

Point-by-Point Answer of the reviewer's comment of the thesis

(No: CL7373, Name: Dhana Lakshmi Douluri, Roll No: 16CL91R04)

Foreign Reviewer (outside India)

General Comment: While I recognize each Chapter especially Chapters 2, 4, and 6 is well written and very informative, I have several concerns below to be recognizes as a thesis paper.

Answer: Thank you for the complement. The suggestions provided by you are incorporated in the revised thesis and explanations are provided here.

Comment 1: Insufficient review of previous works especially for AR definition and detection method. Although the author mentioned about AR definition a little bit, it is insufficient. For example, Ralph et al. 2018, BAMS mentioned the details referring similar phenomena. So, it is better to refer their work. Also, I was surprised not to find any description about ARTMIP Atmospheric River Tracking Method Intercomparison Project, <http://www.cgd.ucar.edu/projectsartmip>, which discusses about detection tracking methodology to clarify AR studies. To recognize where this thesis paper stands comparing to past current AR studies knowledge, these points should be noted in introduction.

Answer 1: Thank you for the suggestions. As per the suggestions I have added the following points in page number 2.

Regarding the AR definition, the following information in the introduction section is added in the revised thesis: *“In the present study we followed the criteria to define AR in recent studies over the other regions in the world and over Indian region (Laver et al., 2012; Ramos et al., 2016; Thapa et al., 2017; Yang et al., 2018 and Liang and Yong, 2020). The details are given appropriately in each chapter”*.

Regarding the ARTMIP, the following information in the introduction is added: *“The Atmospheric River Tracking Method Intercomparison Project (ARTMIP) is an ongoing, international effort that aims to quantify the uncertainties based on the way ARs are identified, which is vital for diagnosing expectations of their hazards. Currently a variety of AR detection algorithms exist, which have often been developed to suit specific application scenarios and in that regard are best viewed as complementary to one another. AR detection in the present thesis initially based on the global algorithm given by Guan and Waliser 2015*

(<http://www.cgd.ucar.edu/projects/artmip/algorithms.html>; algorithm A3 in ARTMIP list) in Chapter 2. Over 90% agreement in detected landfall dates was found between the global algorithm and the regional IVT algorithm focusing on West and East Coast of Indian region. Further, the algorithm approaches of A18 (Lavers et al., 2012) and A9 (Ramos et al., 2016) from the listed ARTMIP algorithms were used in developing the regional-specific IVT thresholds for the landfalling AR identification (Chapters 3 and 4) in this study”.

Comment 2: Many typos and grammatical errors are found.

Answer 2: Thanks for the comment. The typos and grammatical errors are corrected in the revised thesis with utmost care.

Comment 3: References should be listed as alphabetically. Thesis paper should be prepared in a proper style.

Answer 3: Thanks for the comment. The alphabetical order of references was checked and modified in the revised thesis.

Comment 4: Although the author provide a list of abbreviation in Page Vii, their full name should appear in their first appearance in the text. Note that the current list contains typos. No explanation about NCEP. SOI should be Southern Oscillation Index.

Answer 4: Thank you to point out the mistake. List of abbreviations in Page Vii has been modified and corrected in the revised thesis.

Comment 5: Structures of Chapters and their relation. While I understand Chapters 2 4 are taken from the authors published works. How about Chapters 5 and 6. If yes, or they submitted or under review, it should be noted in Introduction. Otherwise, I wonder why the author repeats the same description in Introduction. Otherwise, I wonder why the author repeats the same description in Introduction, as if they appear the first time. Also, it is better to describe in Introduction about each chapter’s relation clearly.

Answer 5: Thank you for the suggestion. Chapters 5 is under review in the Journal of Dynamics of Atmospheres and Oceans and Chapter 6 was submitted to the Journal of Atmospheric research. This was now indicated in the thesis organization section in the introduction of the revised thesis.

Other Specific (minor) Comments.

Comment: Chapter 2: P. 14, L. 7; “1993; 1993a” should be “1993a; 1993b” or “1993, b.”

Reply: Comment has been implemented in the revised thesis.

Comment: P. 15, L. 5, 12; “Pai et al., 2014” should be “Pai et al., 2014a” (Note. If the same authors published several papers in the same year, its first paper should be noted with “a”).

Reply: Thank you to point out the mistake. The comment has been implemented in the revised thesis.

Comment: P. 17, L. 17; “for ex.” Should be “e.g.”

Reply: Comment has been implemented.

Comment: P. 21, L. 13 and others; “Ashok and Shaji” should be “Ashok and Saji”. This typo can be found several times.

Reply: Comment has been implemented.

Comment: Chapter 3: P. 51, 2nd paragraph; In this Chapter, the author use not AR but SMT, and mentioned here about wording. However, though the entire document of this thesis paper, the author basically uses ARs. Could you explain about their difference clearly? Actually, it is okay to put this either in Chapter 3 or in Chapter 1 (Introduction).

Reply: Consideration of strong moisture transport was a large debate in several workshop meetings across the glob. Though, the main outcome of all these debates in different meetings was the clear preference to retain the extra tropical dynamics connection in the definition as finally occurs: http://glossary.ametsoc.org/wiki/Atmospheric_river, increasing frequency of studies over the Asian region emphasizes the term AR in the present study of Indian region. Supporting references in this regard asserting the usage of AR term over Indian region: Thapa et al., 2017; Yang et al., 2018; Liang and Yong, 2020; Guan et al., 2020; Guo et al., 2020. (Since the reviewer of the Chapter 3 paper published in JASTP recommended the term SMT which is the analogue of AR over the study region we considered the same in Chapter 3). As per your suggestion, in the Chapter 3 with the above explanation in the revised thesis has been added.

Comment: Chapter 4: Section 4.3 is entitled as “Results and Discussions,” however, it seems only the description after P. 138, L. 7 are the main discussion points (as the author’s original published work did). At least, description after this line does not

argue about sub-section 4.3.10. Note that P. 140, L. 15 (Fig. 4.21 (c) & (d)) is typo. Correct one is Fig. 18, which is discussed in sub-section 4.3.8. Thus, it should be separated there as Discussion section.

Reply: Thank you for your comment. It has been implemented and correction is made in the revised thesis.

Comment: Chapter 5: The author uses Case-1, 2, and 3 for three events. However, the term “case” is already used to indicate eight cases in Table 8. So, to avoid any confusion, it should use other words like Cae-A, B, and C.

Reply: Thank you for the comment. It has been implemented in the revised thesis.

Comment: Page 153, L. 9; it should be clearly noted that the authors studies all 8 cases (19 events), but here the results of three cases are shown.

Reply: Thank you for the suggestion. The comment has been implemented.

Comment: I thought the results of Chapter 5 can be confirmed from Chapter 6, as the latter also shows WRF fidelity. So, it is better to note the difference at the end.

Reply: Thank you for the suggestion. The comment has been implemented in the revised thesis.

Comment: Chapter 6: Typos. In Page 190, both “microphysical” and “microphysics parameterization” are abbreviated as MP. In addition, both “CP” and “CU” are used for the same meaning. Use one.

Reply: Thank you for the suggestion. The comment has been implemented in the revised thesis.

Indian Reviewer (inside India)

General Comment: This study can be improved by incorporating additional global and regional parameters for teleconnection study and also by using various observed high resolution data products like satellite, radar etc. to improve the model performance. Here, WRF-ARW model was run only for one member, ensemble run can provide more reliable results. The use of high resolution initial and boundary conditions for WRF model are also recommended to run at high resolution (at 1 to 3 km). **All these suggestions are for future work. At Ph.D. level sufficient work has been done.**

Answer: We thank the reviewer for the comments. This has been incorporated in the revised thesis as future scope of work.