

## **A framework for the detection and attribution of terrestrial ecosystem dynamics**

Jiafu Mao<sup>1†</sup>, Whitney Forbes<sup>2</sup>, Daniel M. Ricciuto<sup>1</sup>, Mingzhou Jin<sup>2</sup>, Xiaoying Shi<sup>1</sup>, and Peter E. Thornton<sup>1</sup>,

[1] Environmental Sciences Division and Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN, USA

[2] Department of Industrial and Systems Engineering, University of Tennessee, Knoxville, TN, USA

The statistical methods of detection and attribution (D&A) have been widely used in studies of climate change and quantifications of causes underlying the multi-year changes. Their successful applications in the terrestrial ecosystems, however, are limited, mainly due to the lack of long-term and broad-scale observational records, and the lack of suitable simulations from both coupled and uncoupled models. We will overcome these challenges by proposing a framework that includes the development of effective D&A algorithms, the design of factorial land model ensemble simulations, and the assembling of observational and observation-based datasets at relevant scales. This work is expected to increase the efficiency and our confidence in attributing observed changes in carbon and water fluxes, and vegetation activities to extensive natural and anthropogenic factors.