



Gradient adaptive dynamics: Aggregate modeling from Daisyworld to an ESM anthroposphere component

C. Lemmen (1), K. Haberhorn (2)

(1) GKSS-Forschungszentrum Geesthacht, Institut fuer Kuestenforschung, Abteilung Oekosystemmodellierung (KOE), Germany, (Fax +49 4152 87-2020, carsten.lemmen@gkss.de) (2) Kerstin Haberhorn, Meteorologisches Institut, Universitaet Hamburg, Germany (Fax +49 40 42838-5066, kerstin.haberhorn@zmaw.de)

The gradient adaptive dynamics (GAD) approach is used to describe the coevolution of a population along with the frequency selection of its growth-influencing adaptive traits. First described more than ten years ago and successfully applied to diverse ecological problems, the approach has not received much attention, mostly due to insufficient communication of this technique. Here, we reintroduce the concept and demonstrate the ease and efficiency of using gradient adaptive dynamics in complex adaptive system modeling. As a tutorial system, we present a Daisyworld implementation. Secondly, we demonstrate the utility of the gradient adaptive dynamics approach in describing the shift from hunting-gathering to agropastoral subsistence societies during the Holocene. The magnitude, timing and spatial pattern of prehistoric anthropospheric land cover change is assessed in this novel ESM subcomponent. Within the DFG priority project InterDynamik, we will couple the socio-technological model to the Planet Simulator ESM. We commend GAD for further exploitation due to its mathematical consistency and numerical efficiency in describing adaptive systems, especially the biological and sociological domains of our Earth system.