

## ***Interactive comment on* “Teleconnection between Australian winter temperature and Indian summer monsoon rainfall” by S.-Y. Lee and T.-Y. Koh**

### **Anonymous Referee #1**

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Review of "Teleconnection between Australian winter temperature and Indian summer monsoon rainfall" by Lee and Koh

The authors propose a teleconnection mechanism that enhances Indian summer monsoon rainfall by moisture advection from the ocean west of Australia during extremely cold winter months. While the separate parts of the study appear scientifically valid, there is not sufficient evidence to support a substantial physical link in terms of moisture advection from the southern Indian ocean to West India. As detailed in the comments below, due to the essentially unsubstantiated claims, the study should not be published in its present form.

Main comments

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The authors argue that the ocean west of Australia is a "non-negligible source of water vapour for the Indian summer monsoon" (pg. 26428, l. 23). However, the study in fact remains fully qualitative in this respect. Back-trajectories are started at all times, irrespective of the amount of water vapour or precipitation that is advected with them. Of all these trajectories, only 3-10% actually end up in Australia. Even without considering the uncertainties involved in a 30-day backward trajectory calculation, it cannot be deduced from this finding that the Indian summer monsoon is modulated by such a small air mass contribution (NB not even a rainfall contribution).

A second issue is that the time scale of water transport needed to support the hypothesis brought forward by the authors is at odds with findings from the literature. Methods are available to estimate the evaporative sources of water vapour from backward trajectories, e.g. from considering specific humidity changes, interpreted as Evaporation-Precipitation (E-P) along air parcel trajectories (e.g. James et al., 2004, Sodemann and Stohl, 2009, and references therein). From these studies it is typically seen that moisture is transported over 2-10 days before precipitating, much shorter than the 17 days or more assumed in this study. Without further evidence, one has to conclude that the authors' mechanism only works when extending the life time of atmospheric moisture far beyond realistic values.

A further problematic issue is that only boundary-layer air from 850hPa and below is traced back in time. Due to the continuous turbulent mixing of this boundary layer air in the latitudes considered here the air mass of a trajectory will be diluted and over time more than once have been replaced by ambient air, including ambient water vapour. Thus, the mere existence of a potential transport path does not allow the conclusion that water vapour is materially conserved along this transport path. Again, this leaves no basis for arguing for a direct Australian-Indian teleconnection via the presented mechanism.

While the general thought of a southern hemisphere equivalent to the cold surges in the South China Sea is certainly attractive, the evidence presented in this manuscript

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argues for the opposite as claimed by the authors, namely that the proposed mechanism is unable to modulate the Indian monsoon. This does of course not preclude that another mechanism could cause such a teleconnection, e.g. through modulating both, the cold spells in Australia and some factors influencing the Indian summer monsoon, but it would have to be shown by further extending the study into that direction.

#### Detailed comments

In Fig. 1, it is argued for a moisture transport path as indicated by the arrows over the Arabian sea. Fig. 2 however shows a much more direct transport path from Australia to India, which basically points out that the mean flux and source-sink pattern shown in Fig. 1 is at least partially misleading. Also, it is not stated for which season this figure is representative. Furthermore, the quantity E-P, which presumably is plotted here, does not exclude that precipitation events can have occurred on a net evaporation area, and vice versa, at shorter time scales.

On pg. 26424, l. 10, the authors interpret time-lagged correlation between Australian temperature and TRMM rainfall over India. Are these correlations tested for significance, and at what level? It should be more clearly explained why the areas of much stronger positive and negative correlation on shorter lag times are ignored.

On pg. 26425, l. 10, the authors interpret the correlation between rainfall gauges and VCD in Australia shown in Fig. 2. The interpretation appears very much biased towards a desired outcome. 5 out of 7 West Indian stations are far in the North were as the authors argue the influence of Australian moisture should be small. The southernmost station where correlations should be strongest shows no significant correlation. This does not mean that the correlations have to be artifacts, but at least the proposed mechanism does not help to explain the observations.

#### References

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