Exploring Mechanisms for Westerly Wind Anomalies

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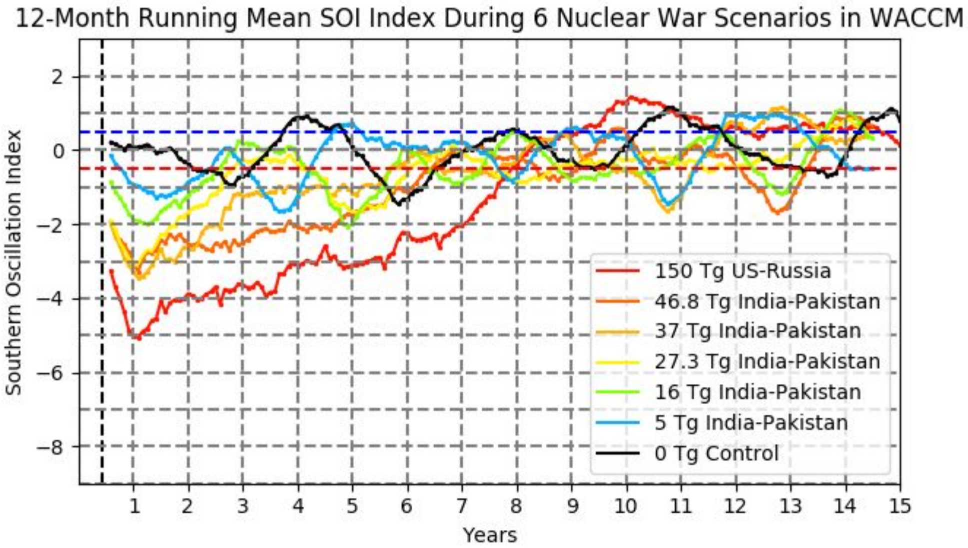
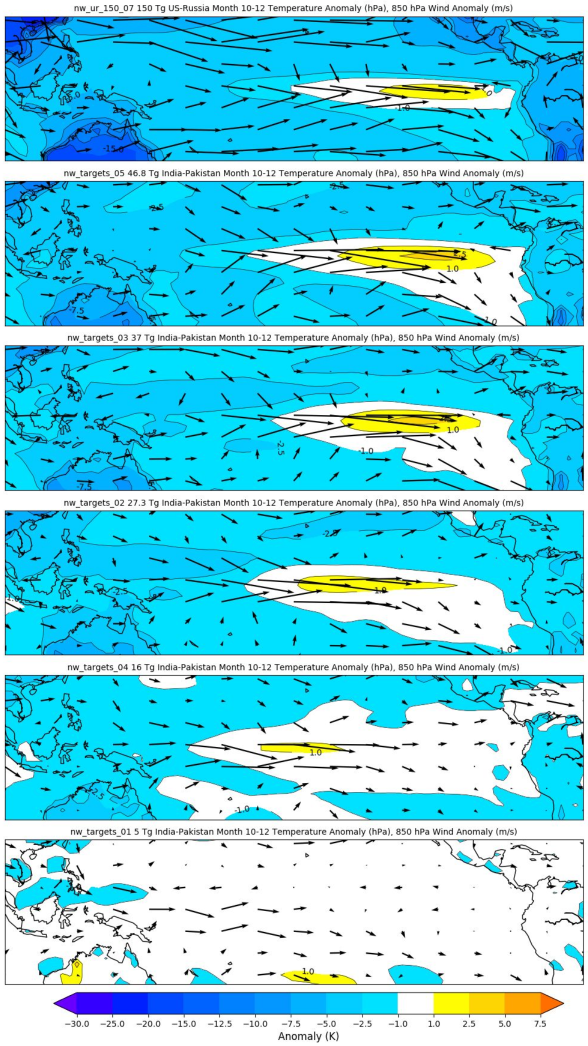
1/29/19

Goals:

1. Understand mechanism driving westerly wind anomalies in the western Pacific within months of the injection of soot.
2. Understand how the westerly wind anomaly scales with amount of soot injected.



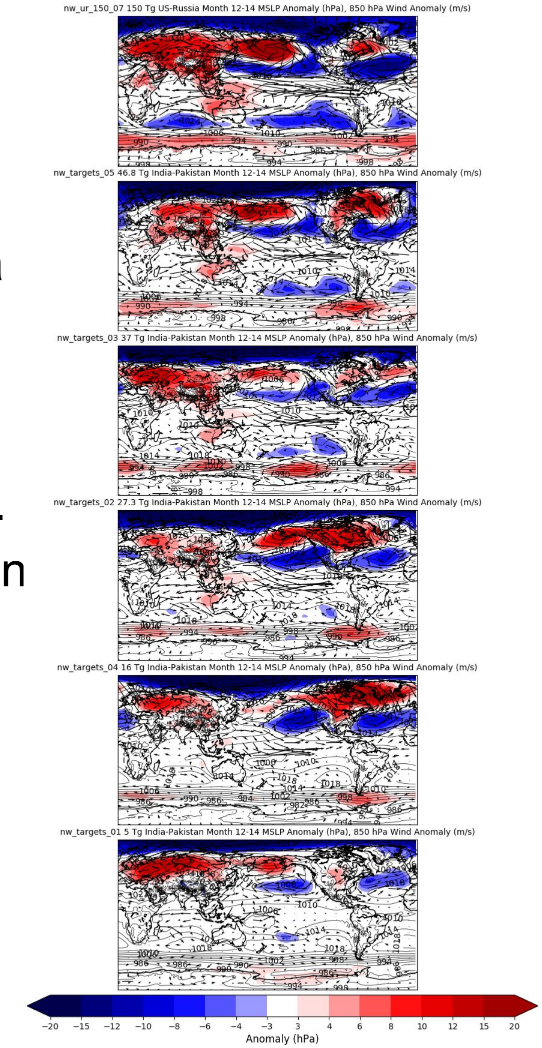


Previous idea:

Large-scale land-sea pressure gradient over southeast Asia and Pacific Ocean drives wind anomaly.

Why? Higher MSLP observed over entirety of eastern Asia as cooling continent causes shift in convection over oceans.

* drives flow from land to ocean in Pacific and Indian Ocean



[Link to all of these plots by month here.]

GIF of SOI / equatorial Pacific SSTAs

Khodri et al., 2017

nature COMMUNICATIONS

ARTICLE

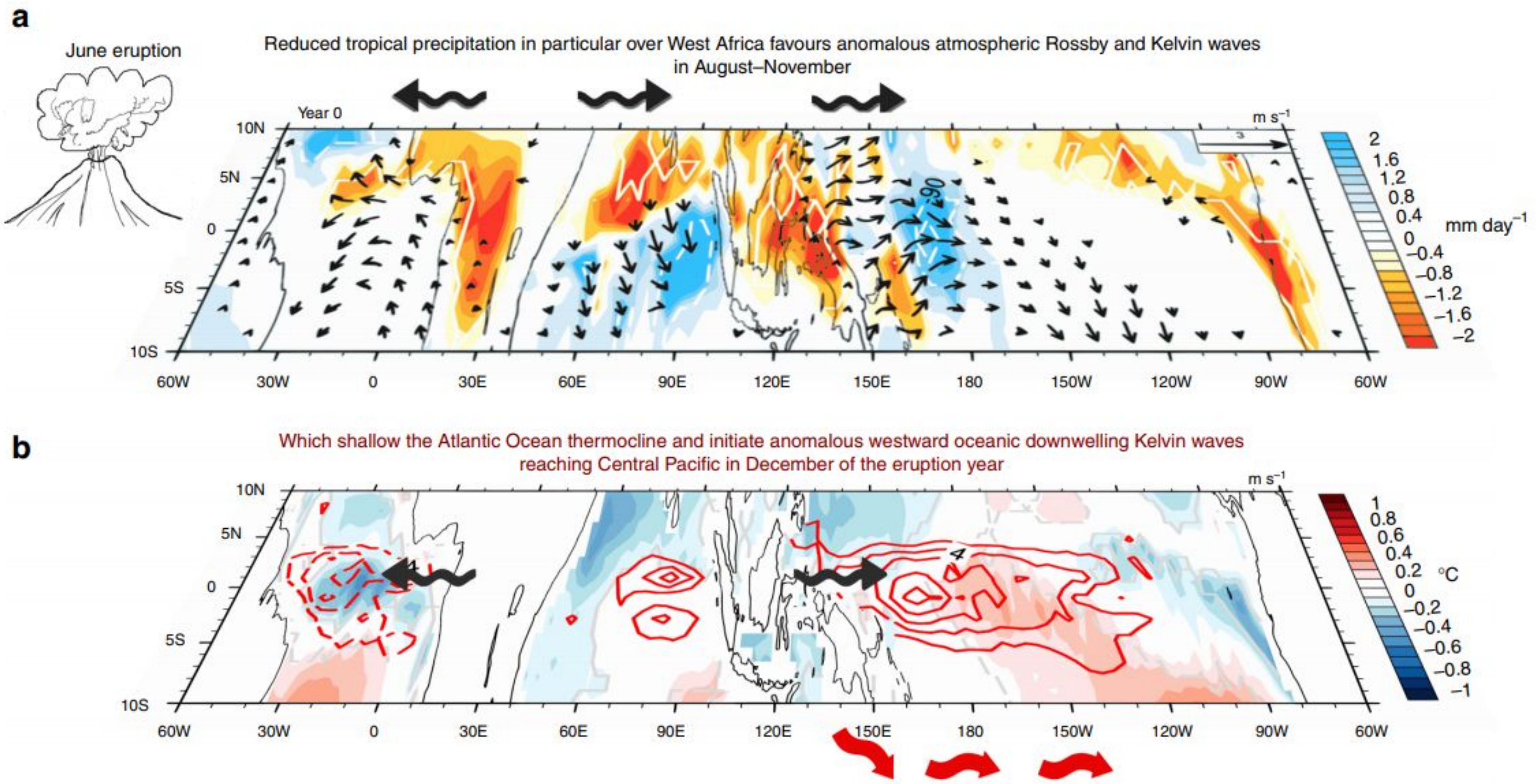
DOI: 10.1038/s41467-017-00755-6 OPEN

Corrected: Publisher correction; Author correction

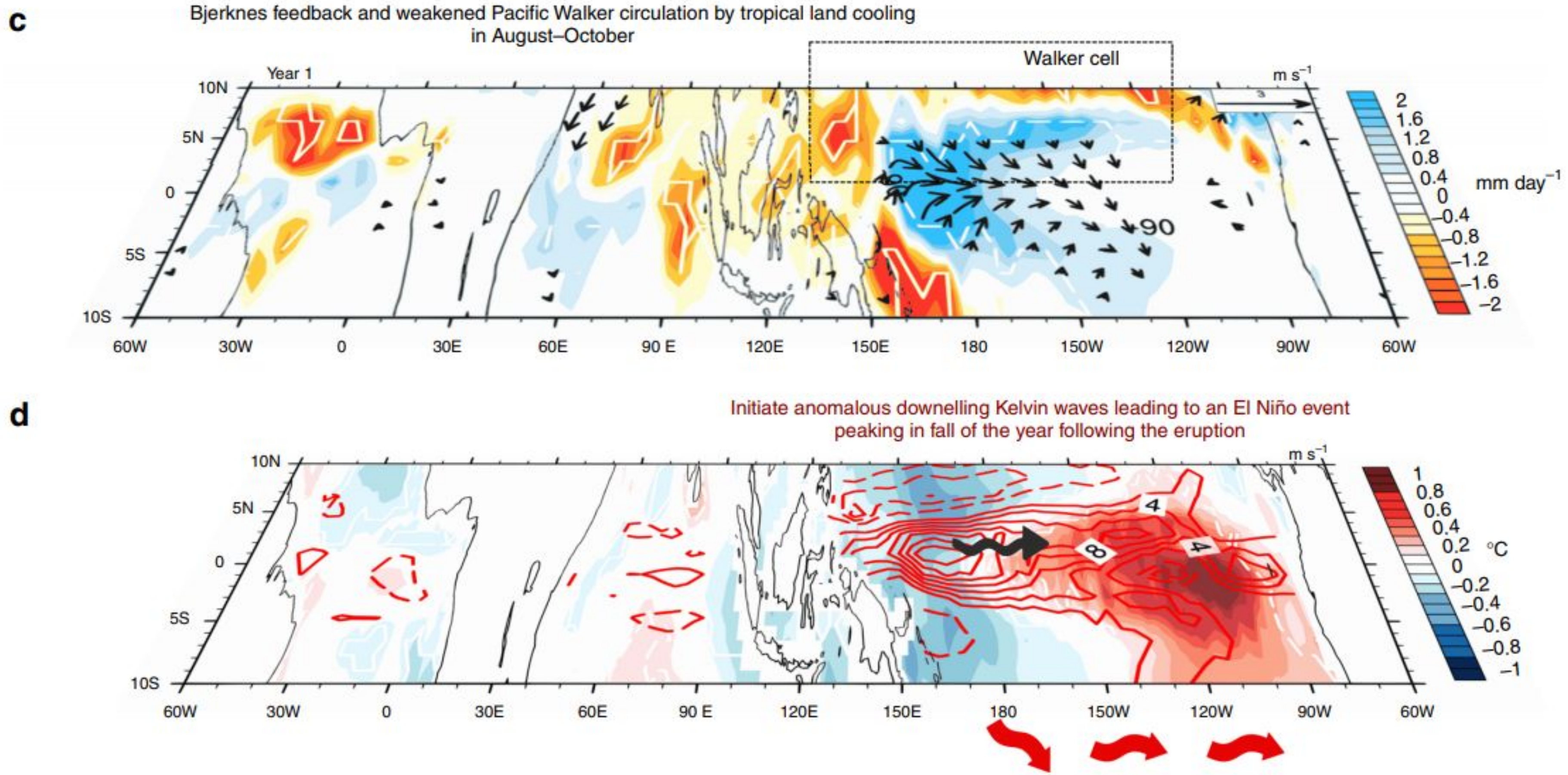
Tropical explosive volcanic eruptions can trigger El Niño by cooling tropical Africa

Myriam Khodri[1], Takeshi Izumo[1,2], Jérôme Vialard[1], Serge Janicot[1], Christophe Cassou[3], Matthieu Lengaigne[1,2], Juliette Mignot[1], Guillaume Gastineau[1], Eric Guilyardi[1,4], Nicolas Lebas[1], Alan Robock[5] & Michael J. McPhaden[6]

Khodri et al., 2017



Khodri et al., 2017

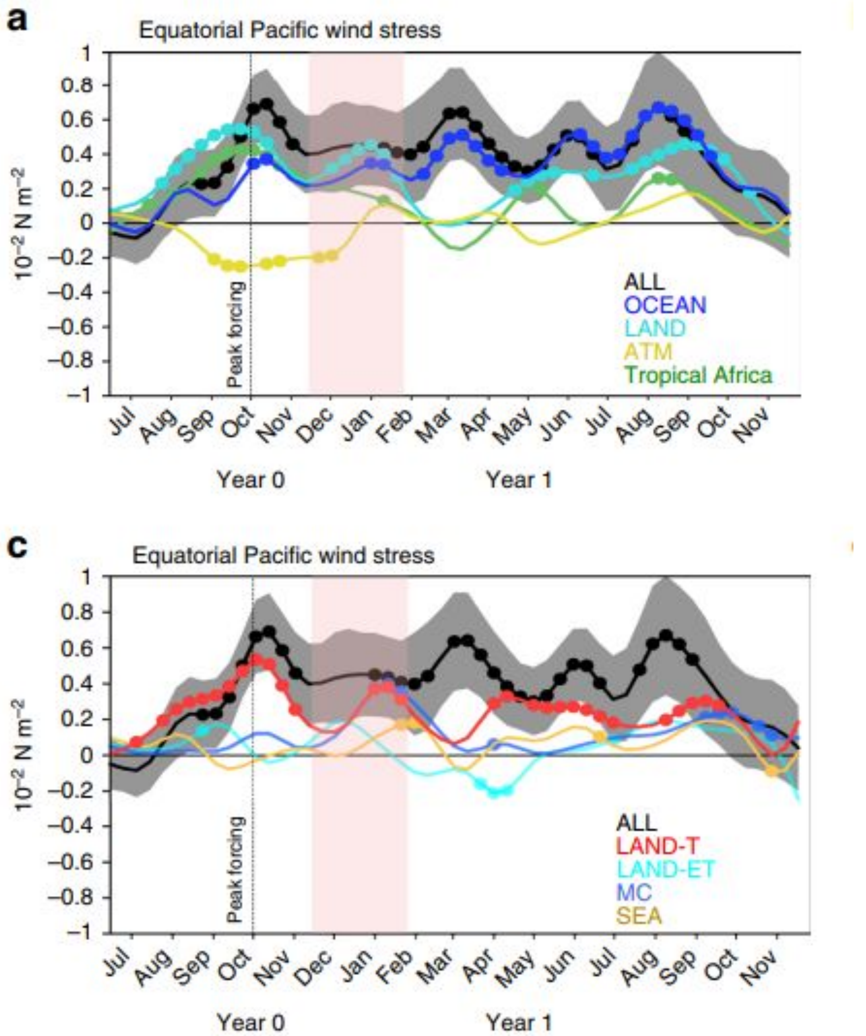


Khodri et al., 2017

Performed a number of model experiments

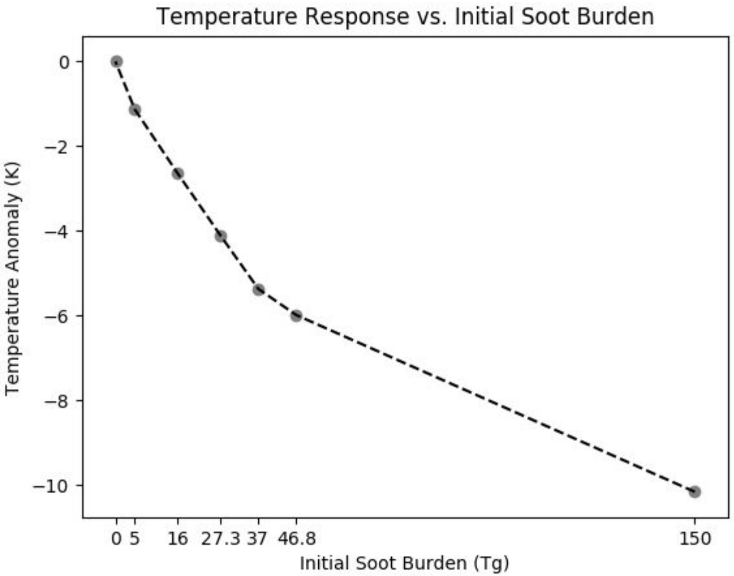
1. ATM - volcanic aerosol forcing but surface albedo of continents modified so they do not cool - simulates change in vertical temperature profile.
2. OCEAN - horizontal SST gradients are changed and atmosphere is allowed to respond
3. LAND - land surface albedo modification enforcing surface cooling
   a) LAND-T: tropical regions
   b) LAND-ET: extratropical regions
   c) LAND-AFRICA: Africa
   d)LAND-SEA: southeast Asia
   e) LAND-MC: maritime continent

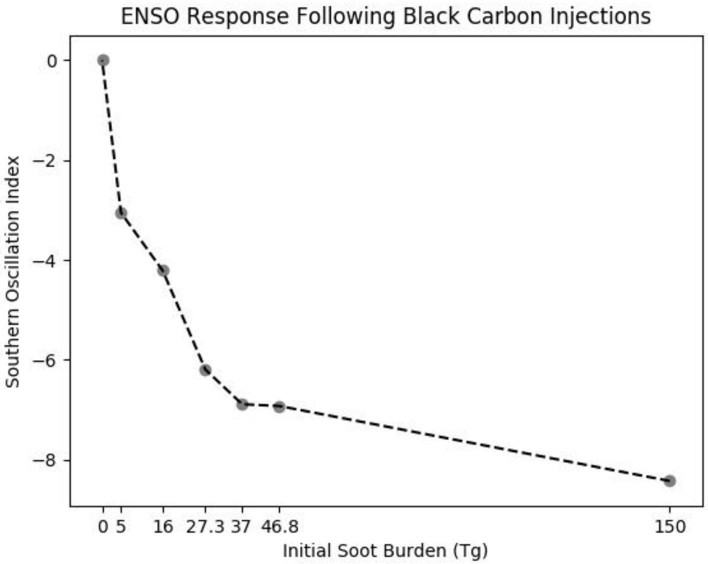
Khodri et al., 2017

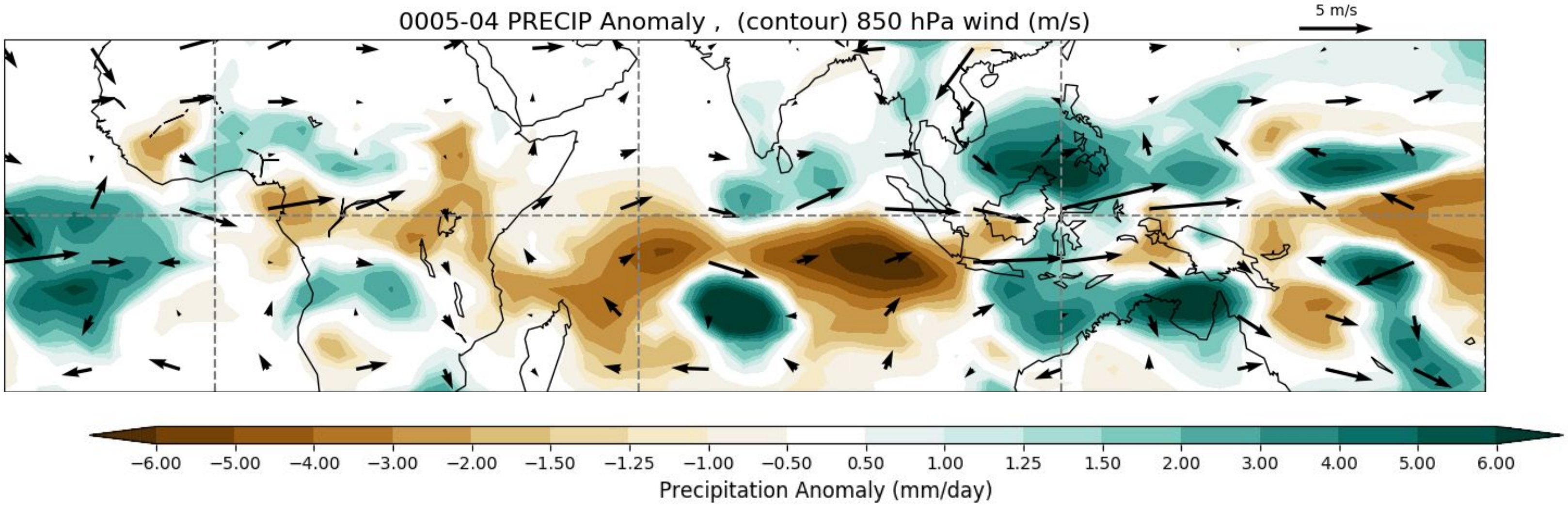


Initial soot vs Climate response

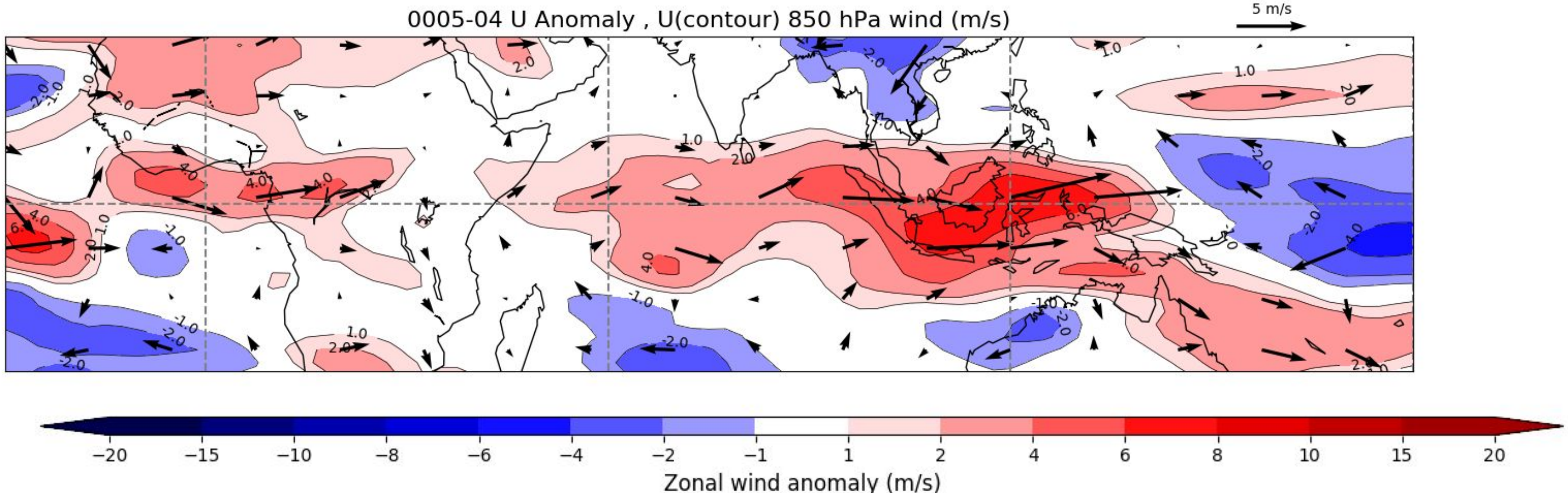
Temperature response vs initial soot burden and lowest SOI vs initial soot burden have similar relationships, good indication that ENSO response directly relate to cooling.



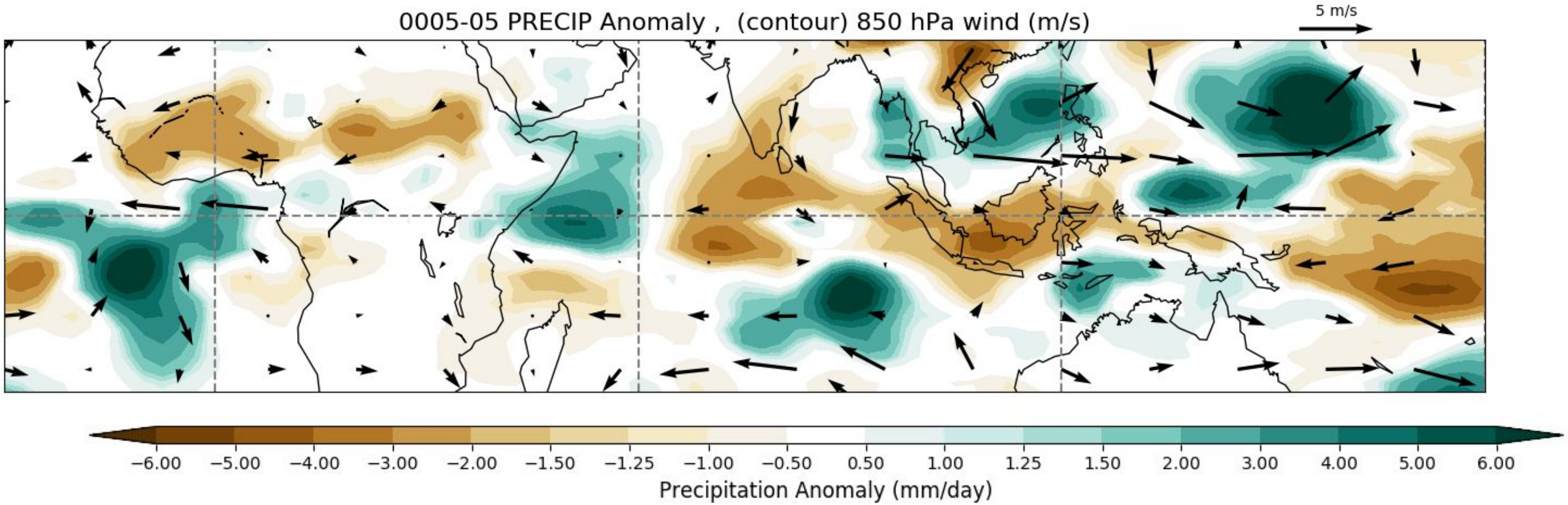




0005-04 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
−6.00 −5.00 −4.00 −3.00 −2.00 −1.50 −1.25 −1.00 −0.50 0.50 1.00 1.25 1.50 2.00 3.00 4.00 5.00 6.00
Precipitation Anomaly (mm/day)



0005-04 U Anomaly , U(contour) 850 hPa wind (m/s)
5 m/s
−20 −15 −10 −8 −6 −4 −2 −1 1 2 4 6 8 10 15 20
Zonal wind anomaly (m/s)


0005-05 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
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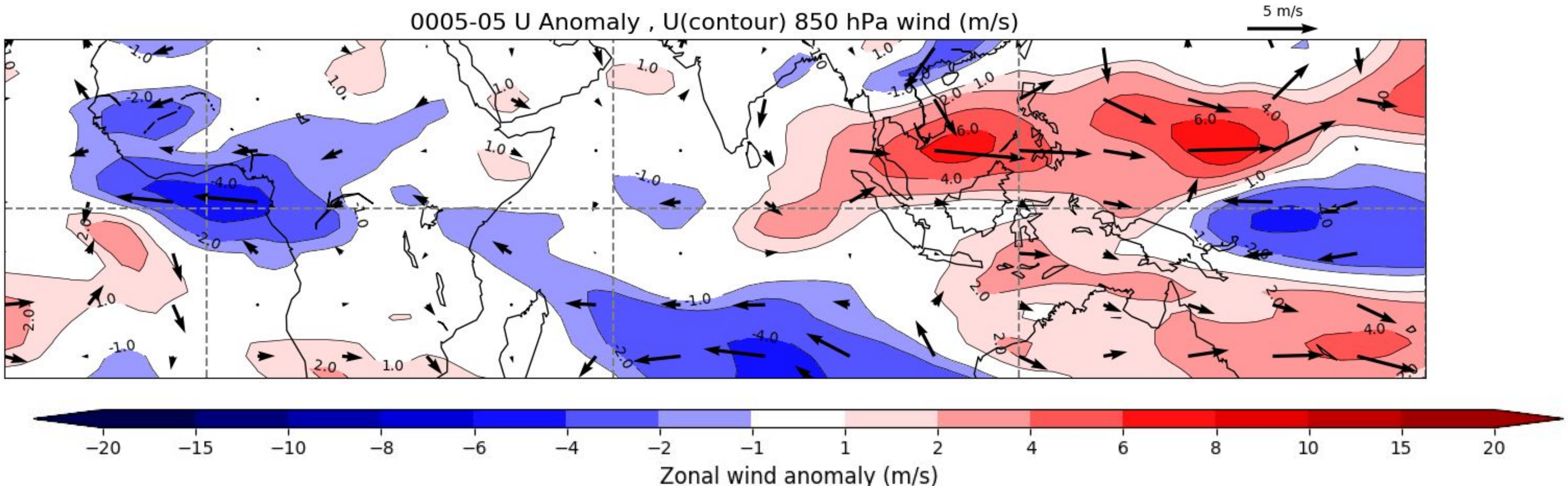
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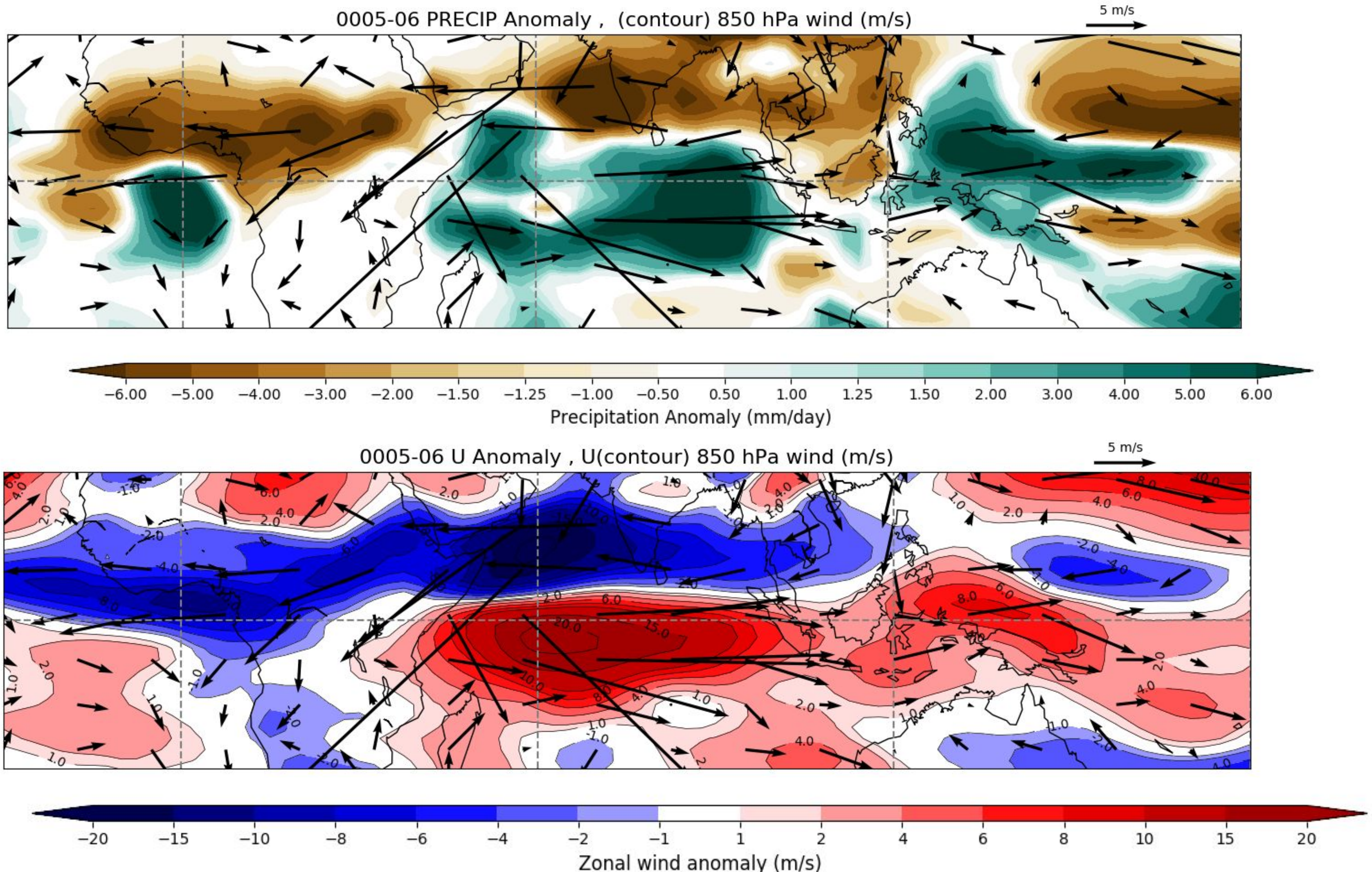
Zonal wind anomaly (m/s)


0005-06 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
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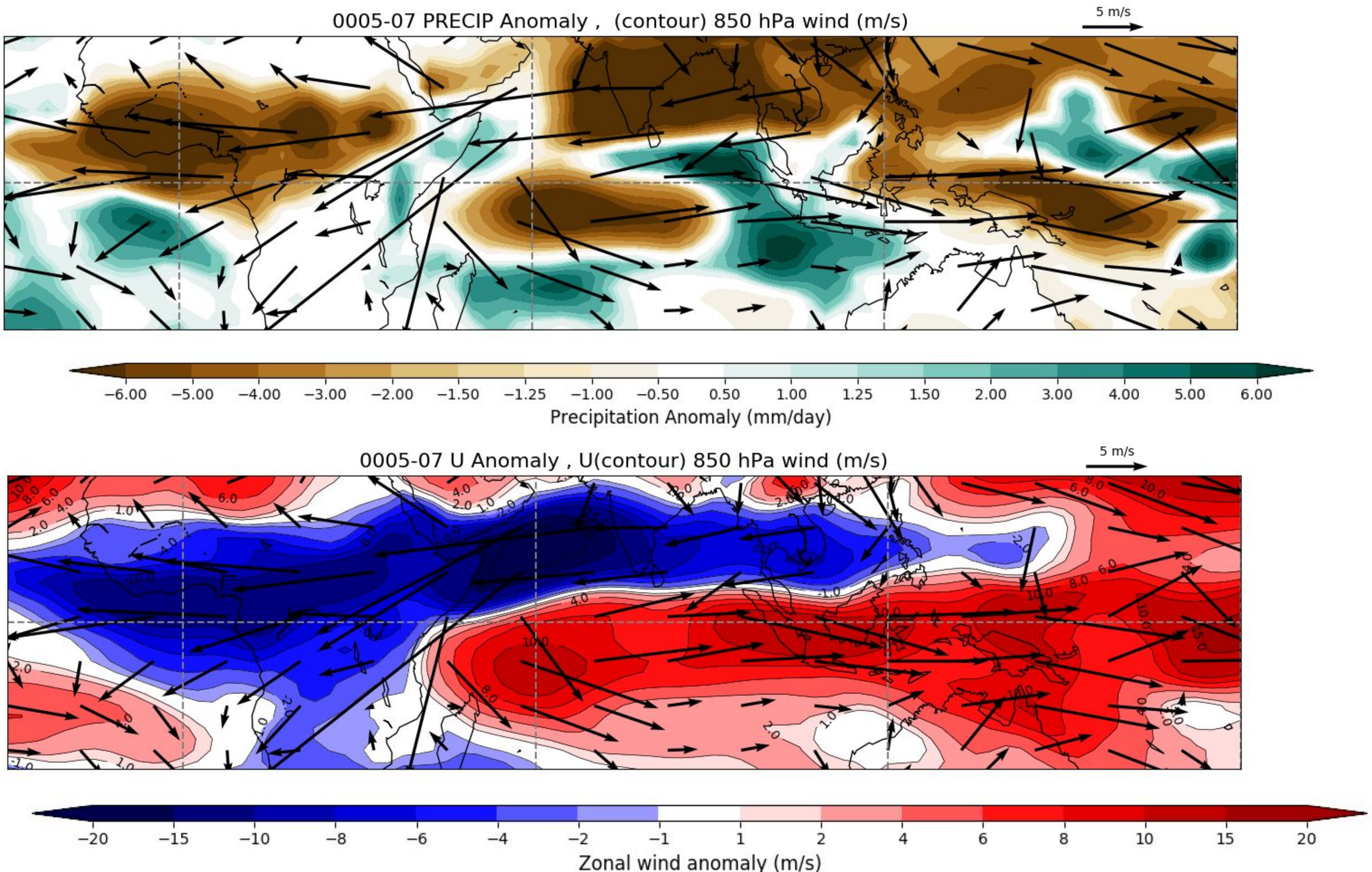
Precipitation Anomaly (mm/day)
0005-06 U Anomaly , U(contour) 850 hPa wind (m/s)
5 m/s
−20 −15 −10 −8 −6 −4 −2 −1 1 2 4 6 8 10 15 20
Zonal wind anomaly (m/s)


0005-07 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
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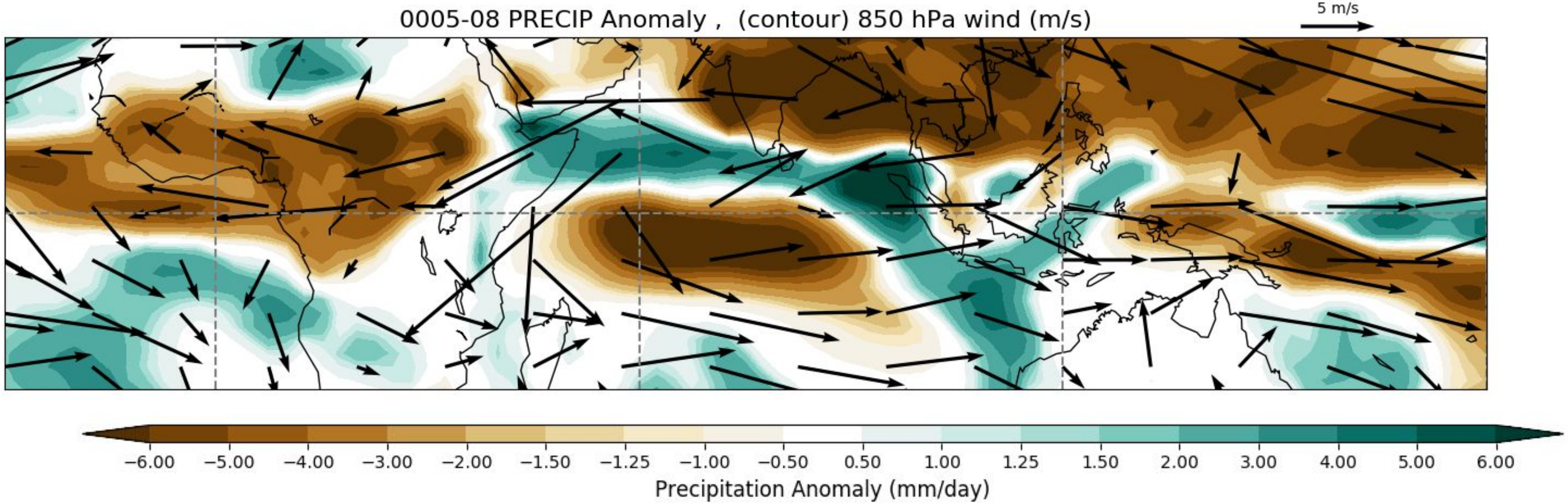
Precipitation Anomaly (mm/day)
0005-07 U Anomaly , U(contour) 850 hPa wind (m/s)
5 m/s
−20 −15 −10 −8 −6 −4 −2 −1 1 2 4 6 8 10 15 20
Zonal wind anomaly (m/s)


0005-08 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
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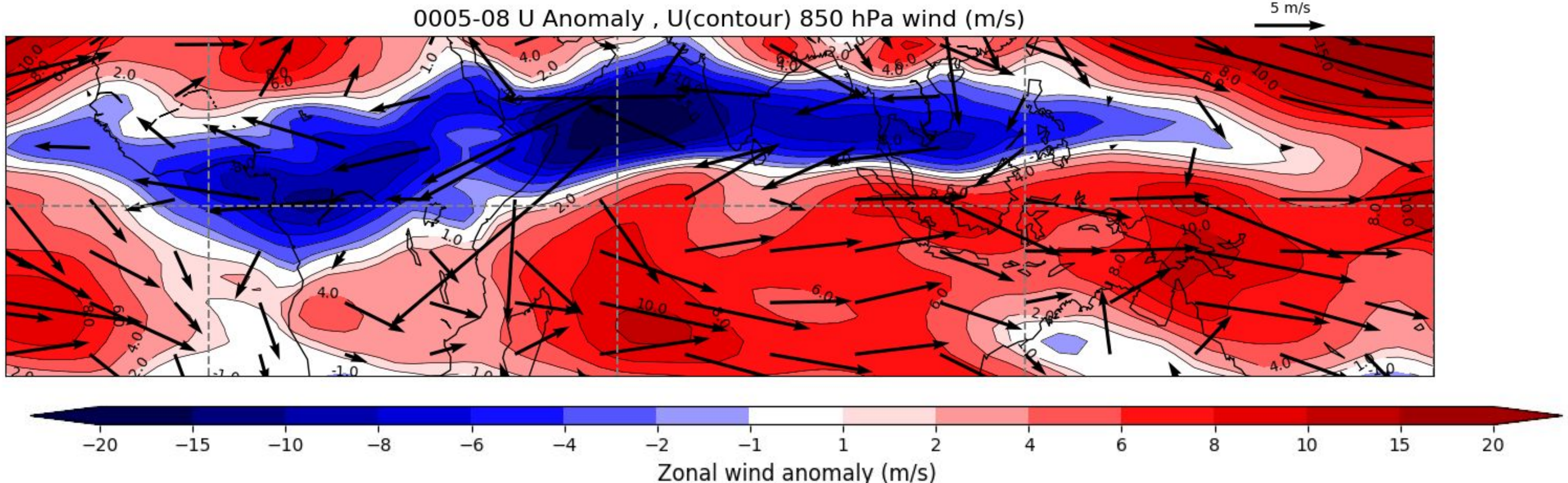
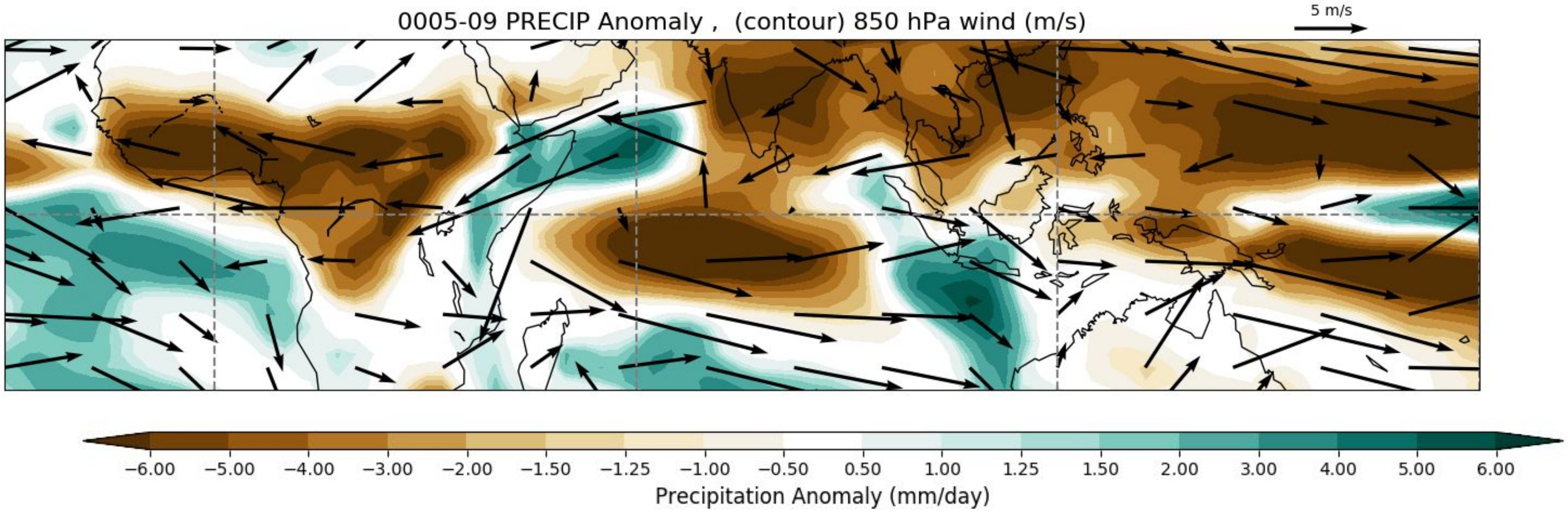
Precipitation Anomaly (mm/day)


0005-08 U Anomaly , U(contour) 850 hPa wind (m/s)
5 m/s
−20 −15 −10 −8 −6 −4 −2 −1 1 2 4 6 8 10 15 20
Zonal wind anomaly (m/s)


0005-09 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
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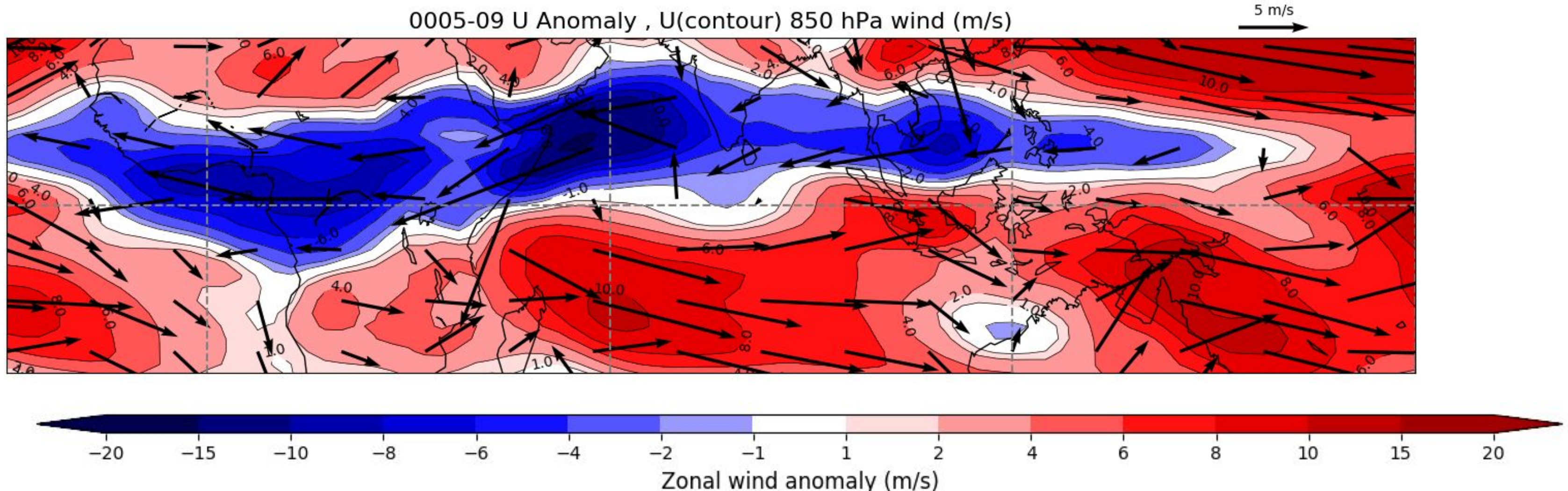
Precipitation Anomaly (mm/day)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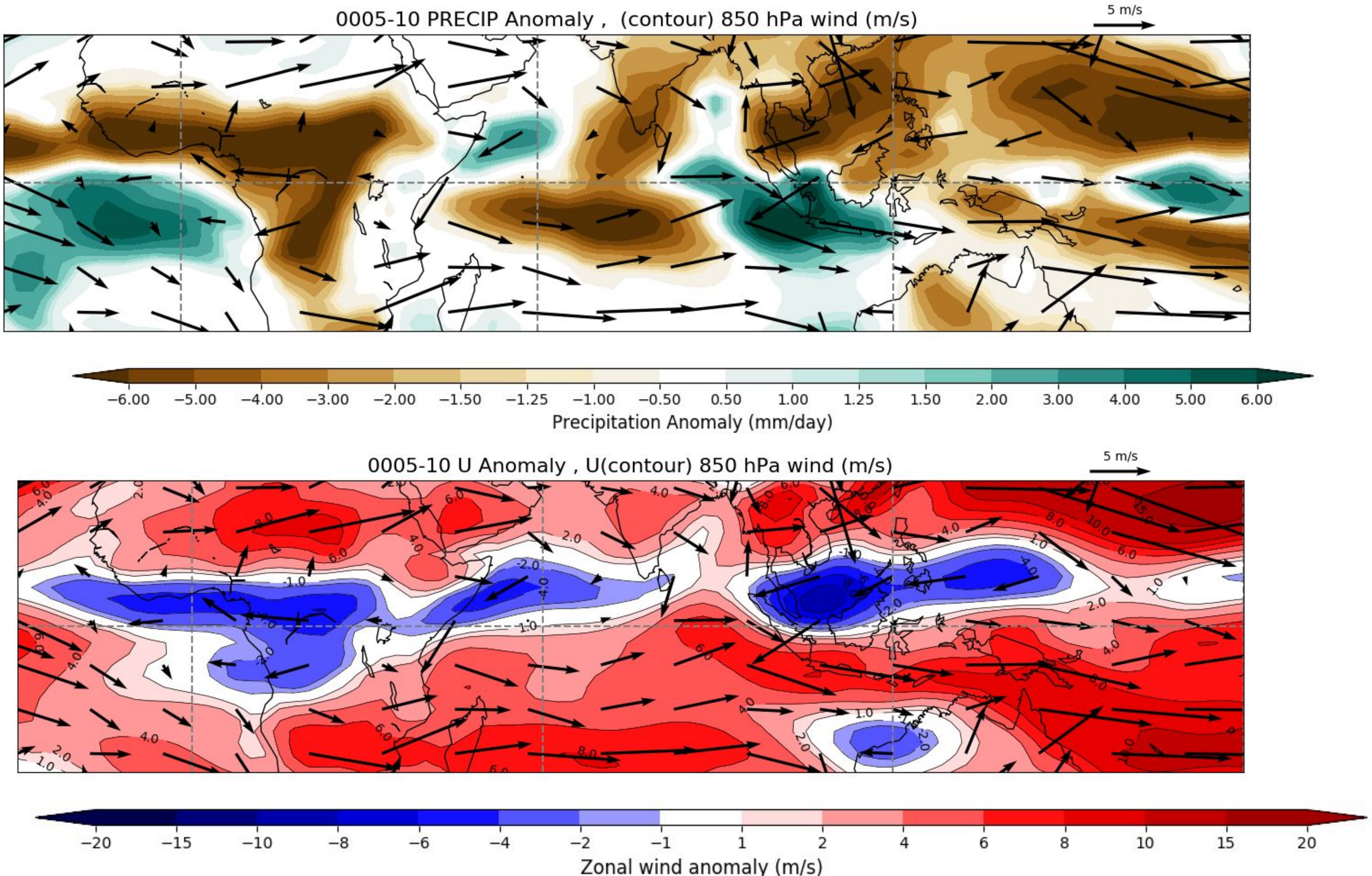
Zonal wind anomaly (m/s)


0005-10 PRECIP Anomaly , (contour) 850 hPa wind (m/s)
5 m/s
−6.00 −5.00 −4.00 −3.00 −2.00 −1.50 −1.25 −1.00 −0.50 0.50 1.00 1.25 1.50 2.00 3.00 4.00 5.00 6.00
Precipitation Anomaly (mm/day)
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Zonal wind anomaly (m/s)