

## Responses to Referee #2

We thank the Reviewer very much for the helpful and constructive review of our paper. We have addressed all the proposed suggestions and comments in our revised manuscript. Our responses to the individual comments are outlined below.

### General comments

This contribution is based on the broadly accepted principle that “understanding how farmers perceive changes in climate and what factors shape their adaptive behavior is desirable for adaptation research”.

The originality of the paper resides mostly on the chosen case study. In fact, as stated in the paper “Despite internationally extensive research on agriculture adaptation to climate change, a little work is done so far in South Asia. Similarly in Pakistan, the scope of research on linking climate change to agriculture is very restricted.”

Findings from the modeling procedure are robust and support the results and discussion sessions.

The following scheme resumes the main elements presented in this work:

Dataset: Farm household data of 450 households from three districts in Punjab province of Pakistan

Climate challenges: Rising temperatures Floods Droughts Yield losses

Aims: Examine how: farmers perceive climate change farmers adapt their farming accordingly

Results from dataset analysis: 58% of the farm households adapted their farming to climate change

Most common adaptive strategies: Changing crop varieties changing planting dates Plantation of trees changing fertilizer

Factors improving adaptive capacity Education Farm experience Household size Land area Tenancy status Ownership of tube-well Access to market information on weather forecasting Extension

Factors hampering adaptive capacity Lack of information Lack of money Resource constraint Shortage of irrigation water

Method Binary logistic model

Identified policy shortfalls Ineffective climate policy V. low technological, financial capacity in adapting to climate change

Policy-making suggestions Greater investment in farmer education Improved institutional setup for climate change adaptation \_\_\_\_\_

**Answer:** We thank you for your valuable positive comments and review of our manuscript.

### **Specific comments**

Pages/lines: comment

**1363-1371:** There are overlaps between sections 2 and 3 in that both of them present methodological aspects. Section 2 presents methodological aspects related to modeling. Section 3 presents methodological aspects related to sampling and data collection as well as description of the study area. These two sections could be restructured as follow: 3.2 could be integrated in the introduction, becoming e.g. 1.2 2 and 3 could be merged as 2, where: 3.1 becomes 2.1 2.1 to 2.5 follow accordingly 4 becomes 3 and so forth

**Answer:** We thank you for your suggestion. We merged section 2 and 3 as suggested. Instead of shifting section 3.2 to 1, we put it in the start of section 2 as 2.1 and other sections were changed accordingly. This was done to separate the methodology part from the introduction part.

**1370/1:** The presence of table 2 here suggests that an arrangement similar to that proposed above has previously been considered.

**Answer:** Now sections have been rearranged and we put section 3.1 and 3.2 at the beginning of section 2.

**1363/23:** Adaptation is a term with a very long trajectory of use across disciplines. Here you should specify the field/domain to which you are referring before stating “Adaptation is a way to avoid losses due to increasing temperature and decreasing precipitation (Hassan and Nhemachena, 2008).”

**Answer:** We revised the definition as suggested.

**1364/4-7:** Economical and risk factors are the only ones considered to affect household adaptive choices in the present model: “we assume that farm households will choose to adopt certain adaptation measure only if they perceive reduction in risks to crop production and increase in net farm benefits associated with adoption of a particular measure”. No cultural traits are considered to affect household choices in the present study. This is fine as long as it is clearly stated, or otherwise taken into account (i.e. by introducing uncertainty in the decision making process), and perhaps shortly justified.

**Answer:** We have included district dummies which not only incorporate the agro-ecological zones but they may also consider cultural traits which are different in all three regions. We included little description in section 2.3 line 1366/6.

**1400/Figure 3:** It may be useful to add a figure here presenting actual (measured) changes in summer/winter temperature and precipitation over a given time (which should correspond to the estimated time of meteorological/climatic memory applied in this study, i.e. c. 10/20 years according to 1371/20)

**Answer:** Thank you for your suggestion. We will consider to add a figure according to your suggestions.

**1373/10-14:** It is unclear whether or not this statement is based on answers from the interviews. In this sense, it would be useful to have a table/image presenting a sample of the questionnaire used for interviews.

**Answer:** This statement is not based on the answers from the interviews instead it is based on literature and constraints faced by farmers shown in fig. 6.

**1373/18-20:** Idem

**Answer:** This assumption was based on the fact described earlier in section 3.2 line 1371/10 that Gujrat district is mainly rain-fed and dependent on rainfall or groundwater for farming activities.

**1377/20:** “schooling of the household head” is a powerful explanation factor in this model. In the introduction you could perhaps briefly introduce how households are organized in the region/districts of study: e.g. average number of members, composition, structure, “head”, internal hierarchies relative to decision-making, : : :

**Answer:** The household structure is briefly described in section 2.3. Particularly,

*“The average household’s characteristics which play an important role in shaping the decision making process in climate change adaptation vary to some extent in all three regions. For example according to our study, the average land holding size (in acres) varies to some extent in district Rahim Yar Khan (18), Toba Tek Singh (14) and Gujrat. A little variation is also found in average household size (9-10) and years of schooling (8-9) in all three districts. In terms of agriculture as the main source of income, all three regional districts Rahim Yar Khan (85%), Toba Tek Singh (79%) and Gujrat are different”*

**1378/6:** it is difficult to imagine a 1% increase in household, unless households are made of 100+ members. It may be more useful to present these data in terms of increase in members, e.g. “an increase in one member of the average household: : :”.

**Answer:** Thank you for your suggestion. We revised the description according to your suggestion.

**1379/14:** Information nowadays is mostly passed via mobile telecommunications (phones and internet services). Would perhaps “Access to telecommunication technologies” be a more robust indicator of access to information than proximity to market.

**Answer:** We used this indicator based on literature and local settings. Access to telecommunication technologies is also an important factor to include. But we did not use this indicator directly because we already have indicators of access to marketing services and access to weather forecasting information which may serve the purpose of access to telecommunication technologies. Mainly farmers get the weather forecasting information from telecommunication sources (mobile phones, television, radio or internet) as we learned from our survey.

**1379/24-25:** Within the same sentence, changing crop type is said to be positively and negatively correlated to access to farm credit

**Answer:** Thank you for your comment. It was a typing mistake. We wrongly put the changing crop variety instead of changing crop type in the start of sentence. It was only the changing crop variety which is positively correlated to access to farm credit. We have also corrected the mistake in text.

**1380/10:** conclusive sentence is missing in this section (4.5.10)

**Answer:** We added a conclusive sentence in the section 4.5.10.

**1381/17:** idem

**Answer:** We added a conclusive sentence in the section 4.5.10.

**1383/4:** Clarity of the conclusions may perhaps be improved by some rephrasing and the presentation of the main findings of the study as bullet points

**Answer:** thank you very much for your valuable suggestion. We have improved conclusion of the study as per your suggestions.

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### **Technical corrections (TC)**

**TC1:** Although I have tried to address some of the typos and grammatical issues in the text, a further revision/editing by a native English speaker would help clarify some passages in the manuscript (specifically in Sections 1, 4 and 5).

**Answer:** We thank you for the technical corrections and suggestions. We implemented all the technical corrections and suggestions for improvements in the updated version of manuscript.

**TC2:** Numbering of tables and figures should be revised as tables and figures in the text are not always introduced progressively. E.g.: Table 1 is introduced at p. 1366, followed by Table 3 at p. 1367 Figure 1 is followed by figure 3 at p. 1368.

**Answer:** Thank you for the valuable suggestion. We revised the numbering as suggested.

### **Pages/lines: comment**

**TC3: 1361/2:** delete space in “food- insecure”

**TC4: 1362/17:** perceive rather than perceived

**TC5: 1362/21:** delete “a” before “little”

**TC6: 1362/22:** delete “on” before “linking”

**TC7: 1363/5-7:** for clarity formulate the two questions separately

**TC8: 1363/10:** add “are” before “already”

**TC9: 1363/20:** “Sect.” should be “Section”

**TC10: 1363/20:** change to “We conclude presenting: : :”

**TC11: 1364/21-22:** in two instances “his or her” should be “its” (i.e. for household)

**TC12: 1366/23:** “measure” should be “measures”

**TC13: 1368/26:** revise unclear sentence “even: : :stage”

**TC14: 1372/25:** add “some form of climatic risk” after “perceived”

**TC15: 1372/27:** delete “the next”, write “Sec-tion”

**TC16: 1373/2:** delete “long-term”

**TC17: 1373/3:** delete “by them”

**TC18: 1373/6:** rewrite as “: : , the most common adaptation measures: : :”

**TC19: 1373/7:** delete “the”

**TC20: 1373/6 and 17:** add “.” after “were”

**TC21: 1373/19:** add “be” after “may”

**TC22: 1373/24:** “used” instead of “use”

**TC23: 1374/5:** delete “the”

**TC24: 1374/17-18:** “interest” is used in the same sentence in two instances with different meanings making the message unclear

**TC25: 1374/25:** “,” should be “,”

**TC26: 1375/3:** “Section”

**TC27: 1375/5:** “theses” should be “these”

**TC28: 1375/6-8:** unclear sentence needs reformulating “Hence, we assume that perceptions, intentions to adapt and adaptation to climate change differ both in term of extent and decision to choose different adaptation measures.

**TC29: 1375/12:** “term” should be “terms”

**TC30: 1375/19:** change as follows: “schooling were more likely (44.2%) to perceive changes in climate over the past 10-20 years than farmers: : :”

**TC31: 1376/4:** idem

**TC32: 1375/25:** “had” instead of “are having”

**TC33: 1376/15-71:** modify as follows “In summary, the higher the level or education and farming experience for a given household, the higher its probability of adaptation to climate change.

**TC34: 1402/Figure 5:** in the legend “total” should be “average” or “mean”

**TC35: 1377/7:** change to “in years of experience”

**TC36: 1377/10:** Begin sentence as follows “Results from this study are in accordance with those from: : :”

**TC37: 1378/2:** use “more” instead of “higher”

**TC38: 1378/13:** use “held’ instead of “holds”

**TC39: 1378/22:** use “This” instead of “As”

**TC40: 1381/15:** use “farmers”

**TC41: 1382/8:** delete “one exception”

**TC42: 1382/14:** unclear sentence “: : :both for Rahim Yar Khan respectively which indicates: : :”

**TC43: 1382/18:** these two sentences should be merged, separated by a “,”: “: : :Rahim Yar Khan. While the lowest elasticity: : :”

**TC44: 1383/7:** what do you mean by “less uncertain rains”? perhaps “less predictable precipitation patterns”

**T45: 1383/7:** per-haps you should rephrase “Being mostly rain-fed, agriculture in Pakistan is

most likely to be affected by ongoing climate change”

**T46: 1384/10:** use “by” instead of “with”

**T47: 1384/13:** I am not sure about the choice to use “improvement” here rather than “betterment”. (“Betterment, making better, is a general term used particularly in connection with the increased value given to real property by causes for which a tenant or the public, but not the owner, is responsible”. Wikipedia)

**Answer for TC2-TC47:** All the above mentioned technical corrections (TC2-TC47) were implemented in the revised version of manuscript.

Thank you again for the helpful comments. – Authors.