Dissemination of seasonal fire weather information for stakeholders and researchers

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Seasonal fire weather info / Dissemination

1. Seasonal fire weather – Monthly Drought Code (MDC)
   Quantifies moisture content in deeper soil based on monthly precipitation and maximum temperature from April to October. Reasonable proxy for actual burned area for most regions in Northern hemisphere (Eden et al., 2019)

2. Seasonal forecasting model
   KNMI Probabilistic empirical predictions (K-PREP)
   Statistical empirical forecasting system, update from Eden et al. (2019)

3. Forecast dissemination
   Multi-page interactive web application for stakeholders and researchers
   direct to web application

Eden et al. 2019 - https://doi.org/10.1002/joc.6363

K-PREP system overview

- Seasonal forecasts, built on multiple linear regression. See Eden et al. (2015)
- Emphasis on physical principles and avoiding overfitting.

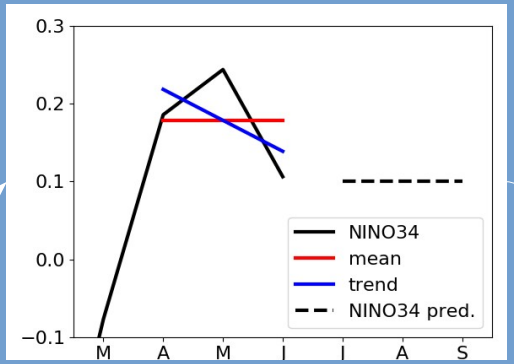
Predictor selection:

Step 1: Select potential predictors. Total time series of 1951-current

Step 2: Predict future state of predictor, based on last 3-month mean and 3-month trend.

Step 3: Predictors selected on their potential to add skill, avoiding overfitting.

Step 2



Step 1

NINO34
PDO
IOD
AMO
Precipitation
Max. temp.
Persistence

Previous value MDC

Step 3

NINO34
PDO
IOD
AMO
Precipitation
Max. temp.
Persistence

K-PREP system overview

- Seasonal forecasts, built on multiple linear regression.
- Emphasis on physical principles and avoiding overfitting.

Model fitting:

Step 4: Fit model based on selected predictors.

Step 5: Residuals used to generate forecast ensemble.

Step 6: Repeat for every grid point and predictand.

Step 7: Repeat for all leadtimes

Subset of significant (not inter-correlated) predictors

Step 4

CO_2 equivalent

$$x = \alpha + \beta C + \sum_{i=1}^{k} (\Phi_i F_i^S) + \epsilon$$

Step 5

Residuals randomly sampled to produce forecast ensemble

K-PREP MDC forecast dissemination

Interactive web application at http://climexp.knmi.nl/kprep_mdc

Dash by plotly

Constructed using Dash / Plotly (only Python!)

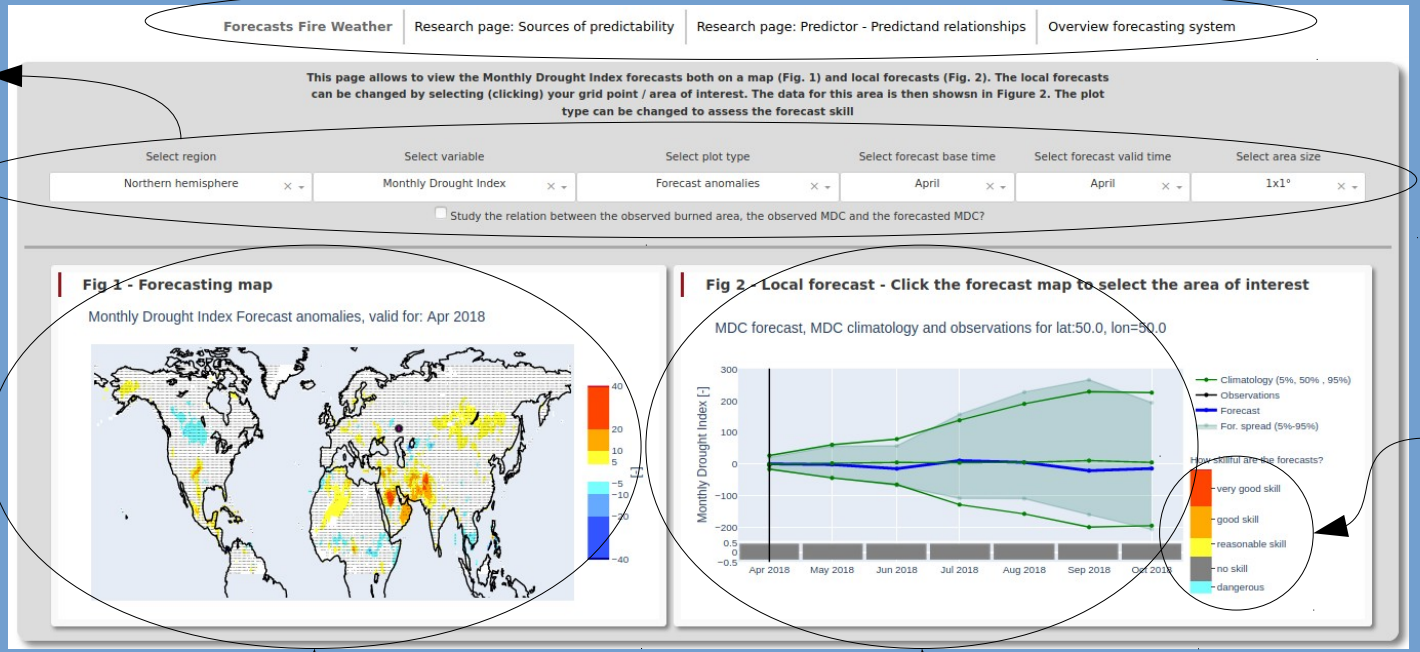
Aimed to provide monthly updates from April to September of seasonal fire weather data (MDC) for stakeholders and researchers

Forecast dissemination – Web app

End-user information page

Select which page to show

Dropdown menus to select area to plot, variable to plot, different plotting types etc.



Forecast skill in words based on certain values of the CRPSS

Main forecasting map, clicking on a specific point will update Figure 2 for that specific point.

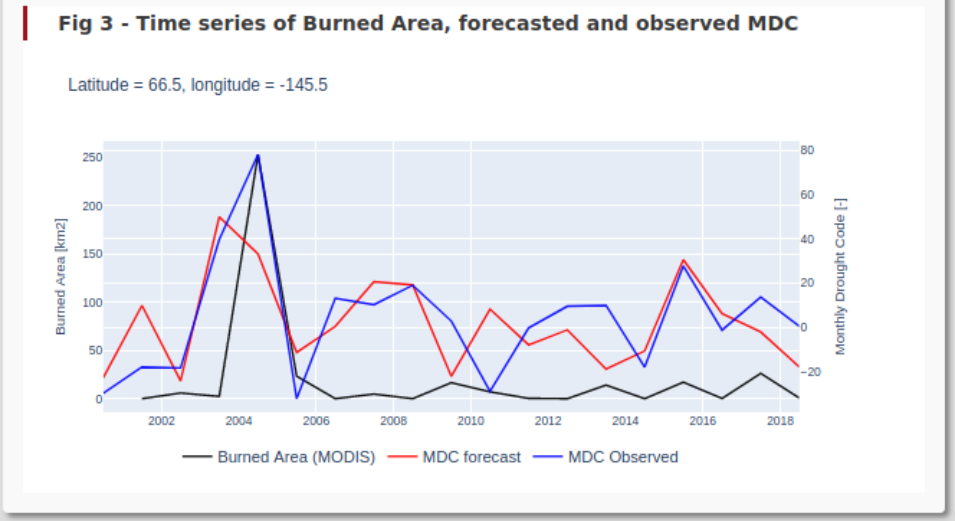
Forecast plume of grid point selected in the map. Also shows the climatology and observations

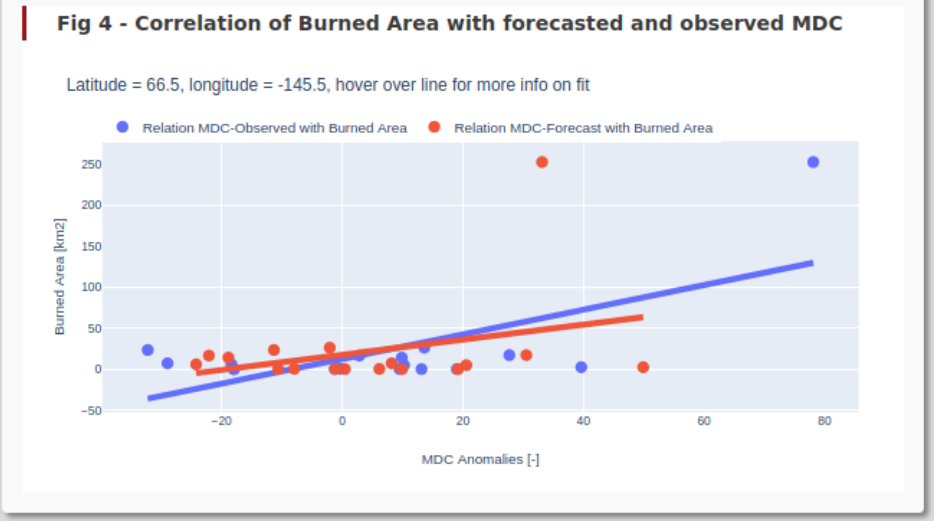
Forecast dissemination – Web app

End-user information page

Assess the relation between the observed and forecasted MDC with observed Area Burned (MODIS). i.e., does the MDC provide information on actual fires?

Figure 3 and 4 provide information on the relation between the Monthly Drought Code (MDC) and actual wild fires (burned area).

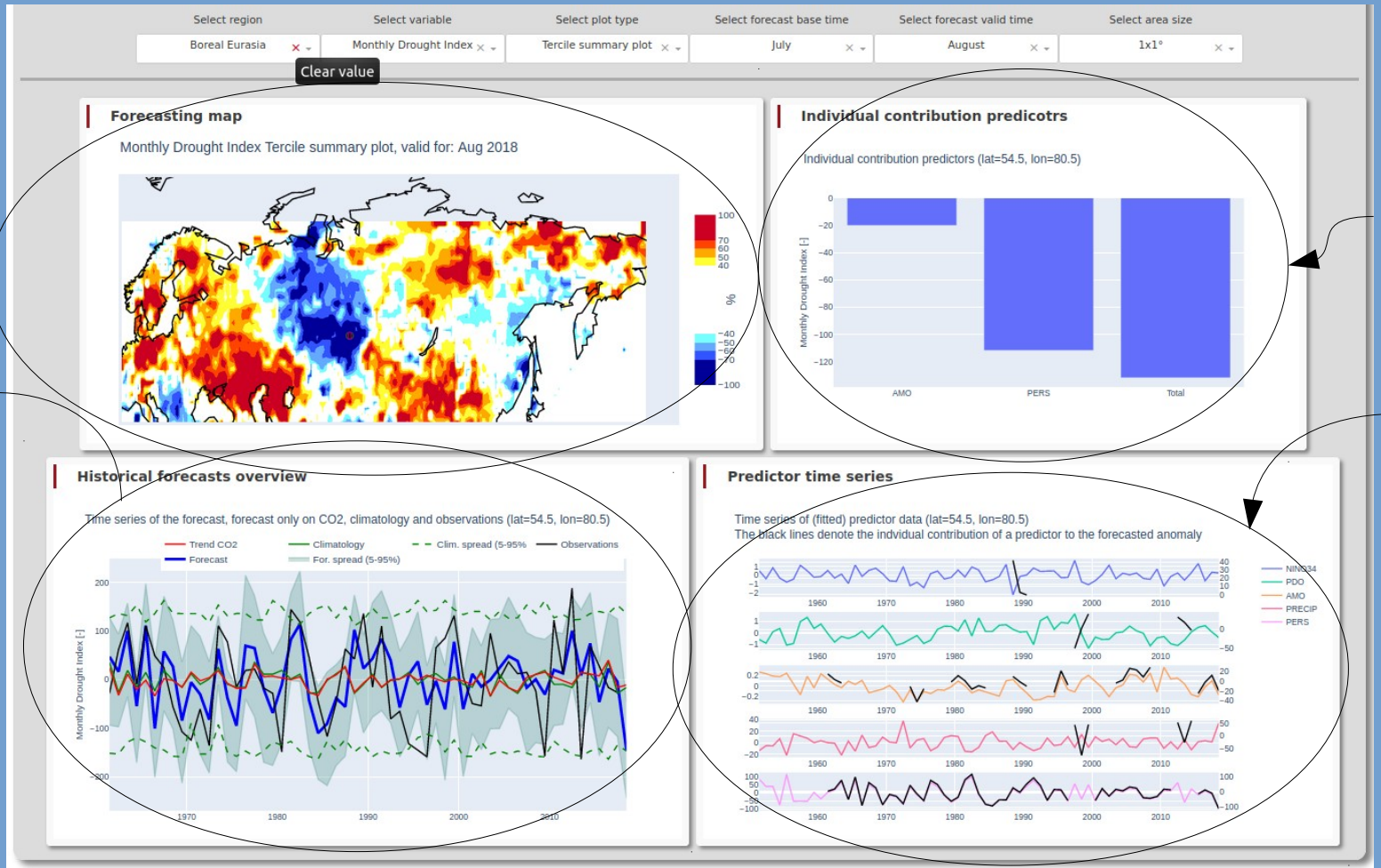




Forecast dissemination – Web app

Research page: Sources of predictability

Forecasting map, clicking a grid point will update the other figures



Overview of hindcasts, climatology and a forecasts only based on CO2 forcing (climate trend).

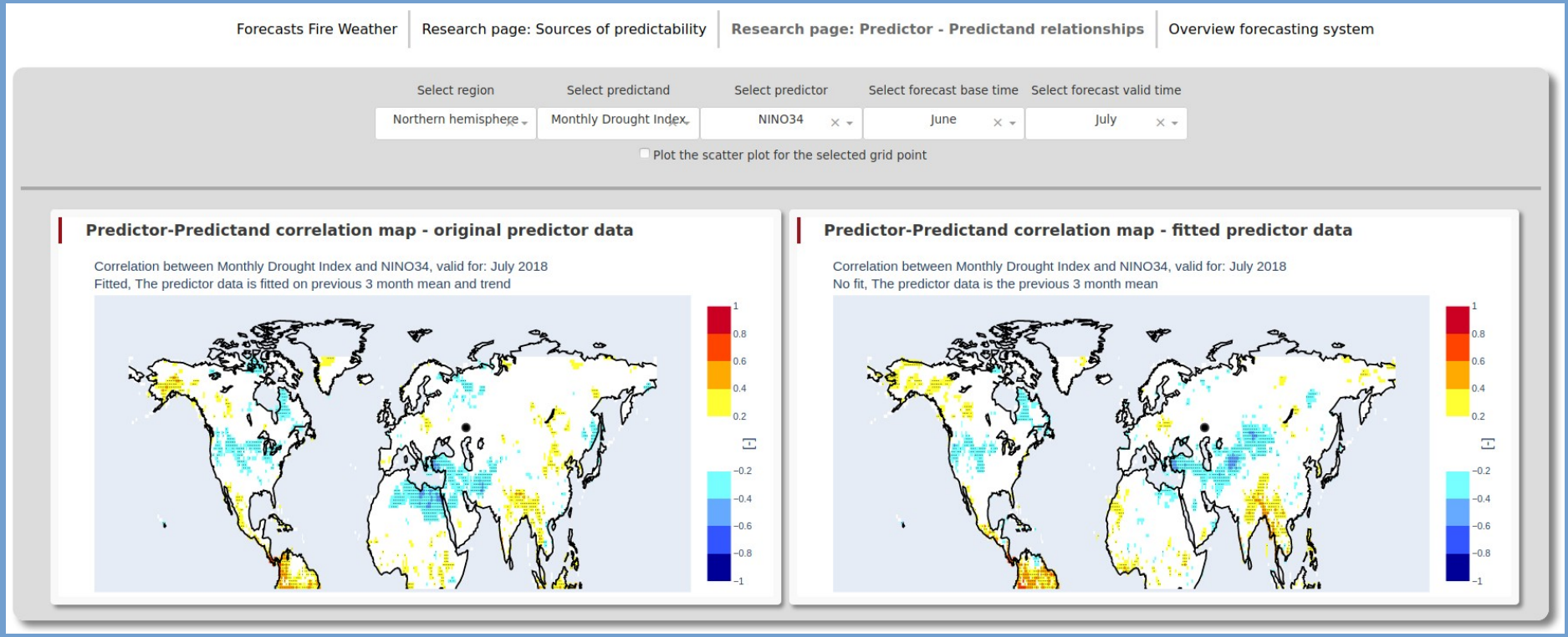
Which predictor contributed how much to the forecasted anomaly?

Which predictor contributed when and how much to forecasted anomalies in the hindcasts (leave-3-year out cross validation)

Forecast dissemination – Web app

Research page: Predictor – Predictand relations

Study the relation between predictor predictand pairs in maps.



Conclusion

- Seasonal empirical forecasts of the MDC, built on multiple linear regression, can provide regionally skillful forecasts up to multiple months.
- Interactive web applications can be useful in providing seasonal forecasting data in a digestible manner to stakeholders.
- Understanding the sources of predictability, the forecast skill and limits of predictability, is crucial in the use of seasonal forecasts, and to further improve both statistical and dynamical seasonal forecasts.

Next steps..

- Compare empirical forecast to dynamical forecasts
- Possibly add other relevant predictors. Any suggestions?
- Make fully operational