Response to the editor

We thank the anonymous reviewers and the editor for the positive response regarding our manuscript "Dominant patterns of interaction between the tropics and mid-latitudes in boreal summer: Causal relationships and the role of timescales" (wcd-2020-14).

We have revised the manuscript following all minor suggestions made by the second reviewer in his/her thorough review. Our point-by-point response is found below.

We thank the reviewers for finding the time to carefully and effectively reviewing the manuscript and the editor for her supportive role in the reviewing process.

Point-by-point response to Reviewer #2

1) L51, L279, L286: Change "the causal maps that plot" to "the causal maps show"
   We have changed the manuscript accordingly to the reviewer's suggestion.

   2) L57-58: "and therefore works towards improved sub-seasonal and climate projections". I think the authors wanted to say "sub-seasonal predictions and climate projections" as predictions and projections are two different types of climate simulations: the former one is the initial-value or initial and boundary value problem whereas the latter is the boundary-value problem. On the other hand, the sentence could be finished before "and therefore".
   We thank the anonymous reviewer for point out this missing word. We have changed the sentence to "This study paves the way for process-based validation of boreal summer teleconnections in (sub-)seasonal forecast models and climate models and therefore works towards improved sub-seasonal predictions and climate projections. " (lines 56-58).

   3) L247-248: "By repeating this step for each variable…" But also repeating this step for all lat and lon, isn't it? Or from which step the analysis should be repeated for each lon and lat, please specify this more clearly.
   We have clarified this sentence: "By repeating this step for each variable (and for each longitude and latitude position), preliminary sets of parents are estimated." (lines 247).

   4) L262: Eta should be also explained for completeness of the description.

   We have added the definition of eta in the manuscript:
   Finally, we estimate the Causal Effect Network (CEN) (Kretschmer et al., 2016; Runge et al., 2015a) among A, B and C(lat,lon) by applying standardized multiple regression of each actor onto its causal parents identified via PCMCI, i.e., for Y ∈ in A_t, B_t, $C(lat,lon)_t$ and the parents P:

   $$Y_t = \sum_i \beta_i X_i + \eta_Y \qquad\qquad (13)$$

   where $X_i \in P\{Y\}$, i = 1, .., N, i.e. the set of N parents of Y_t and η_Y is the residual of Y_t (i.e. the difference between the observed value Y_t and the value obtained by the linear regression on the causal parents $\sum_i \beta_i X_i$).

   5) L310: Should be "Figure 2a-d show"
   We have corrected this expression following the reviewers suggestion (line 312).

6) L536-541 is one sentence, which is too long and difficult to follow.
We have spitted the sentence in two to improve its readability: "Two pairs of co-varying patterns are identified: a) convective activity of the South Asian monsoon (SAM) paired with a mid-latitude wavenumber-5 wave train resembling the circumglobal teleconnection (CGT) pattern and b) convective activity of the western North Pacific summer monsoon (WNPSM) paired with a second wave-5 circumglobal wave pattern with its strongest action centre represented by the North Pacific High (NPH). This second mid-latitude wave pattern is phase shifted with respect to the CGT pattern, to the longitudinal position of WNPSM monsoonal convection in the tropics." (lines 537-543).

7) L546: " ... dominate" what?
We have changed the sentence to "At longer timescales (from monthly to seasonal) slowly varying components such as tropical SST and associated regions of convective activity dominate tropical – mid-latitude interactions." (lines 547-549).

8) L604: Did authors wanted to say "it is still significant"?
We have corrected this sentence following the anonymous reviewer's suggestion (line 607).

9) L604: "stronger causal effect": stronger than what?
We have clarified this sentence: "During La Niña summers, SAM exerts a stronger causal effect on the Tibetan High than over the entire 1979-2018 period, ..." (line 607-608).

10) L641: "CEN provide an encoded predictive model" Please be more specific, it reads a bit strange. One could say it provides a statistical model but it feels that the authors somehow avoid using this term.
Indeed CEN provides a statistical predictive model, we have added this term in the sentence (line 644).

11) L644: "path coefficient β ~ 0.4, thus indicating potential for predictability." Doesn't it mean that in terms of the variance explained SAM explains about 16 % of the CGT variability? Thus, the statement is a bit too bold.
We agree with the reviewer and we have modified the sentence, which now reads "Our analysis shows that at 4-weekly timescale, the effect of SAM on the CGT pattern has a path coefficient β ~ 0.4, thus indicating some potential for predictability." (lines 646-648).

12) L645: Further or future studies instead of "Further work"
Following the reviewer's suggestion, we have changed "further work" to "future studies" (line 645).

13) Figure2 caption: timescaletimescale typo
We thank the anonymous reviewer for his/her careful read. We have corrected these typos in the revised version of the paper.