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High Impact Climate Events

Origins of adverse climate for wheat in Australia

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Dry and hot climate, affected by atmospheric circulation, is associated with severe wheat failure in Australia. However, upwind droughts may trigger the downwind transport of dry and hot air, which shows the possibility of climate extremes propagation in space. Here, we use a novel atmospheric Lagrangian modelling framework, along with satellite observations to delineate the source anomalies of moisture and heat during crop failure years. In the initial phase of the Millennium Drought (2002), upwind land–atmosphere feedbacks contribute to 5% lower-than-usual moisture and 2% higher-than-usual heat imports into the downwind breadbasket, thus amplifying wheat failure risks.

References:

- Li, H., Keune, J., Smessaert, F., Nieto, R., Gimeno, L., Miralles, D., 2023. Land--atmosphere feedbacks contribute to crop failure in global rainfed breadbaskets. In Review.
- Keune, J., Schumacher, D.L., Miralles, D.G., 2022. A unified framework to estimate the origins of atmospheric moisture and heat using Lagrangian models. Geosci. Model Dev. 15, 1875–1898.
- Li, H., Keune, J., Gou, Q., Holgate, C., Miralles, D., 2023. Understanding the origins of climate anomalies during crop failure events over the Southeastern Australian wheat belt. In Preparation.

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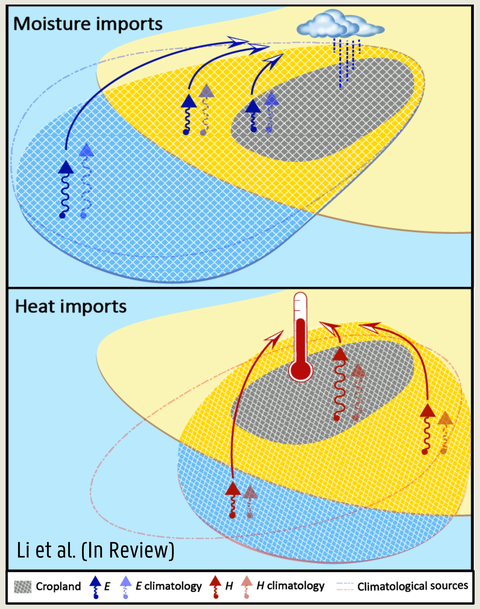
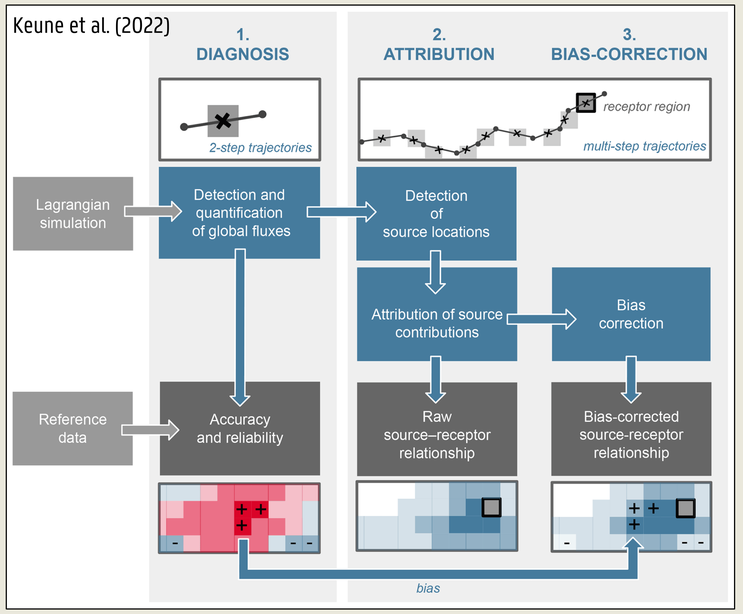
1 Hypothesis

During crop failure events, the source regions of moisture and heat may shift from the climatological ones, in which land–atmosphere feedbacks influence the contribution from upwind and local land.

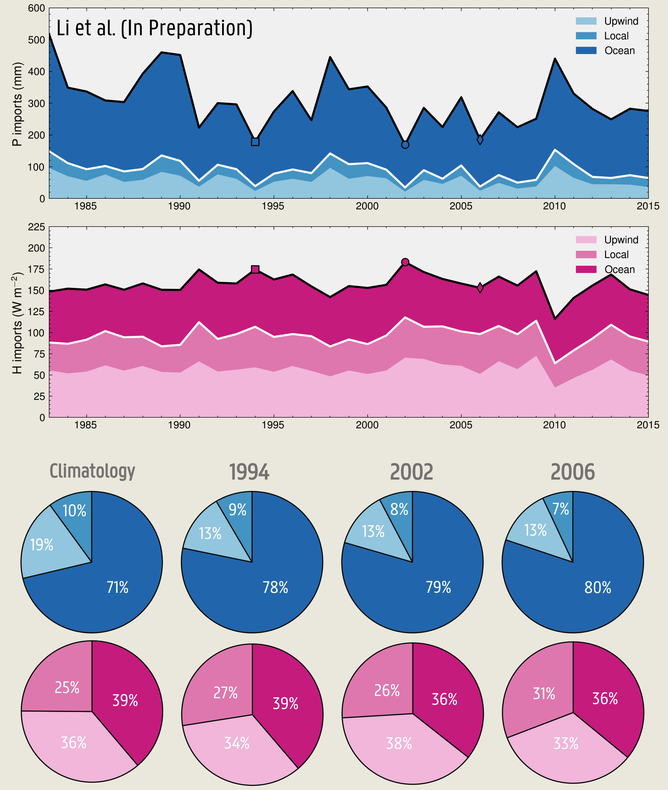


2 Research Method



We use the FLEXPART V9.01 driven with ECMWF reanalysis at 1° resolution to trace 3 million air parcels globally. A unified framework is applied to evaluate 15-day backward trajectories and bias-correct source regions. The bias correction is done using P from MSWEP, E from GLEAM and OAFlux, and H from GLEAM.

3 Heat and Moisture Budget



4 Drought Impact on Downwind Climate in the Initial Phase of the Millennium Drought (2002)