Dissemination of seasonal fire weather information for stakeholders and researchers

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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.
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

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

Step 4: CO₂ equivalent

Step 5: Residuals randomly sampled to produce forecast ensemble
K-PREP MDC forecast dissemination

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

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

Constructed using Dash / Plotly (only Python!)
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.

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 skill in words based on certain values of the CRPSS.

This page allows to view the Monthly Drought index forecasts both on a map (Fig. 1) and local forecasts (Fig. 2). The local forecasts can be changed by selecting (clicking) your grid point / area of interest. The data for this area is then shown in Figure 2. The plot type can be changed to assess the forecast skill.

Select region
- Northern hemisphere

Select variable
- Monthly Drought Index

Select plot type
- Forecast anomalies

Select forecast base time
- April

Select forecast valid time
- April

Select area size
- 1x1°
Assess the relation between the observed and forecasted MDC with observed Area Burned (MODIS). i.e., does the MDC provide information on actual fires?
Forecast dissemination – Web app

Research page: Sources of predictability

Which predictor contributed how much to the forecasted anomaly?

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

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

Forecasting map, clicking a grid point will update the other figures.
Study the relation between predictor and 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