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Interactive comment on "An interaction network perspective on the relation between patterns of sea surface temperature variability and global mean surface temperature" *by* A. Tantet and H. A. Dijkstra

Anonymous Referee #1

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Review of "An interaction network perspective on the relation between patterns of sea surface temperature variability and global mean surface temperature" by A. Tantet and H. A. Dijkstra

Recommendation: Accept with minor (but mandatory) revisions

Summary: This paper examines the connection of regional SST variations to interannual and decadal variability of the global

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ocean surface temperature (GOST), the global land surface temperature (GLST) and the global mean surface temperature (GMST). The authors use an Infomap community detection algorithm to find the patterns of connected SST variability. The main results of this study are, that on interannual timescales the GMST/GLST is highly correlated with SST variations of the ENSO community, and on decadal timescales with SST variations of the Indian Ocean-West Pacific (IWP) and North Atlantic (NA) communities.

Overall Opinion: This paper is well written and well organized and I found the focus on decadal variability of GMST and their relationship to the SST variations in the IWP and NA communities interesting. My major concern is that from this analysis one cannot conclude, that the SST in these two communities determines GMST/GLST variability. Even the arguments in the discussion part make it plausible that the SST over the IWP and NA could be the driver of GMST/GLST variations, it can't be excluded that GMST/GLST drive the SST over the IWP and NA or something else is the driver of both. This point should be clarified. Hence, I am suggesting that the paper should be accepted with minor (but mandatory) revisions.

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Minor Comments:

p744 l 13f: Please moderate your statement, as in my opinion you cannot conclude, that the Indian Ocean and North Atlantic determine most of the GMST variability. You only get a hint (for more details see comment p758 l3-10).

p745 l3ff: "The AMO is the dominant pattern of SST variability in the North Atlantic on decadal-to-multidecadal time scales (Enfield 2001)." This sentence should be placed in line 7 to have the ENSO and AMO sentences together

p748 l22: "We found that in the worst case the p-value of the 95

p749 l20: "First-neighbours map provide insight into the connections of all nodes in the network to a selected group of nodes." This sentence is hard to understand. Maybe better: "First-neighbours map provide insight into the connections of one particular node in the network to a selected group of nodes."

p751 l8ff: "The communities are ordered by the total PageRank of their nodes (Brin and Page, 1998), which corresponds to the steady state flow of random walkers through the nodes of the community. The larger the PageRank of a community the higher the probability of random walkers to travel through the community."

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What does this mean exactly? The explanation of PageRank is hard to understand. A more descriptive example would be desirable. Something like: "A PageRank of 50

p752 l10ff: "Such a community cannot be considered as a coherent physical pattern of variability so that, **in the context of our study**, it would be preferable not to associate nodes of weakly modular regions to any community or **to distribute them into several small communities**, and this is what the Infomap algorithm does." Why? Please explain! Also p753 l1: "which are not representative of any physical pattern variability." Are the small pattern representative of any physical pattern variability? I think as every statistical analysis method you also need in community analysis additional investigations to find out, if a community represents a physical pattern. Please clarify this in the text.

p755 l27f: "Hence, the community analysis allows to detect more detailed features of SST variability in the climate systems." As every statistical method has pros and cons I am sure that this is not always true. Please do not generalise. p756 l6f: "... to filter out the 2 to 7 yr band usually attributed to ENSO." 2 to 7 yr variability is not only ENSO. => "... to filter out the 2 to 7 yr band which is strongest influenced by ENSO."

p757 l1ff: "These results indicate that important components of decadal variability are present in the Indian Ocean–West Pacific region and the North Atlantic." Please explain why this is the case? Because of the higher PageRank? Then there would be also important components of decadal variability be present in the southern wind-driven gyres community, isn't it?

p758 l3-10: Figure 7 is quite important in this study, but additional information are necessary: How large are the regression coefficients? What does the "coefficients of multiple-determination" exactly mean? How do you calculate the time series of community 23 (Just the average over both time series or the average over all nodes of these two communities?)? And most important: From a strong correlation between the time series of the communities and GMST and GLST you cannot state that these two communities explain/determine most of the GMST and GLST variability. You cannot exclude that they are both driven by something else or that GMST/GLST variations drive the SST variations in these regions, as you discuss on p762 l3 – p763 l8. So please moderate your statement here.p758 l15: you should make clear that you do not analyse the ensemble mean.

p759 l13ff: Please explain why you use communities 13. And

again please moderate your statement, as you cannot exactly say who the driver is.

p759 l14f: "... and IWP communities, but misses the connection to the AMO as found in the observations (Table 4 and Fig. 10)." => "... and IWP communities (Fig.10), but misses the connection to the AMO as found in the observations (Table 4)."

p759 l18: "These model biases could be efficiently identified **thanks to** the network approach." Please be more neutral. e.g. "using the network approach."

p760 l17: "Finding communities in a network is a much more efficient way to reveal non-overlapping spatial patterns of variability of the global climate system than an EOF analysis." I think you cannot generalise this statement, as every statistical method has pros and cons.

p760 l26ff: "... with the second community (2) could also be associated with the first community which was also suggested by Guan and Nigam (2009)". => "... with the second community (AMO) could also be associated with the first community (ENSO) which was also suggested by Guan and Nigam (2009)". Makes it easier to follow.

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p761 l12ff: "In short, **thanks to** the community detection algorithm, ..." Again, please be more neutral.

Technical Corrections:

p745 l5: "Enfield (2001)" => "(Enfield 2001)"

p745 l7: "Trenberth (1997)" => "(Trenberth 1997)"

p745 l19: "Monahan et al. (2009)" => "(Monahan et al. 2009)"

p747 l4: "were then filtered via a Lanczos filter" => "were then low-pass filtered via a Lanczos filter"

p748 l11: Mudelsee (2010) => (Mudelsee 2010)

p748 l25: 2x "p values" => "p-values"

p750 l20: "Lancichinetti and Fortunato (2009)" => "(Lancichinetti and Fortunato 2009)"

p751 l22: "Thus" => "thus"

p751 l22f: "the modularity M is defined as (Newman and Girvan, 2004)" => "the modularity M is defined as in Newman and Girvan (2004):"

p753 l13 and l23: Figures 4 and 5 are mentioned before Fig.3. Please rearrange your figures.

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p755 l2: "Lau and Nath (1996)" => "(Lau and Nath 1996)"

p755 l7: "Guan and Nigam (2009)" => "(Guan and Nigam 2009)"

p756 l8: "p value" => "p-value"

p756 l15: "the degrees of the nodes" => "the degrees centrality of the nodes"; Otherwise it is hard to understand which degree you mean.

p757 l16: "networks" => "dataset"

p757 l25: "Indian Ocean–West Pacific community" => "Indian Ocean–West Pacific (IWP) community" And then l27: "Indian Ocean–West Pacific (IWP) community" => "IWP community"

p757 l27: "to the GOST with the Indian Ocean–West Pacific (IWP)" => "to the GOST, with the IWP"

p758 l21: "degree distribution" => "degree centrality distribution"

p760 l1: "Monahan et al. (2009)" => "(Monahan et al. 2009)"

p760 l13: "degree distribution" => "degree centrality distribution"

p762 l28: "is made difficult" => "is difficult"

p763 l10: "is too strong (compared to observations)" => "is too strong compared to observations"

p763 l12: "Most of the nodes of the network are orphans,..." =>
"Most of the extratropical nodes of the network are orphans,..."

Interactive comment on Earth Syst. Dynam. Discuss., 4, 743, 2013.