THE EFFECT OF DROUGHT AND TEMPERATURE EXTREMES ON BURNED AREA IN SOUTHEAST AUSTRALIA

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DATA

Burned area (BA) from FireCCILT11 0.25˚, 1982-2018

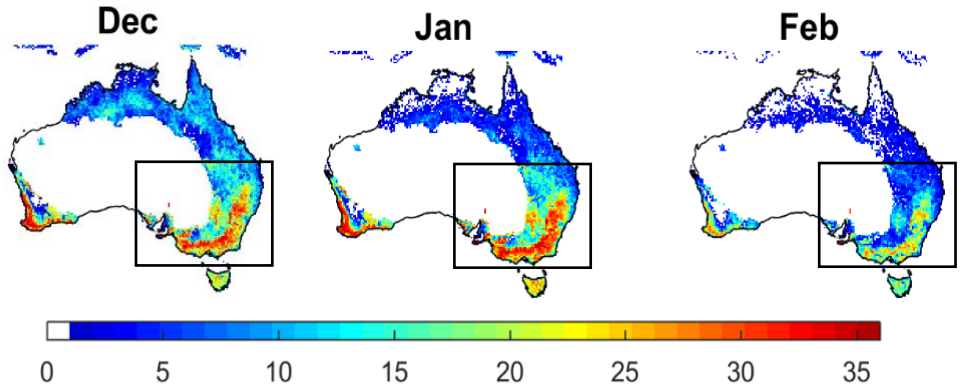

Fig. 1 – Number of times burned, from 1982 to 2018

Hourly temperature from ERA5
0.25˚, 1982-2018

Number of Hot Days (NHD)

Precipitation and temperature from CRU TS4.05
0.5 ˚, 1950-2018

Standardized Precipitation Evapotranspiration Index (SPEI)
1, 3, and 6 months

METHODS

- Pearson correlation between BA and SPEI, and BA and NHD
- Joint probability between BA, SPEI, and NHD, using bivariate copulas
- Different lags, to account for the antecedent conditions
- Consider pixels that burned at least 25 times

Table 1 – Number of pixels that burned at least 25 times

Dec	Jan	Feb
545	685	175

RESULTS

CORRELATION ANALYSIS

Dryer and hotter conditions → Larger BA

- Larger areas of significant correlation between SPEI and BA
- Weaker correlation in February

Large area of correlations in the months before the fire:

- Up to 3 months for SPEI
- Up to 2 months for NHD

Stronger correlation with SPEI

SPEI in December and NHD in November are associated with larger areas in December and January

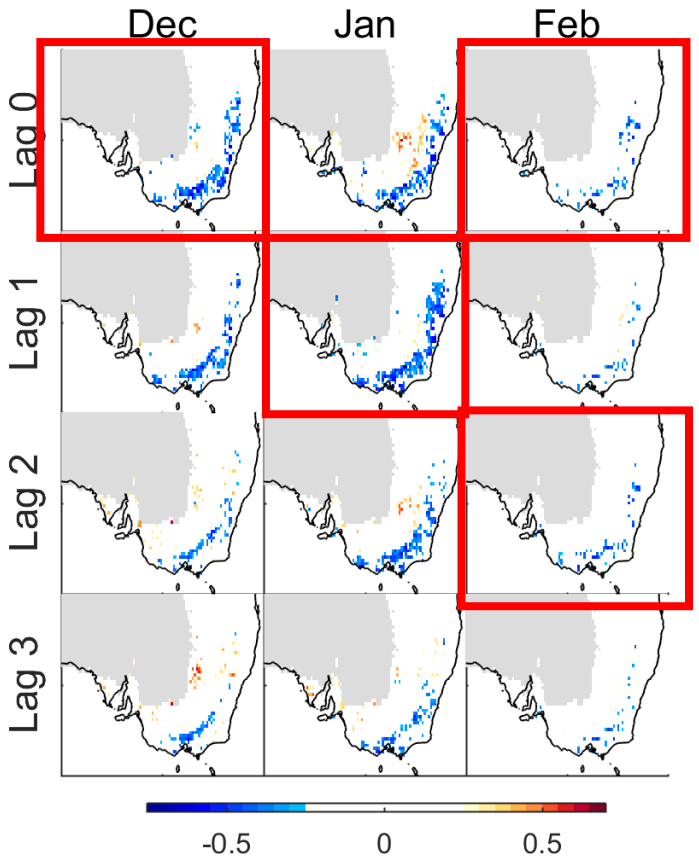

Fig. 2 - Correlation between BA and SPEI

Only the maximum value obtained for the SPEI time scales is shown

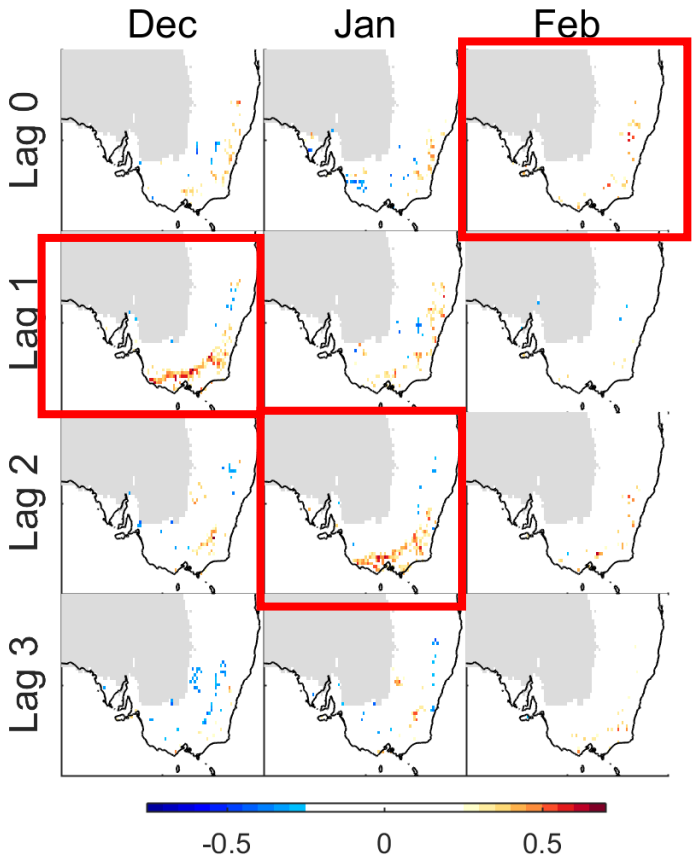

Fig. 3 - Correlation between BA and NHD

RESULTS

BIVARIATE COPULAS - SPEI

What is the probability of BA exceeding the 80th percentile, given drought conditions?

The probability of BA > 80th percentile is higher for drought conditions than for normal conditions.

High probability for lag 0 for all months.

High probability in the months before the fire:

- Up to lag 3 in December

Drought conditions: SPEI<=-0.84

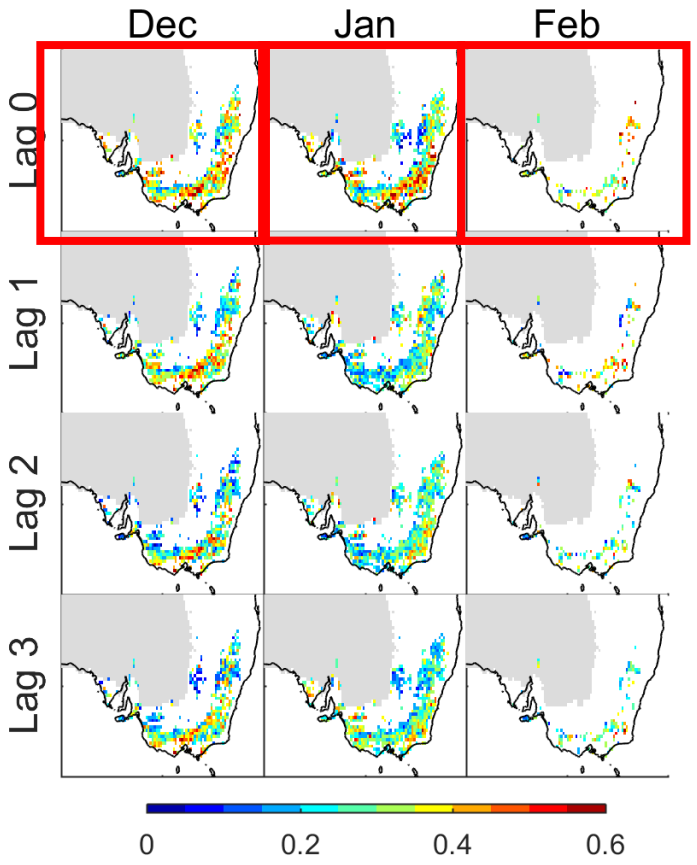

Fig.4 – Prob. of BA exceeding the 80th percentile, given drought conditions

Only the maximum value obtained for the SPEI time scales is shown

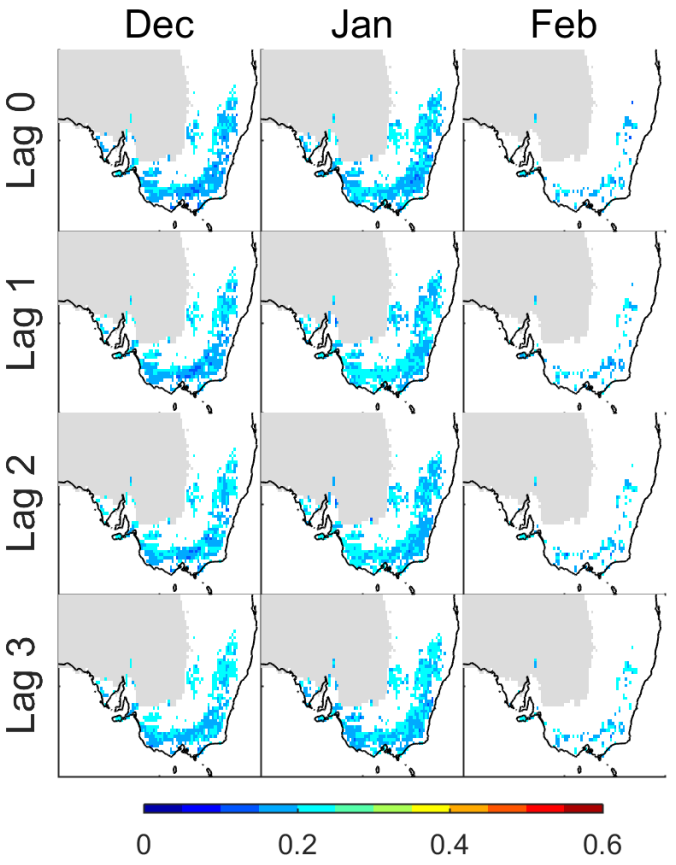

Fig. 5 – Prob. of BA exceeding the 80th percentile, given non-drought conditions

RESULTS

BIVARIATE COPULAS - SPEI

What is the SPEI time scale corresponding to the maximum correlation and probability?

The most frequent time scales are 1 and 6 months.

The SPEI chosen in January includes the accumulated drought conditions in the current and previous 5 months.

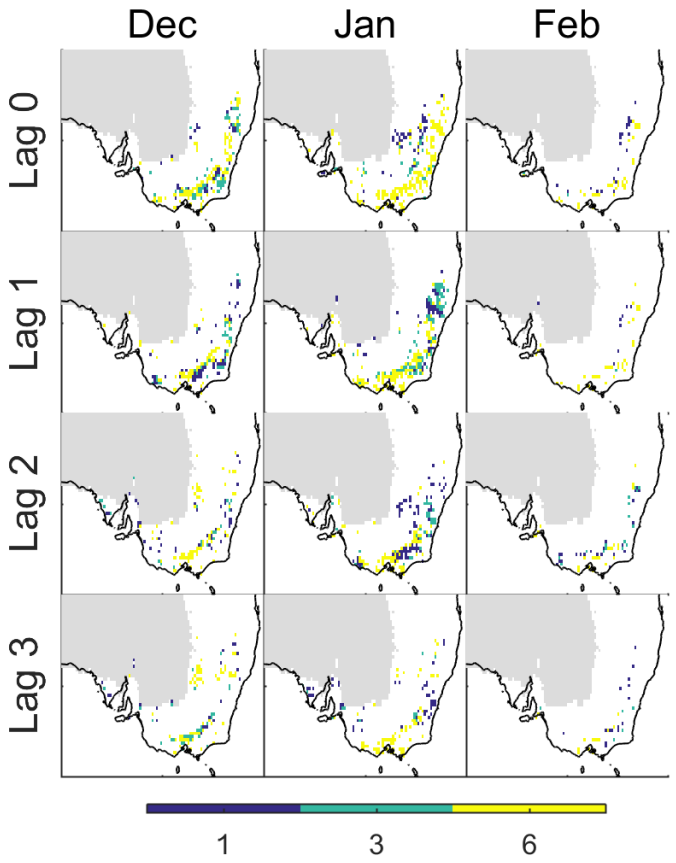

Fig.6 – SPEI time scale corresponding to the strongest correlation

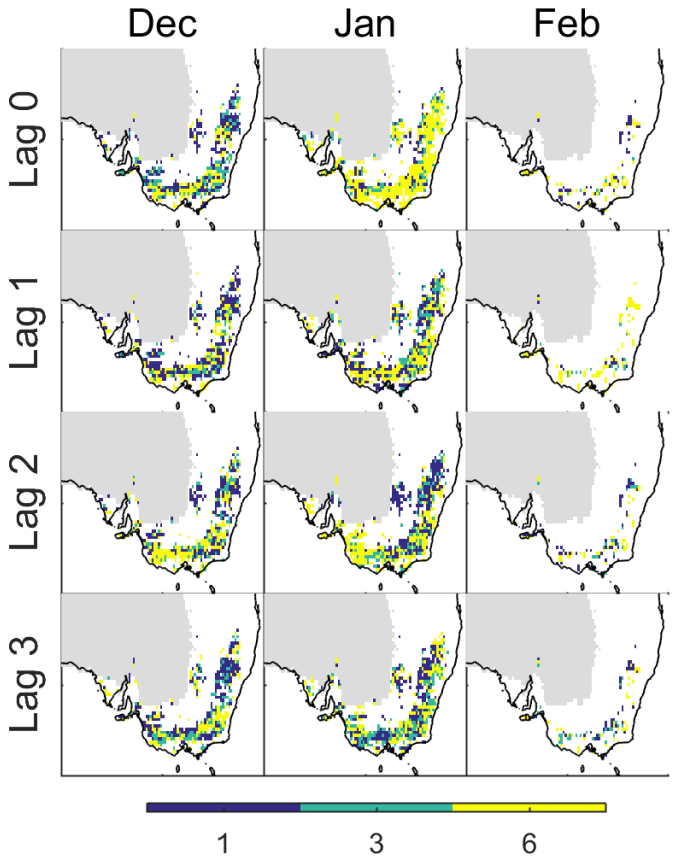

Fig. 7 – SPEI time scale corresponding to the maximum probability

RESULTS

BIVARIATE COPULAS - NHD

What is the probability of BA exceeding the 80th percentile, given extreme T conditions?

The probability of BA > 80th percentile is higher for extreme T conditions than for normal conditions.

High probability for lag 0 on all months.

High probability in the months before the fire:

- Up to lag 1 in December

Extreme T conditions: NHD > 80th percentile

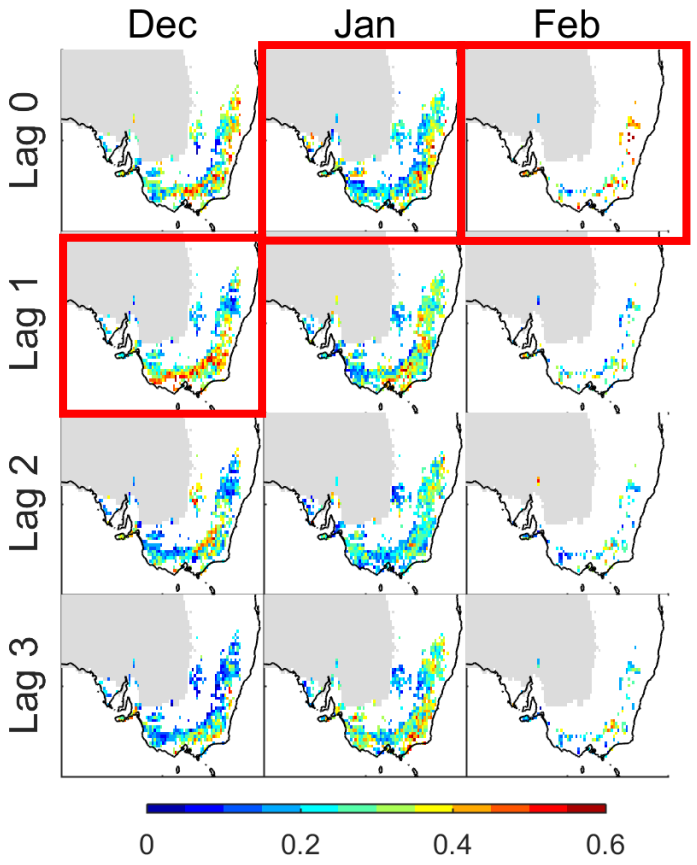

Fig. 8 – Prob. of BA exceeding the 80th percentile, given extreme temperature conditions

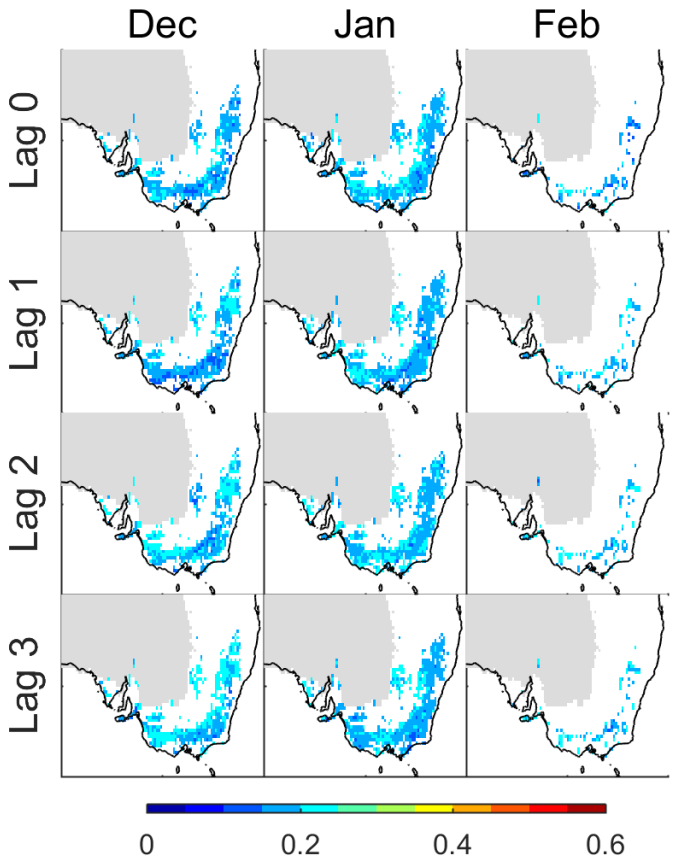

Fig. 9 – Prob. of BA exceeding the 80th percentile, given non extreme temperature conditions

CONCLUSIONS

- Strong correlation between BA and SPEI/NHD.
- High probability of large fires given drought/extreme temperature conditions.
- Drought seems to have a greater influence than extreme temperature, and for larger lags.
- Burned area in December and January is highly affected by drought conditions during spring.

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Thank you!