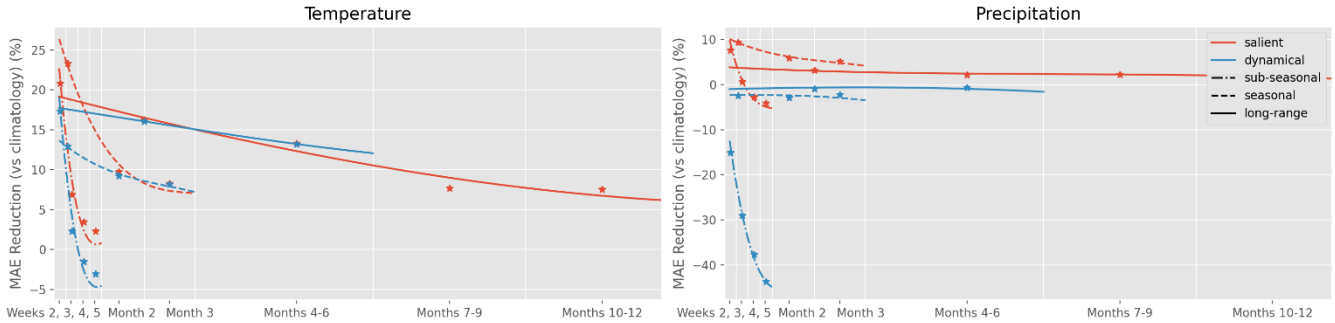

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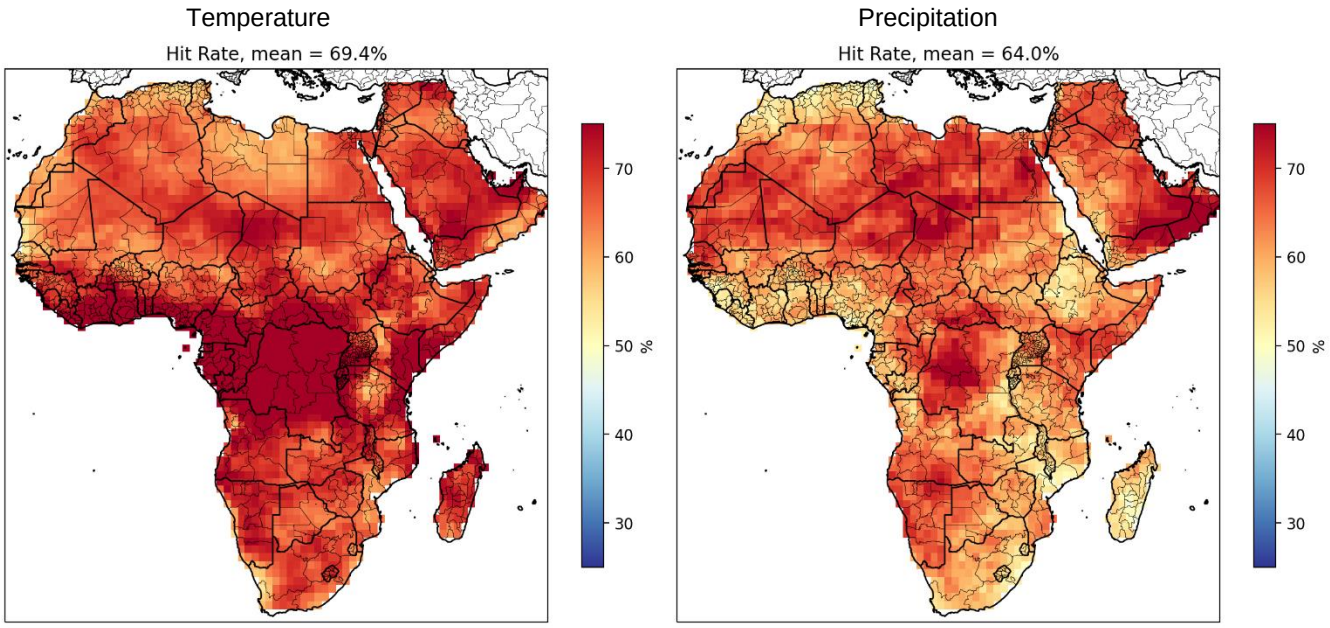
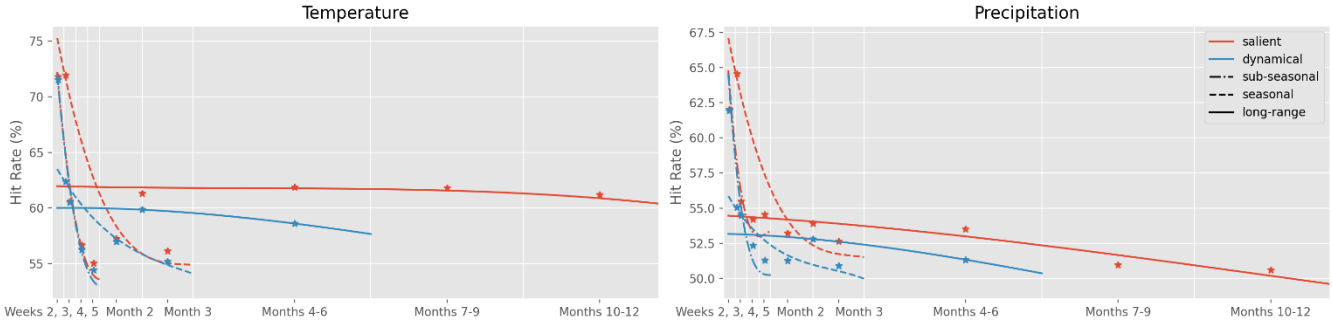


Russia

Hit Rate:



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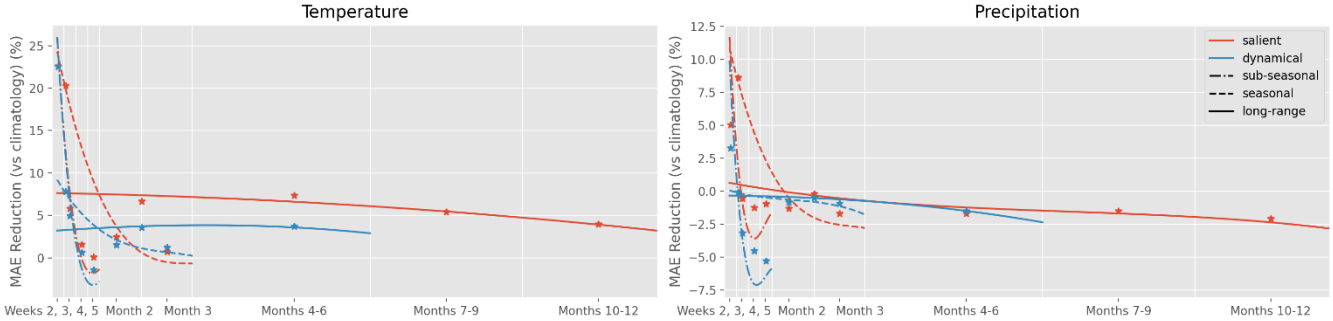

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