

## Reply

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**W**e would like to thank the authors of the comment (Hegerl et al. 2011), all of whom have played leadership roles in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4), for their interest in our paper (Curry and Webster 2011). The authors are correct that since the Third Assessment Report, the IPCC has placed a high priority on communicating their conclusions about uncertainty. Our paper raises the issue of how the IPCC nonetheless again, in the AR4, fell short in this priority as well as in investigating and judging uncertainty. Hegerl et al. focus on the section in our paper on “Uncertainty in the attribution of twentieth-century climate change,” which addresses the IPCC AR4 conclusion regarding attribution: “Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.” (IPCC 2007, p. 10)

We are encouraged that Hegerl et al. (2011) acknowledge the importance of improving traceability—a recommendation made by the InterAcademy Council (IAC 2010) as well. We believe an independent person or group—and not just members of the small community of attribution experts—should be able to understand how the result came to be and to walk through the decision process and achieve the same result. The IPCC should consult with the larger scientific and engineering community experienced in traceability standards to determine what is meant by the IPCC’s traceability guidelines, and what kind of traceability is actually suitable for the IPCC assessments. Beyond the quote we provided in our article, the IAC review provides a starting point for a description of what is suitable: “. . . it is unclear whose judgments are reflected in the ratings that appear in the Fourth Assessment Report or how the judgments were determined. How exactly a consensus was reached regarding subjective prob-

ability distributions needs to be documented.” (IAC 2010; p. 39)

Some fields (e.g., medical science, computer science, engineering) have stringent traceability requirements, particularly for products and processes that are mission critical or have life-and-death implications. We expect the level and type of traceability required of the IPCC will be related to the complexity of the subject matter and the criticality of the final product. Increasing traceability in its assessment reports will enhance both accountability and openness of the IPCC.

Hegerl et al. (2011) state, “The remaining uncertainty in our estimates of internal climate variability is discussed as one of the reasons the overall assessment has larger uncertainty than individual studies.” Translating this uncertainty in internal climate variability (among the many other sources of uncertainty) into a “very likely” likelihood assessment is exactly what was not transparent or traceable in the AR4 attribution statement. We most definitely “do not appreciate the level of rigor with which physically plausible non-greenhouse gas explanations of the recent climate change are explored,” (Hegerl et al. 2011), for reasons that were presented in our paper. In our judgment, the types of analyses referred to and the design of the Coupled Model Intercomparison Project phase 3 (CMIP3) climate model experiments that contributed to the AR4 do not support a high level of confidence in the attribution.

Hegerl et al. (2011) take issue with our statement that “the high likelihood of the imprecise ‘most’ seems rather meaningless.” Hegerl et al.’s proposal to add “>50%” to the attribution statement might have improved communication of uncertainty on this point. Nonetheless, this small change would still fall short of addressing the problems our article described (and quoted from assessment users) about the fundamental difference between 51% and 99% attribution.

Hegerl et al. (2011) object to our statement in the original manuscript: “Figure 9.7 of the IPCC AR4 shows that all models underestimate the amplitude of variability of periods of 40–70 years,” on the basis that we do not consider the uncertainties presented in the chapter. Figure 9.7 is presented on a log–log scale, and the magnitudes of the uncertainties for both the model simulations and the observations are approximately a decade (a factor of 10). Considering uncertainty, a more accurate statement of our contention would have been: The large uncertainties in both the observations and model simulations of the spectral amplitude of natural variability precludes

a confident detection of anthropogenically forced climate change against the background of natural internal climate variability.

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