

Referee Report on “NorESM2-DIAM: A coupled model for investigating global and regional climate-economy interactions”

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1 A brief summary of the paper

The paper by Bjordal, Smith, Cornec, and Storelvmo introduces **NorESM2–DIAM**, a coupled framework linking a state-of-the-art Earth System Model (NorESM2) with a high-resolution Integrated Assessment Model (DIAM). The objective is to study global and regional climate–economy interactions with a level of spatial and physical detail unavailable in conventional IAMs. The economic model covers about 19,000 regions worldwide, where agents optimize consumption, investment, and energy use given temperature-dependent productivity, while NorESM2 simulates the climate response to their emissions.

The coupling is achieved through an iterative fixed-point procedure: DIAM generates emissions that feed into NorESM2, which in turn returns regional temperature and weather outcomes that affect productivity. A simplified statistical version of DIAM ensures tractability and internal consistency of expectations. The model reproduces global emission and temperature trajectories consistent with the NorESM2 climate response and produces credible spatial patterns of warming and economic change.

Quantitatively, the global mean temperature is projected to rise by about 3.5°C by 2100, leading to a decline of roughly 35% in global GDP per capita relative to trend. Around two-thirds of this decline stems from demographic shifts toward warmer, poorer regions, and about one-quarter reflects direct climate damages. Regional outcomes are highly heterogeneous: colder regions gain modestly from warming, while tropical and subtropical regions suffer substantial losses. The framework also shows that internal climate variability generates nontrivial fluctuations in GDP, highlighting the importance of weather variability for economic outcomes.

2 Assessment

This is an exciting and important methodological paper. To the best of my knowledge, it is the first study that succeeds in coupling a spatially highly resolved economic model with a fully fledged Earth System Model (ESM). The authors make a major step toward moving beyond externally imposed RCP or SSP scenarios, into a framework in which emissions are endogenously generated by economic agents. I applaud the authors for this ambitious and timely contribution.

The paper is clearly written, conceptually transparent, and the authors provide an honest and thorough discussion of the methodological challenges and current limitations. It is in excellent shape and, in my view, fully merits publication.

I have only a few minor stylistic suggestions, none of which should delay publication.

3 Minor Comments

1. It might be helpful for readers if the authors included a schematic diagram (e.g., in Section 2) illustrating the structure of the IAM in addition to its algebraic and textual description. Such a figure could clarify where exactly the coupling (“handshake”) between NorESM2 and the economic model occurs.

2. The quadratic functional form of temperature in Equation (1) is introduced on page 7, but its justification appears only later in Section 4.7. Since many readers may be more familiar with the linear specification, it could be useful either to move the discussion in Section 4.7 closer to the equation’s introduction or to insert a brief forward reference to where the justification is provided.
3. Appendix A.6.2 explains how the numerical accuracy of the procedure can be assessed, but I could not find a summary table reporting the associated error statistics. Including such a table would help the reader gauge the quantitative reliability of the solution method.
4. On page 40, line 880, the text reads “*as explained in Section ??*”. It seems that a L^AT_EX cross-reference failed to compile correctly and should be fixed.