Tipping elements and climate-economic shocks: Pathways toward integrated assessment

Rutgers University has made this article freely available. Please share how this access benefits you.
Your story matters. [https://rucore.libraries.rutgers.edu/rutgers-lib/49813/story/]

This work is an ACCEPTED MANUSCRIPT (AM)
This is the author's manuscript for a work that has been accepted for publication. Changes resulting from the publishing process, such as copyediting, final layout, and pagination, may not be reflected in this document. The publisher takes permanent responsibility for the work. Content and layout follow publisher's submission requirements.

Citation for this version and the definitive version are shown below.


Terms of Use: Copyright for scholarly resources published in RUcore is retained by the copyright holder. By virtue of its appearance in this open access medium, you are free to use this resource, with proper attribution, in educational and other non-commercial settings. Other uses, such as reproduction or republication, may require the permission of the copyright holder.

Article begins on next page
Supporting Information for “Tipping elements and climate-economic shocks: Pathways toward integrated assessment”

Robert E. Kopp,1,2 Rachael Shwom,2,3 Gernot Wagner,4 and Jiacan Yuan1

Contents of this file
1. Text S1

Text S1. Supporting methods for Figure 2
The systems shown in Figure 2 are driven by the following equations:

\[ y_{eq}(x) = A(1 - 1/\left[ 1 + \exp \left( - \frac{x - x_0}{\sigma} \right) \right]) - \beta x + c \]  

\[ x(y) = F(t) - \gamma(y - y_0) \]

\[ \frac{dy}{dt} = \frac{y_{eq} - y}{\tau} \]

where \( F(t) \) represents the exogenous forcing as a function of time (Figure 2a), \( y_{eq} \) represents the equilibrium response as a function of a state variable \( x \) related to forcing (Figure 2b), and \( y \) represents the realized response of the system. \( A \) scales the non-linear system response, \( \sigma \) scales the width of the sigmoidal equilibrium response, \( \beta \) is the linear response of the system to the state variable \( x \), \( \tau \) is the timescale over which the system approaches equilibrium, and \( \gamma \) represents the feedback of \( y \) onto \( x \). In Figure 2c-d, \( \gamma = 0 \). In Figure 2e-f, \( \tau \rightarrow 0 \) so \( y = y_{eq} \).

1Department of Earth & Planetary Sciences and Institute of Earth, Ocean & Atmospheric Sciences, Rutgers University, New Brunswick, NJ, USA
2Rutgers Energy Institute, Rutgers University, New Brunswick, NJ, USA
3Department of Human Ecology, Rutgers University, New Brunswick, NJ, USA
4Harvard John A. Paulson School of Engineering and Applied Sciences, Cambridge, MA, USA

Copyright 2016 by the American Geophysical Union.