Are Recurrent Rossby Wave Packets (RRWPs) linked to persistent extreme weather events?

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Are RRWPs linked to persistent extreme weather?

Yes!

RRWPs can foster persistent extreme surface weather

What kind of surface weather?

And what are RRWPs in the first place?
What are RRWPs?

RRWPs = Recurrent synoptic-scale Rossby Wave Packets

“A sequence of recurrent synoptic-scale wave packets in which individual troughs and ridges amplify repeatedly in the same geographical region” (Röthlisberger et al. 2019)

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What are RRWPs?

• RRWPs = Recurrent synoptic-scale Rossby wave patterns

Röthlisberger et al. 2019
Why RRWPs?

*Davies (2015)*: “... the amplitude, recurrence and location of these transient (Rossby wave) patterns account directly for the corresponding anomalous seasonal-mean patterns.”

*Davies (2015)*: “...upper-tropospheric components of weather systems are significant for understanding and predicting season weather patterns...”
How to quantify RRWPs?

• R-metric

Röthlisberger et al. 2019

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What type of surface weather?
What type of surface weather?

- Hot spells
- Hot and humid spells
- Dry spells
Definitions

Hot spells: $T2M > 85^{th}$ percentile

Hot and Humid spells:

$$WBGT = 0.567xT + 0.393xVP + 3.94$$

Dry spells = Precipitation < 1 mm

(gap = 2 days)

Brouillet et al. 2019
• Weibull Regression model, a parametric regression model for survival data (Zhang 2016)

• Set up explained in Röthlisberger at al. 2019

\[
\ln\left(D_{i}^{(g)}\right) = \alpha_0^{(g)} + \alpha_1^{(g)} R_{r,i}^{(g)} + \sum_{j=2}^{6} \alpha_j^{(g)} m_j \left(t_{start,i}^{(g)}\right) + \sigma^{(g)} \varepsilon_i^{(g)} \quad i = 1, \ldots, n_g.
\]

Quantifying the effect of R on spell duration
• How to interpret the model results?

• Acceleration Factors (AF):

  • $\exp(\alpha_1) > 1 (Red)$: R $\uparrow$ $\Rightarrow$ Spell durations $\uparrow$

  • $\exp(\alpha_1) < 1 (Blue)$: R $\downarrow$ $\Rightarrow$ Spell durations $\downarrow$
Hot & Humid Spells
Dry spells
Conclusions

RRWPs can foster hot, dry and cold (not shown) persistent surface extremes

**Hot Spells**
- Increases over Eastern and Central US, Europe, and some parts of Asia
- Increases over Patagonia, SE-Australia and New Zealand

**Hot & Humid Spells**
- Events requiring both heat and moist advective sources don’t have a link with RRWPs

**Dry Spells**
- Increases over parts of Canada, US, Europe
- Increase over parts of Brazil and New Zealand
- Opposite signal than for hot spells over Iberian Peninsula, Argentina and Australia
Thank You

