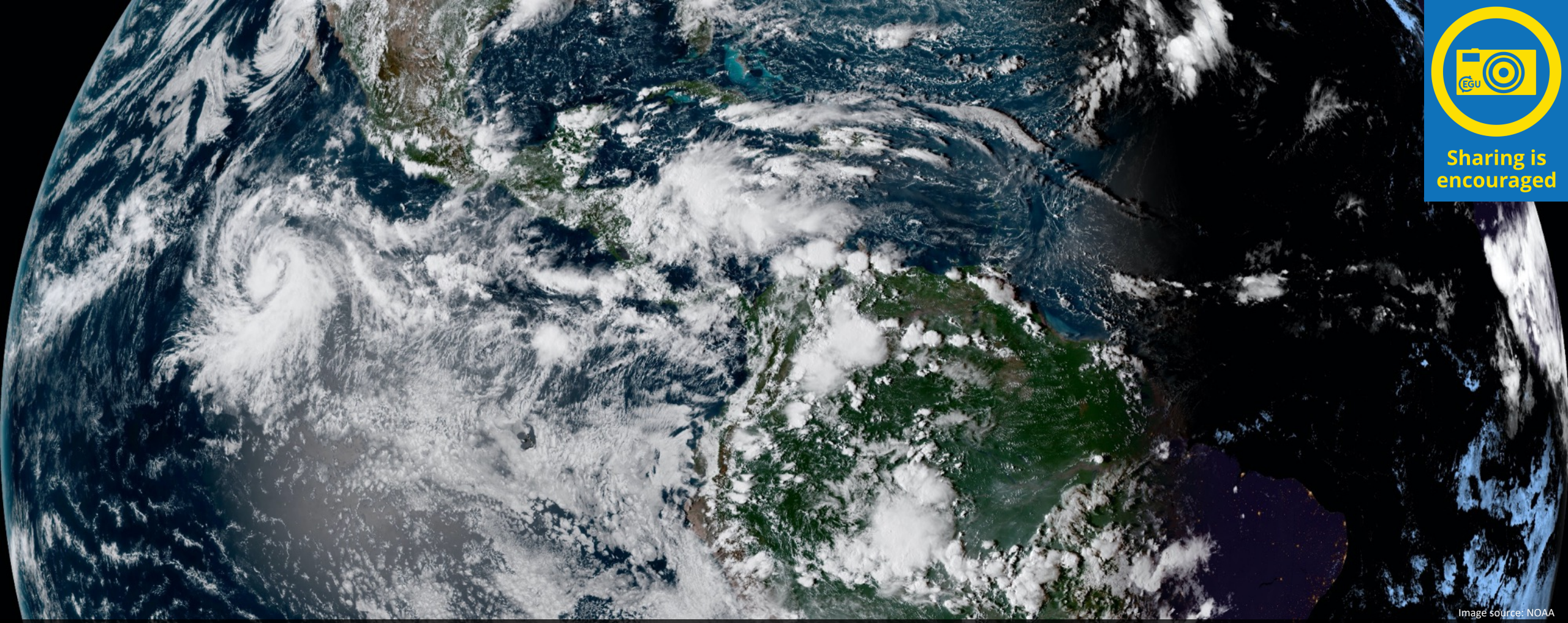

Sharing is encouraged

Image source: NOAA

The impact of land-sea contrasts in the aggregation of convection

Beth Dingley

UNIVERSITY OF OXFORD

With thanks to Guy Dagan, Philip Stier, and Ross Herbert

UKRI Natural Environment Research Council

CONVECTIVE AGGREGATION:

A large-scale reorganisation of convection into clusters

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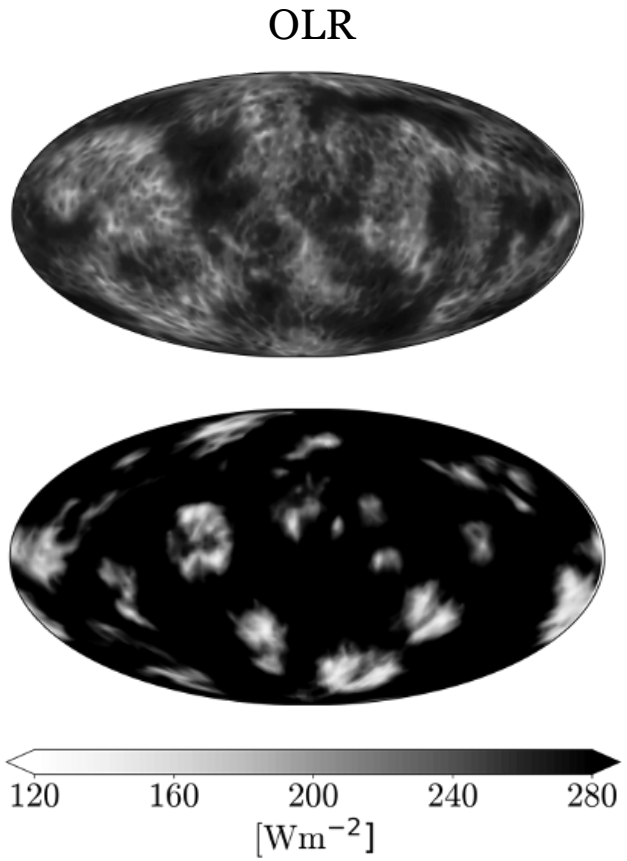

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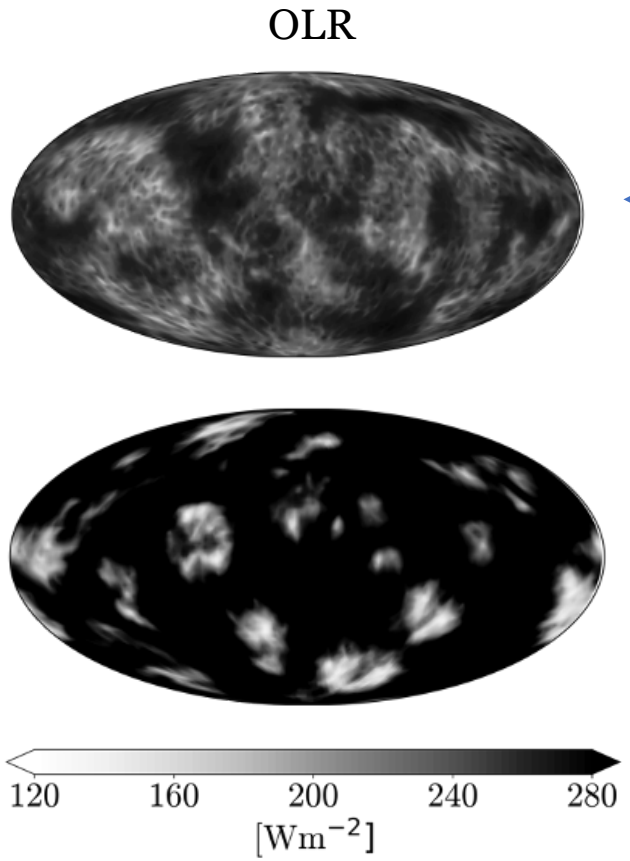

NOT VERY AGGREGATED

STRONGLY AGGREGATED

CONVECTIVE AGGREGATION:

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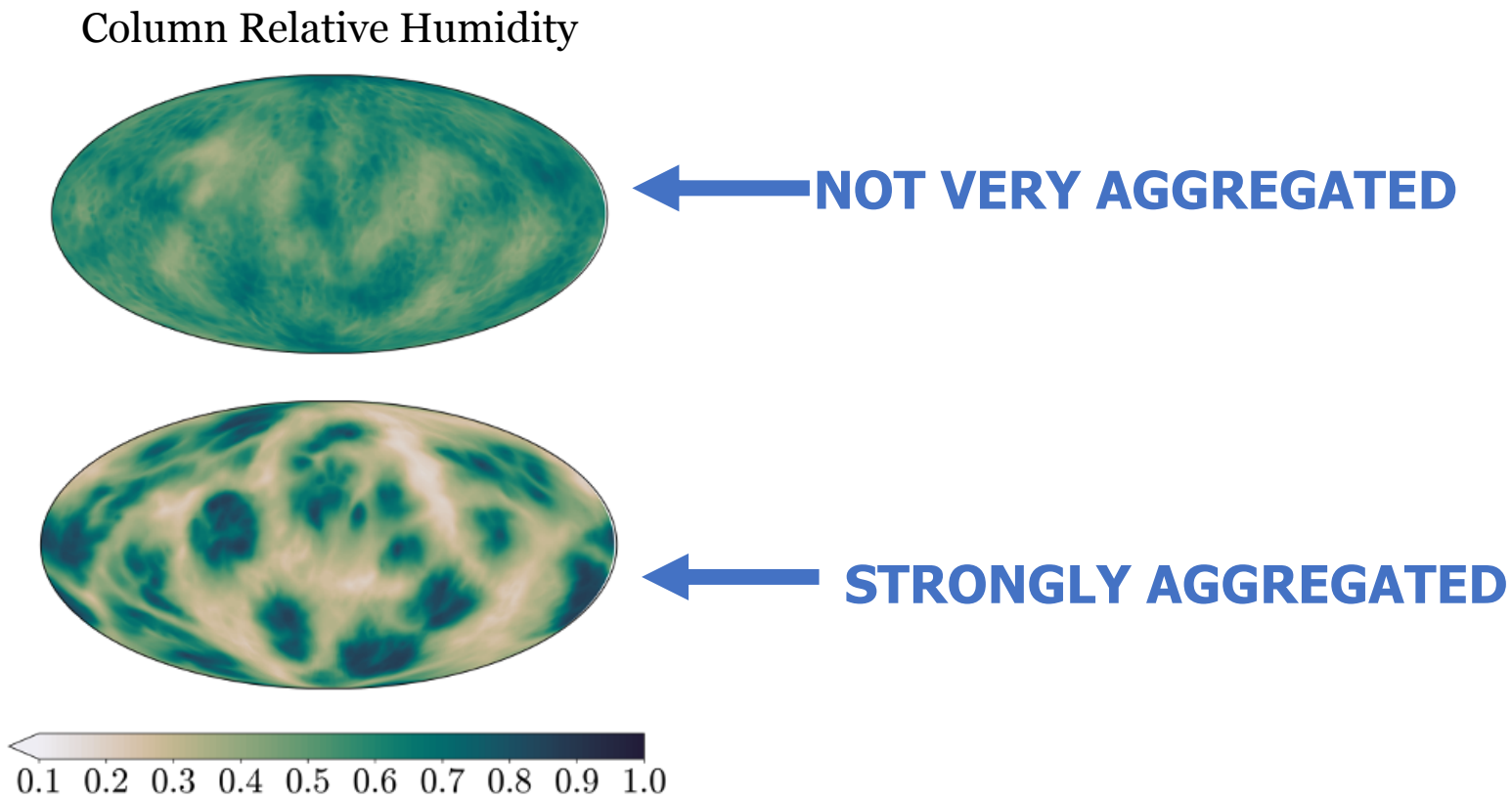

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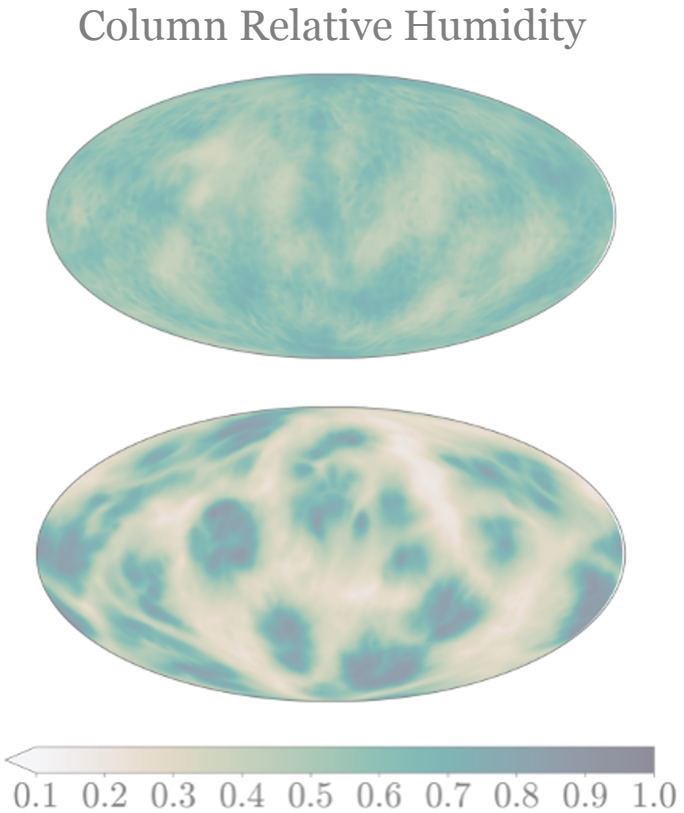

RCE: Radiative cooling balanced by convective heating

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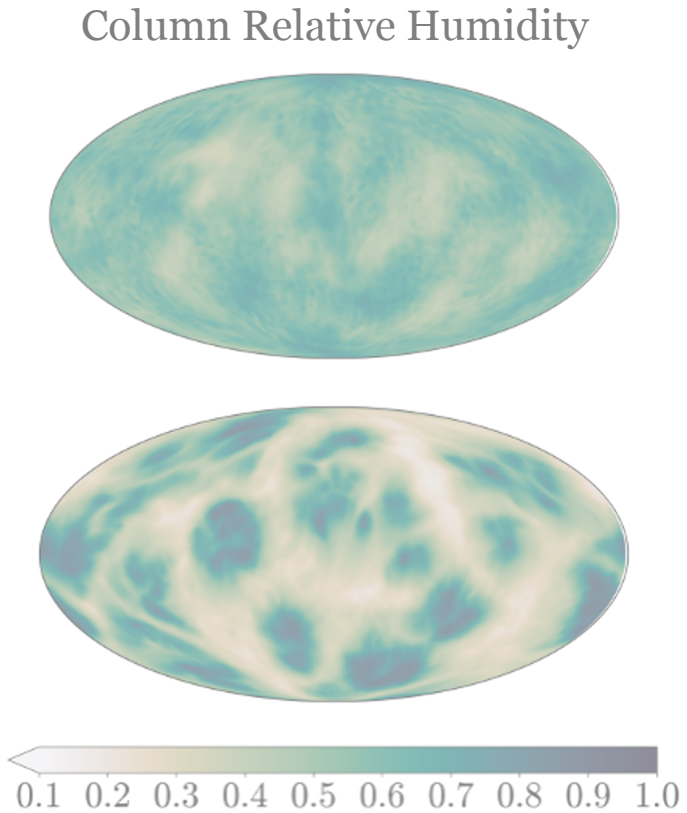

RCE: Radiative cooling balanced by convective heating

- No land
- Globally fixed SST
- No diurnal cycle
- No rotation

How does a continentally sized island affect convective aggregation?

The models

ICON Atmospheric GCM

- RCE configuration:
  - Globally fixed SST @ 305K
  - No diurnal cycle
  - No rotation
- 2-year simulations
- ~160km horizontal resolution

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ICON Atmospheric GCM

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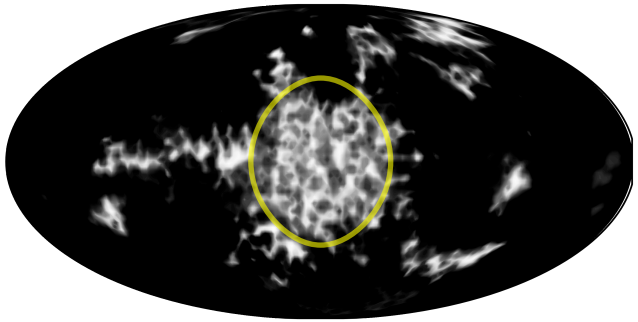
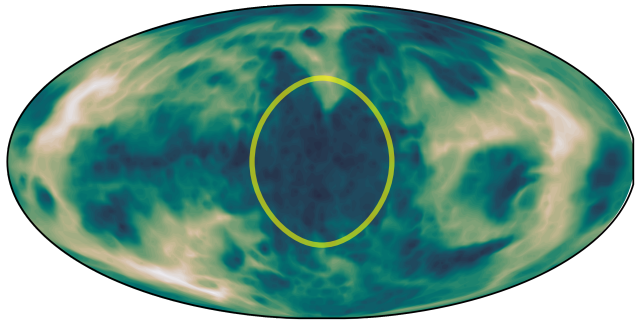
JSBACH4 Land model

- Circular, flat island
  - 40° radius
  - No elevation
- Tropical rainforest surface properties
  - Mean Amazon soil and vegetation

OLR

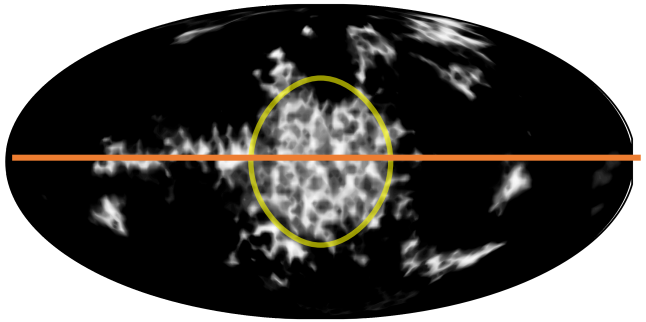


Column Relative Humidity



Convection aggregates over land

OLR



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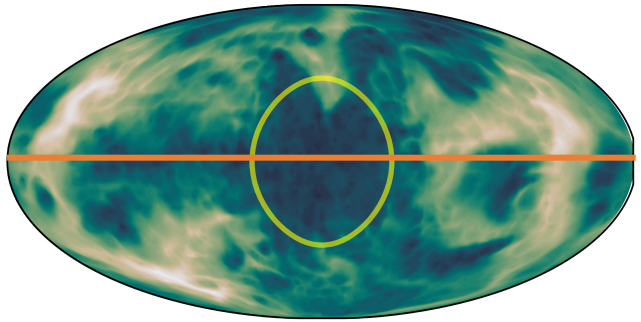

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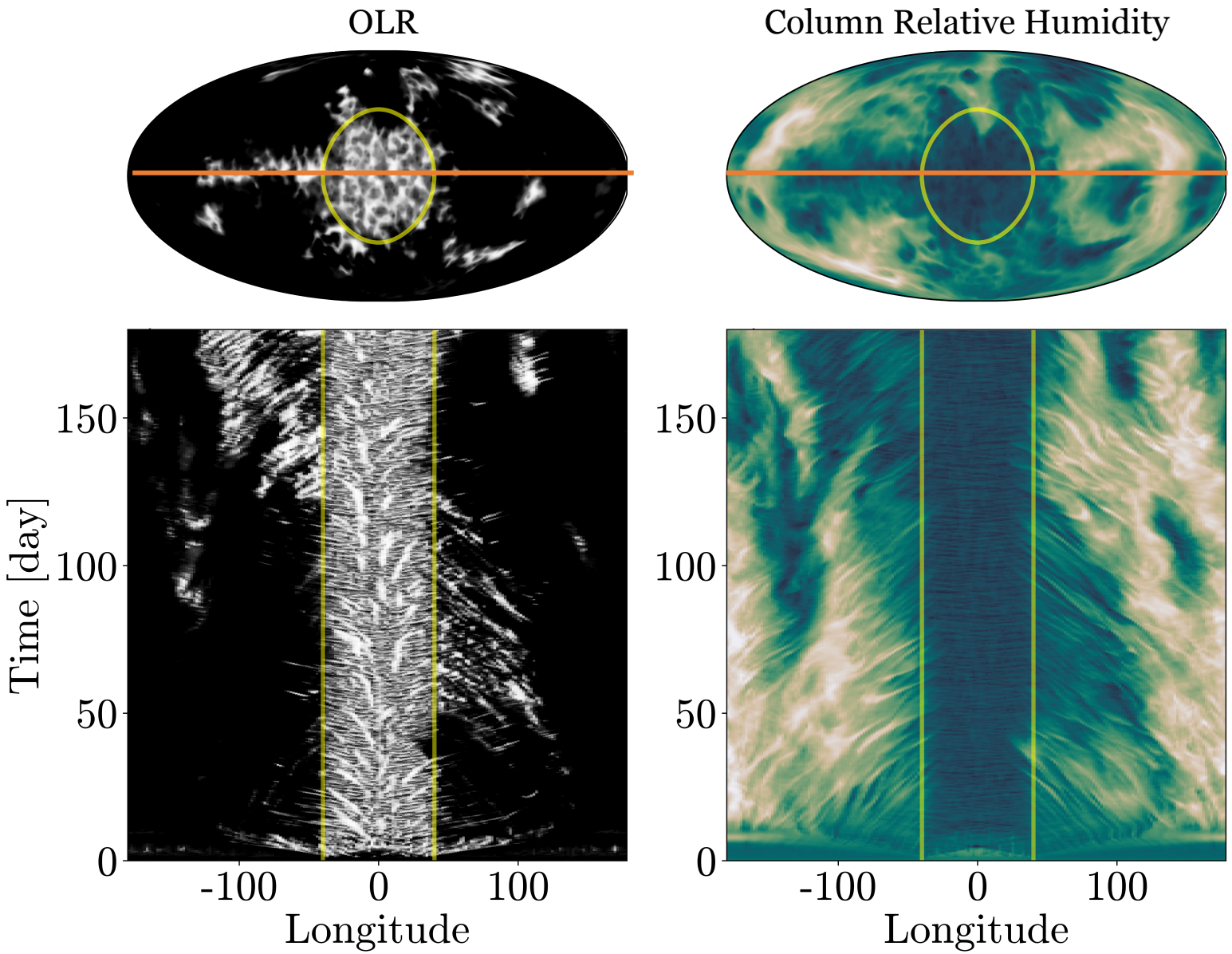

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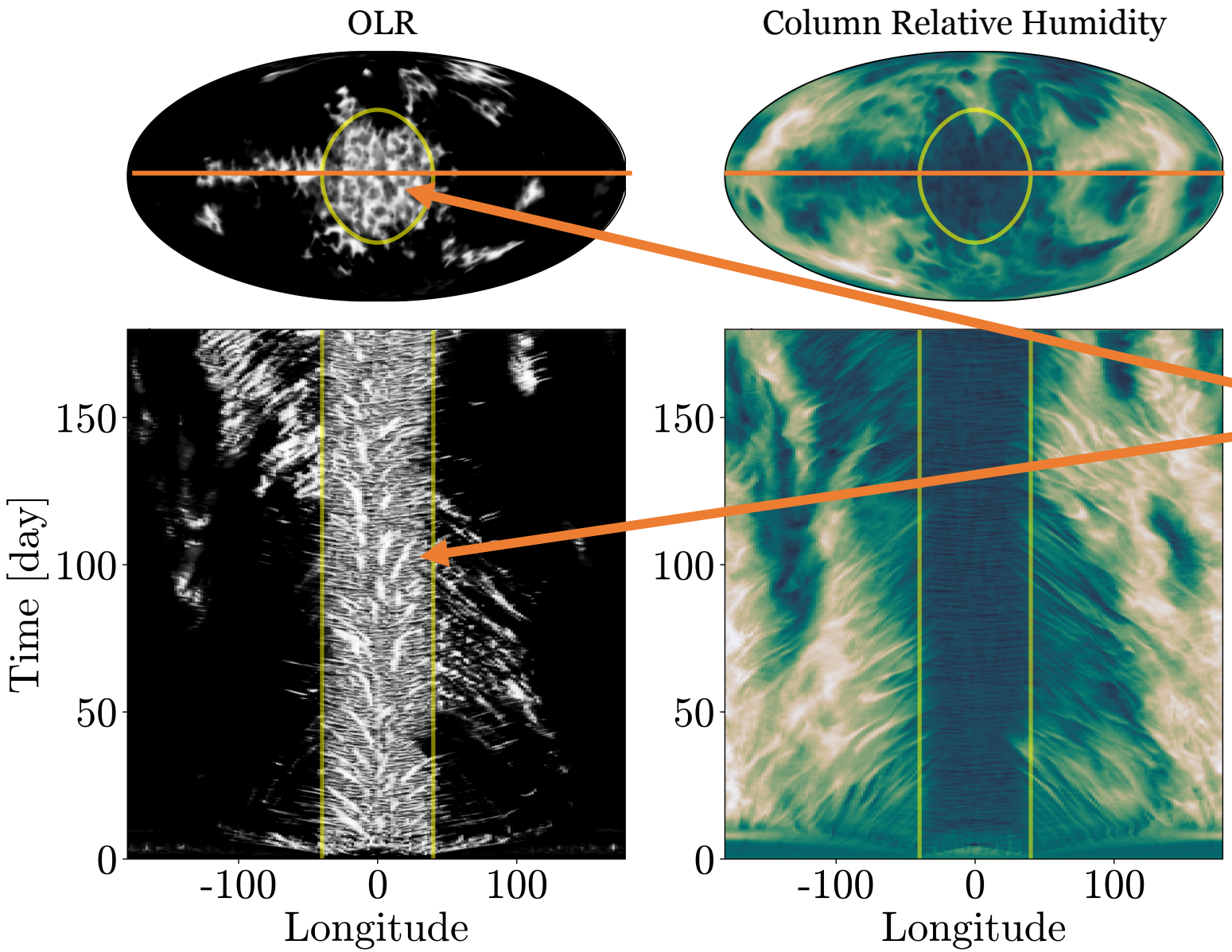
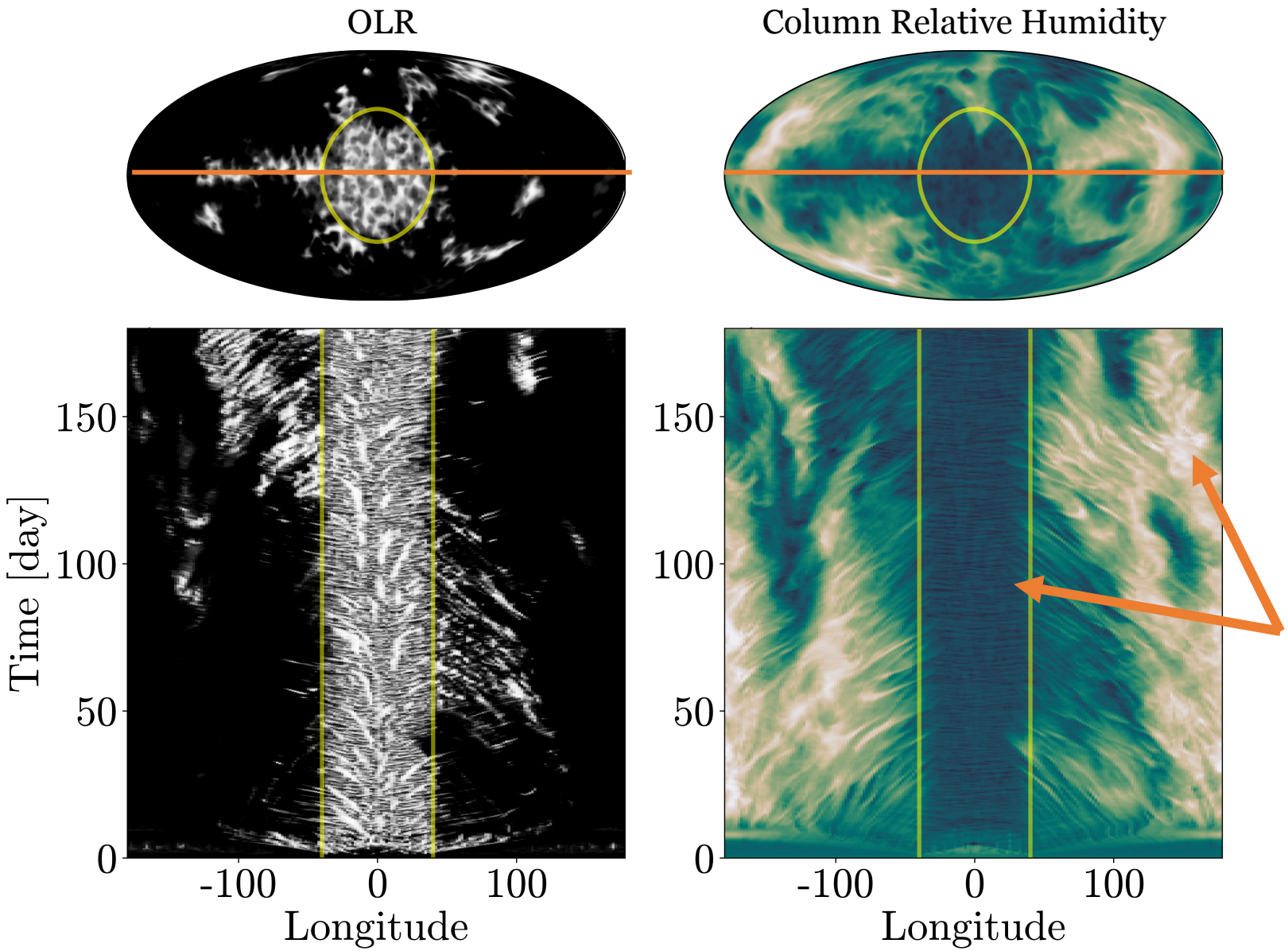


Convection aggregates persistently over island

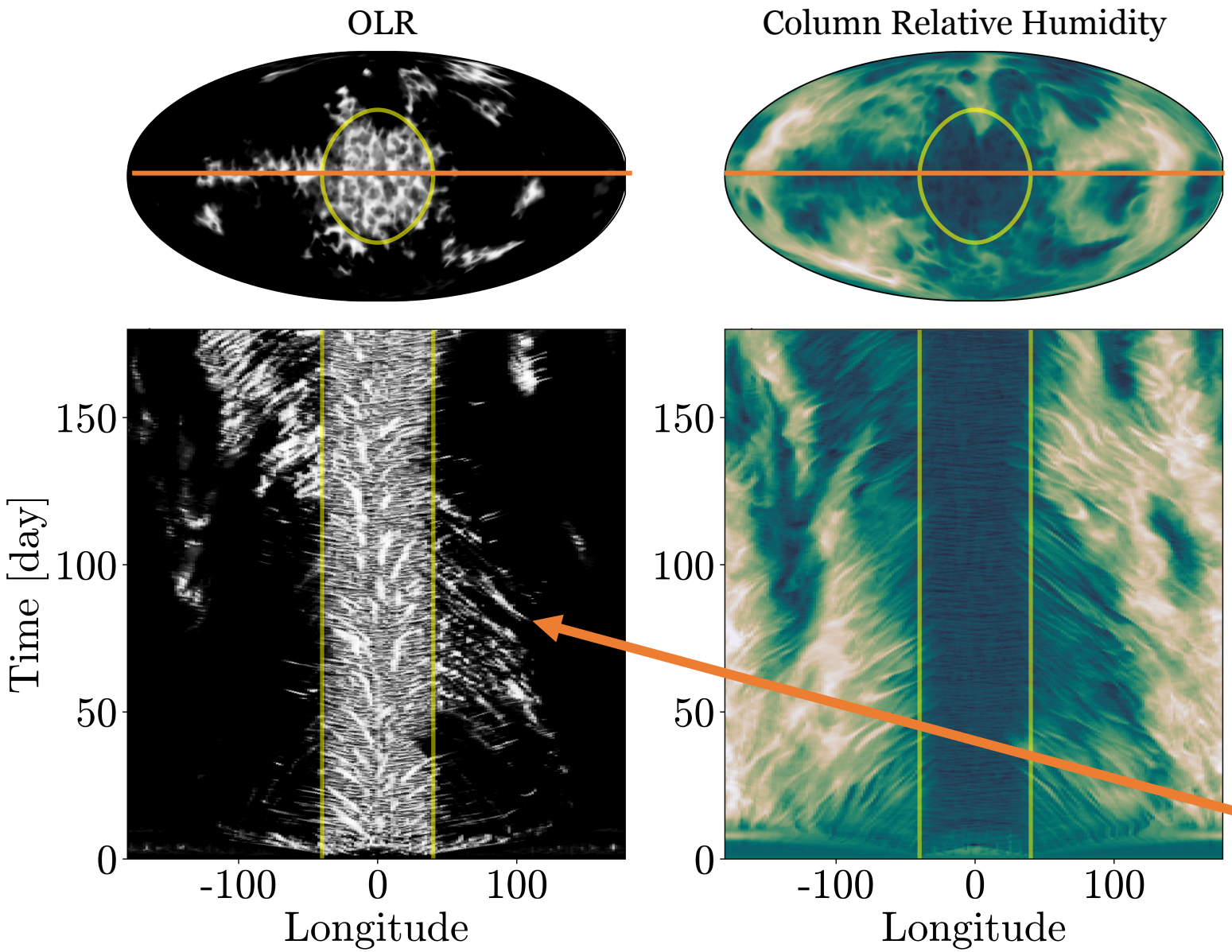
Convection aggregates over land



Convection aggregates persistently over island

Wettest columns also over land, with driest columns away from island

Convection aggregates over land



Convection aggregates persistently over island

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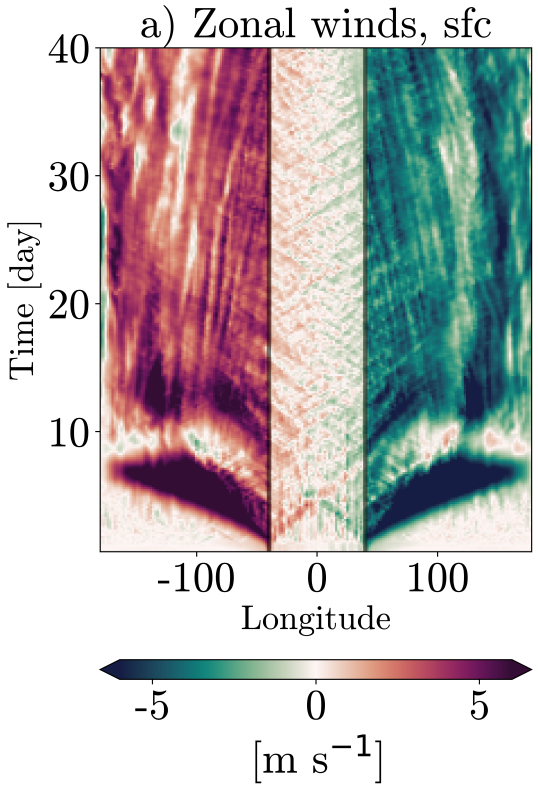
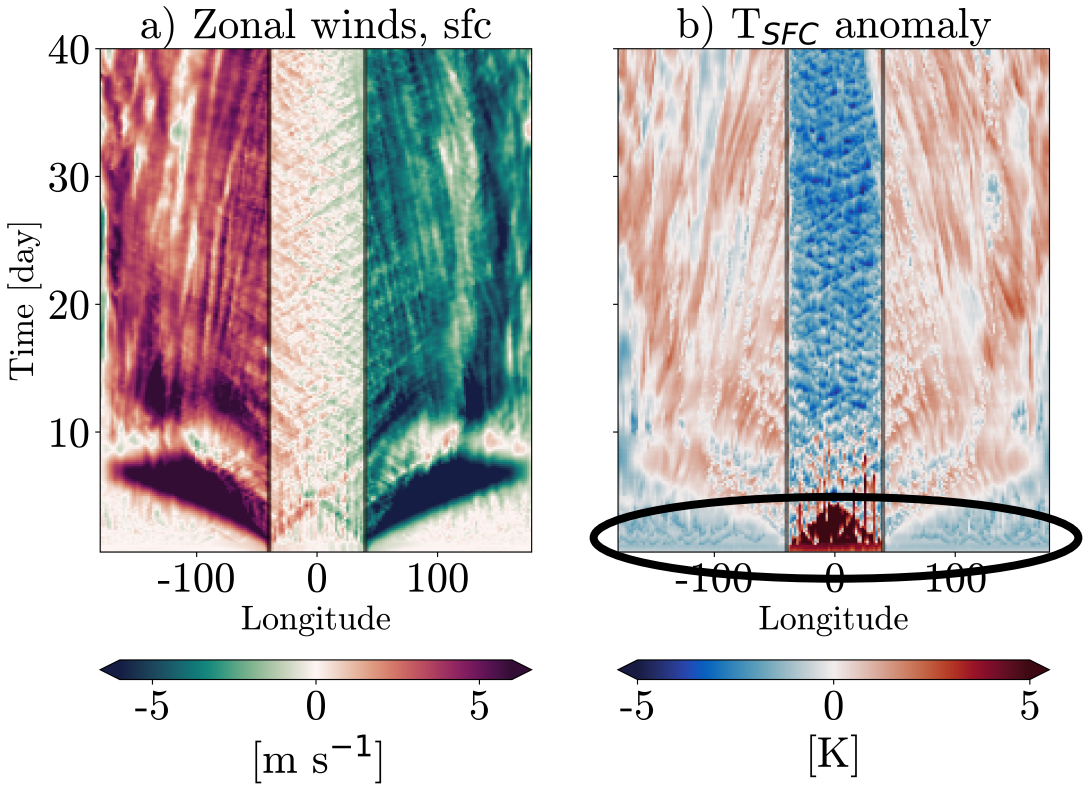
Convection being advected towards island

The large-scale circulation



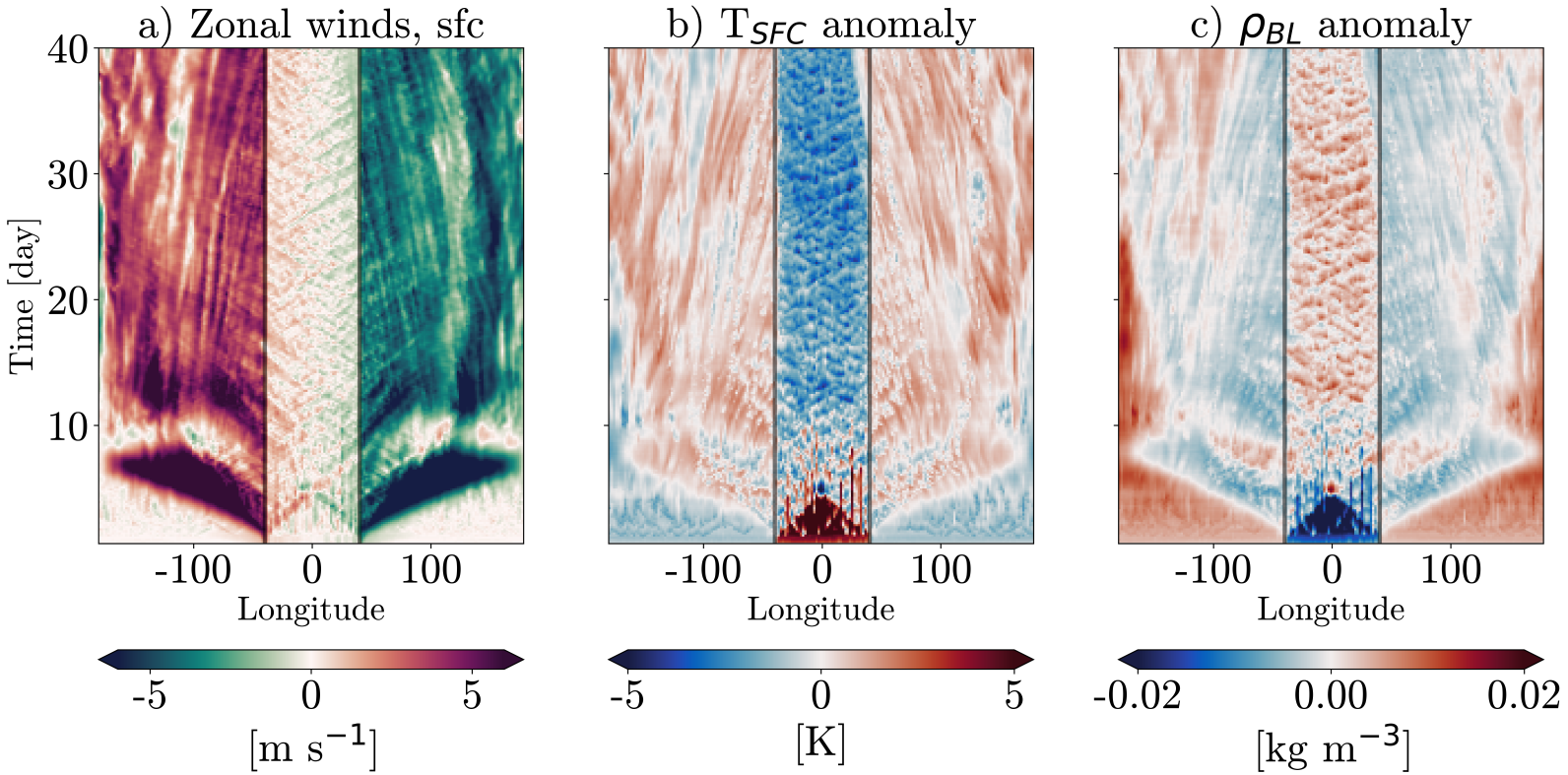
1. Global surface wind convergence towards island

The large-scale circulation



1. Global surface wind convergence towards island
2. Early convergence due to land-sea temperature difference

The large-scale circulation



1. Global surface wind convergence towards island
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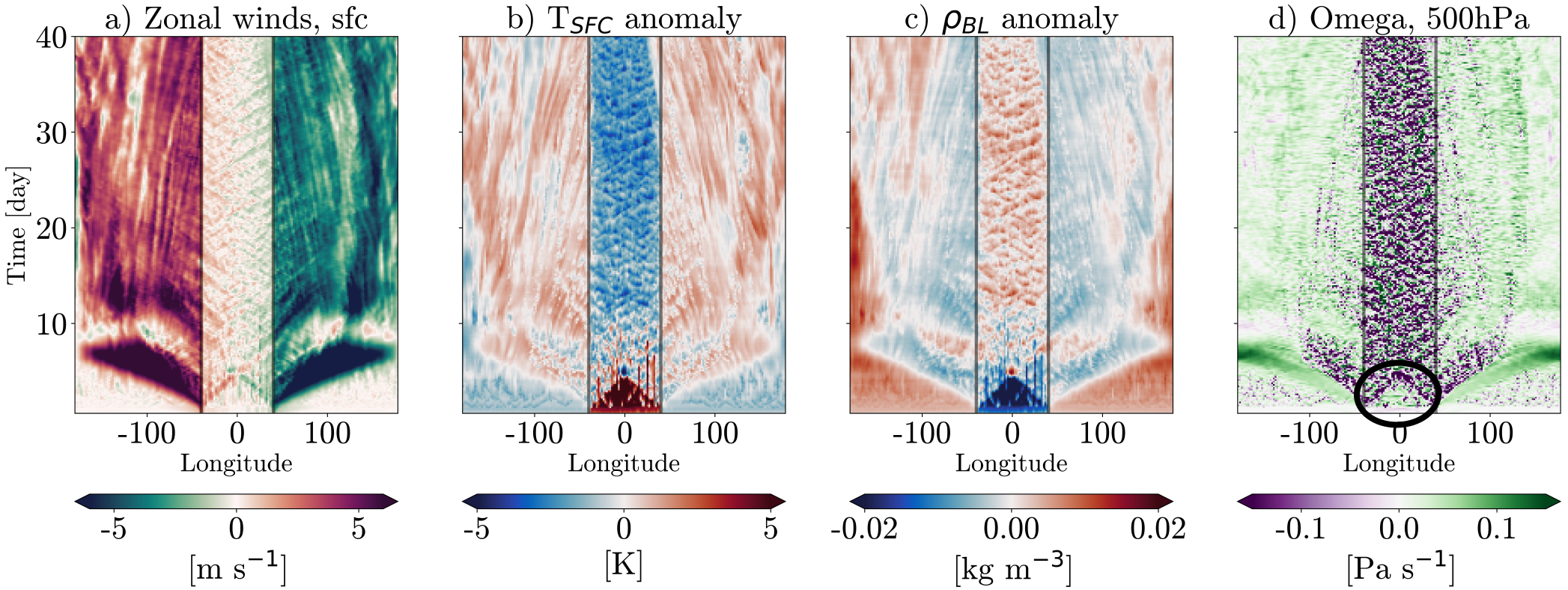

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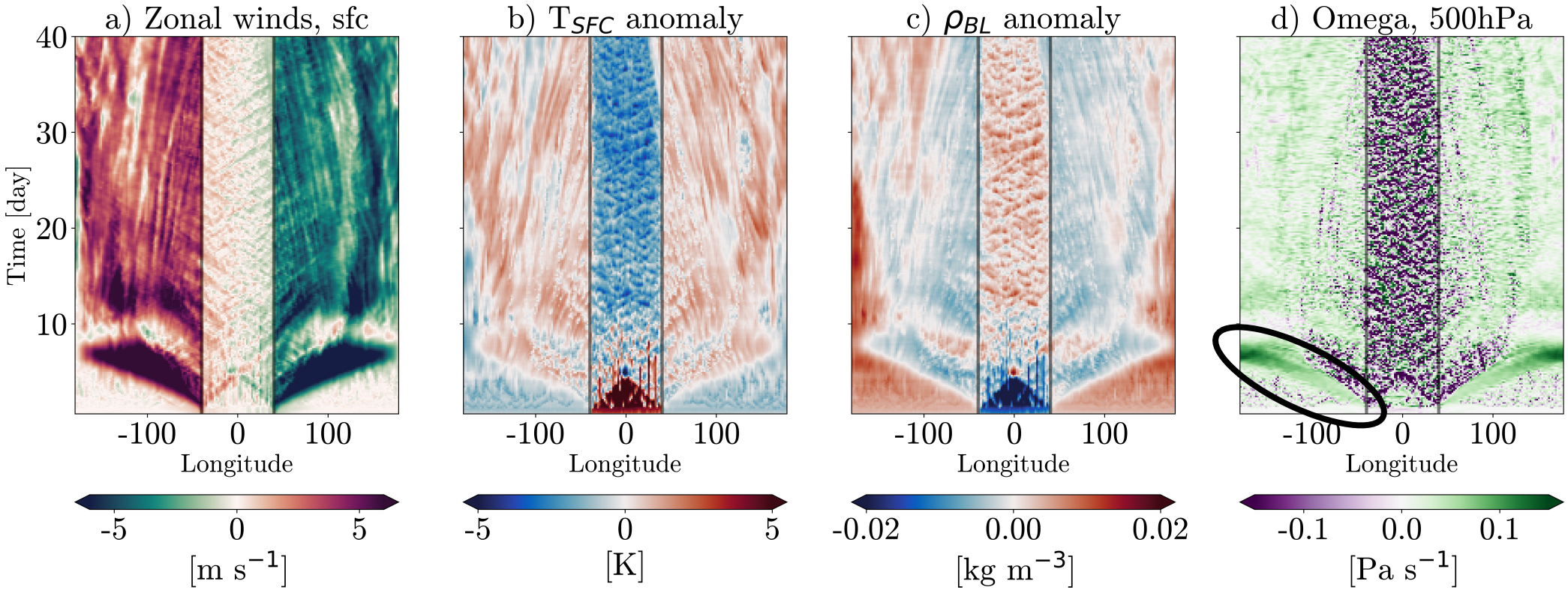
The large-scale circulation



1. Global surface wind convergence towards island
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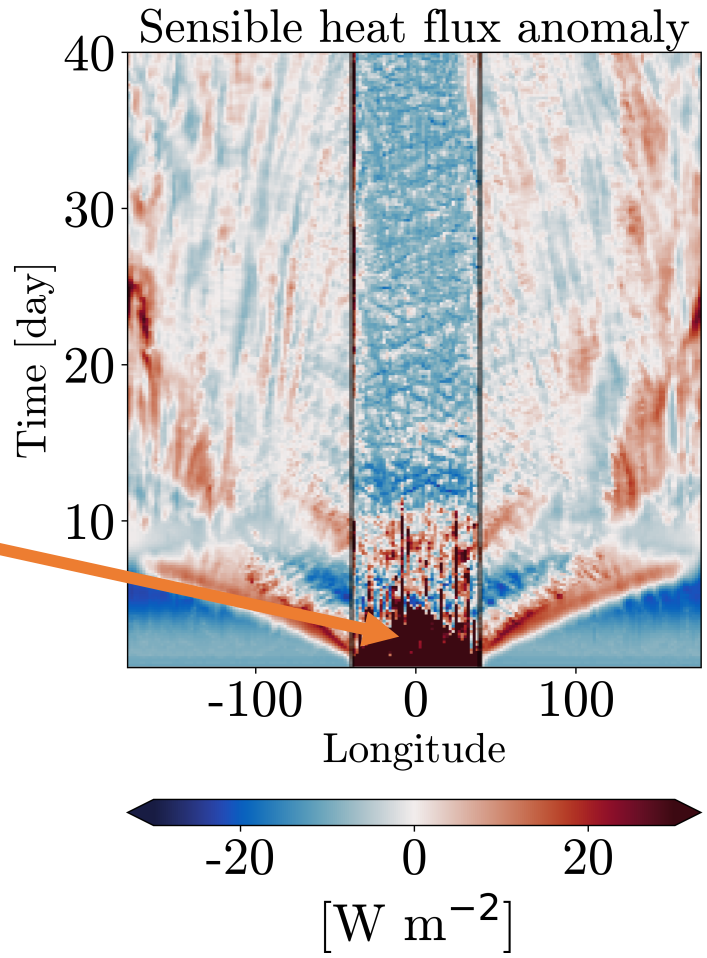
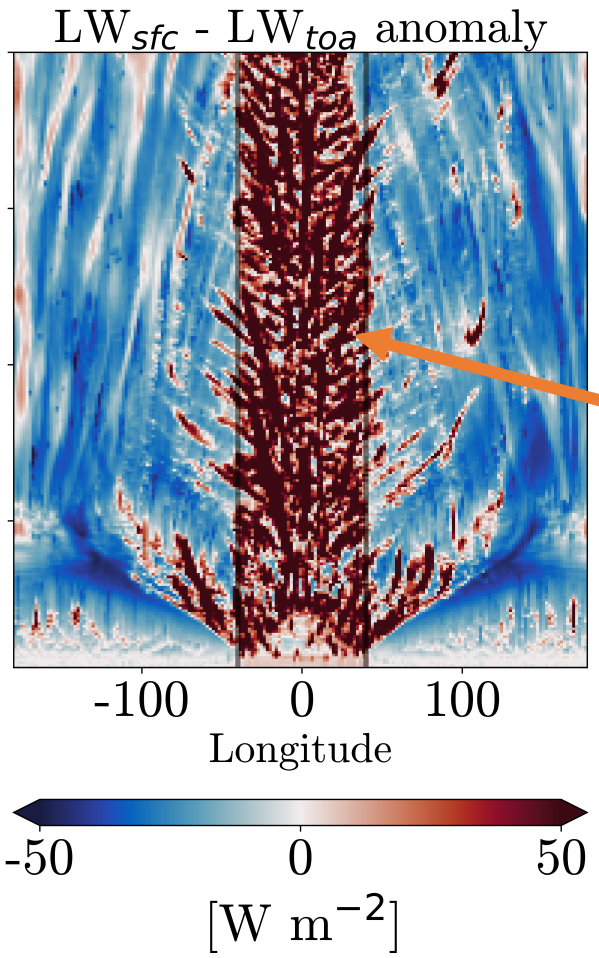
4. This triggers convection over island → **convection triggers gravity wave**

The large-scale circulation

Triggering vs Maintenance

Sensible heat flux driving circulation triggering





Longwave feedbacks driving circulation maintenance

Summary

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Email me for a copy of the preprint!