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## ***Interactive comment on “Climate impacts research: beyond patchwork” by V. Huber et al.***

**V. Huber et al.**

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REFeree 1: General: The manuscript provides a brief review of previous research to quantify the impacts of climate change, and describes the specific contributions of the ISI-MIP project, including how the design of the framework addresses specific challenges in modeling impacts, adaptation, and vulnerability. Overall the manuscript represents a contribution to the climate change science literature, in particular with regards to the review of existing multi-sector analyses, and the descriptions of how the ISI-MIP frame-work is providing insights regarding the relative importance of uncertainties related to structure and design of models and other uncertainty sources that are more commonly explored in the literature. I believe that the theme and content of the manuscript are appropriate regarding the scope of the Journal, and therefore potentially suitable for publication following major revision.

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Specific: Page 723, lines 24-26: It is worth clarifying that a “comprehensive assessment” of climate change impacts would be the ideal type of information to inform mitigation decisions, but that analyses which are less than comprehensive (yet still containing a rich set of information) can be policy relevant. Given the large gaps which still exist in the science community’s ability to produce such a comprehensive assessment, this paper should not suggest that effective policies cannot be designed without this ideal level of information.

AUTHORS: We agree with the referee that adequate mitigation decisions can be based on analyses that are less than comprehensive. We have chosen a more careful wording in the revised version of the manuscript (ll. 45-50) to avoid any misunderstandings.

REFeree 1: Page 724, lines 12-16: “Assessing the vulnerability of human and natural systems to climate change is not possible without accounting for the interactive effects of ...” Again, this wording seems to strong here, and suggests a situation of the perfect being the enemy of the good. One could argue that some climate change impacts can be reasonably modeled in isolation, such as impacts on individual animal species, to tell policy-relevant stories. Other sectors obviously deserve attention to integration, and perhaps more importantly, connectivity on key inputs/assumptions.

AUTHORS: We have changed the wording in the revised version of the manuscript (supplement: ll. 58-64), expressing that accounting for interactive effects is highly desirable but that studies investigating specific climate impacts in isolation are of course also valuable.

REFeree 1: Section 2: The review of existing model-based assessments is a worthwhile endeavor, and if improved will provide a useful set of information to the research community. However the current draft mischaracterizes some of the projects, and care should be taken to appropriately represent what others are doing in the field.

One issue that should be clarified at the start of the section is that the review is based on the description of modeling projects as described in the papers which have been

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published on the efforts. But due to the delays in the publication process, which creates a gap or delay between reported and actual project status, and because these papers may not reflect the totality of any one project (as some papers just focus on one aspect or sector of the broader project), there is a risk that the information presented in this review is not complete.

**AUTHORS:** We think that most readers will be aware of this shortcoming, which is relevant to any literature review. Nevertheless, in order to appreciate the many ongoing integrative efforts in climate impacts research that are not yet reflected in publications we explicitly mention the inevitable incompleteness of information in the revised version of the manuscript (supplement: Il. 139-140).

**REFeree 1:** Another issue is that the categories of model-based assessments developed by the authors do not provide for clean fits for some of the efforts. For example: The CIRA project does not fit perfectly in section 2.1 (several sectors, one model) for the following reasons: 1) over 20 different partial equilibrium, bottom-up models are used to estimate impacts; 2) some sectors have multiple models to analyze structural uncertainties (e.g., three electric power system models, three agricultural yield models) – although inter-model comparison is clearly not a focus of CIRA to the extent of ISI-MIP; and 3) there is integration, or at least linkages, across some sectors (e.g., agriculture, water, energy). As the lines separating the categories established by the authors appear to become blurred

**AUTHORS:** Indeed, some of the mentioned projects would fit into several of the established categories. Nevertheless, we think that the proposed categories (i.e., the impacts integration matrix; Fig. 1) are a useful tool to summarize the current state of integrated assessments of climate change impacts. In the revised version of the manuscript, we now state explicitly that subcomponents of the presented projects may be placed into a different category (supplement: Il. 140-143). This is particularly relevant for projects such as CIRA, which contain some elements of model intercomparison, without them being a focus of the project though (supplement: Il. 152-154).

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REFEREE 1: Similarly, PESETA uses multiple partial equilibrium models to estimate impacts, reports these impacts at the sector level, and then feeds the information into a single CGE to capture welfare effects in an economic framework (i.e., it is not a project investigating several sectors using one model). Also, the description of the PESETA project should be updated to account for the recently released PESETA II report. Additional sectors have been modeled, along with other methodological improvements, which may or may not be worth mentioning here.

AUTHORS: We discuss the PESETA project as an approach that investigates several sectors within a consistent framework using one bottom-up model per sector. It is important to note that the relevant heading “Several sectors, one model” should be interpreted as referring to both integrated multi-sectoral models and multi-sectoral assessments of climate impacts, using one model in each sector. We clearly distinguish these two options at the beginning of section 2.1 (supplement: II. 126-137). Also, the revised version of the manuscript now includes information on the more recent second phase of the PESETA project (supplement: II. 145-150).

REFEREE 1: Page 729, lines 19-20: It is worth noting that there are different levels of integration, and the authors should be clear regarding what has been done in the ISI-MIP project. For example, multi-sector projects can conduct initial linkages between models (e.g., water availability for hydrologic models informing irrigation availability in crop models). A more in-depth effort would entail cross-model convergence to equilibrium, which typically requires many coordinated runs of each model involved. Finally, integration at the extreme end would entail the creation of an integrated assessment modeling framework to dynamically link the sectors.

AUTHORS: As pointed out in the previous response we discuss two of these levels of integration in the beginning of section 2.1: first, dynamically linking sectors by creating an integrated model, and second using offline simulations of different sectoral models (which entails at least some harmonization of the input). Between these two extreme ends, there are obviously intermediate steps of increasingly integrated models/model

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runs. In the revised version, we have added a sentence to be clearer of what level of sectoral integration has been pursued in ISI-MIP (supplement: Il. 192-194).

REFEREE 1: Page 729, lines 26-27: My sense is that this is not an accurate statement, as there are sectoral models to analyze a number of these impacts, particularly for the EU, US, and Japan. I agree that these sectors have not received as much attention when compared to agriculture, water, and energy, but the modeling platforms do exist – even if they are not region-specific and there are not ten of them to do an inter-comparison exercise.

AUTHORS: We agree that for some of these sectors models exist. However, these are generally employed at the regional scale only (EU, US, Japan as the referee points out), and there are not yet enough models to undertake a meaningful comparison. As we understand it, our statement on p.729, l. 26-27 (“For some of these areas, not even one global-scale model exists yet, let alone ensembles of comparable models.”) does not contradict the referee’s and our assessment of the state of the art.

REFEREE 1: Pages 731, line 13 through page 732, line 22: These paragraphs are very interesting, and this work will be of great interest to the impacts community. This is clearly a strength of the ISI-MIP approach.

AUTHORS: Thank you.

REFEREE 1: Page 733, line 25: Another limitation is that intercomparisons cannot be undertaken until there are a sufficient number of models to analyze jointly. In the interim, individual models can still provide policy relevant information, even if the structural uncertainties associated with impact model development have not yet been fully explored.

AUTHORS: We agree that individual models can provide policy relevant information, as long as the specific assumptions of the model are communicated (see revised version of the manuscript; supplement: Il. 403-404). However, to our mind there is

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no such thing as an insufficient number of models for an intercomparison exercise. Comparing two models can make sense depending on the research questions posed. On the other hand, a very large model ensemble can still be too small in order to capture the conceivable structural uncertainty.

Please also note the supplement to this comment:

<http://www.earth-syst-dynam-discuss.net/5/C421/2014/esdd-5-C421-2014-supplement.pdf>

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