

Interannual variability in North American ecosystems

B. Byrne¹, J. Liu², A. A. Bloom², K. W. Bowman², Z. Butterfield³, J. Joiner⁴, T. F. Keenan^{5,6}, G. Keppel-Aleks³, N. C. Parazoo², and Y. Yin⁷

¹NASA Postdoctoral Program Fellow, Jet Propulsion Laboratory, California Institute of Technology, CA, USA

²Jet Propulsion Laboratory, California Institute of Technology, CA, USA

³Department of Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI, USA

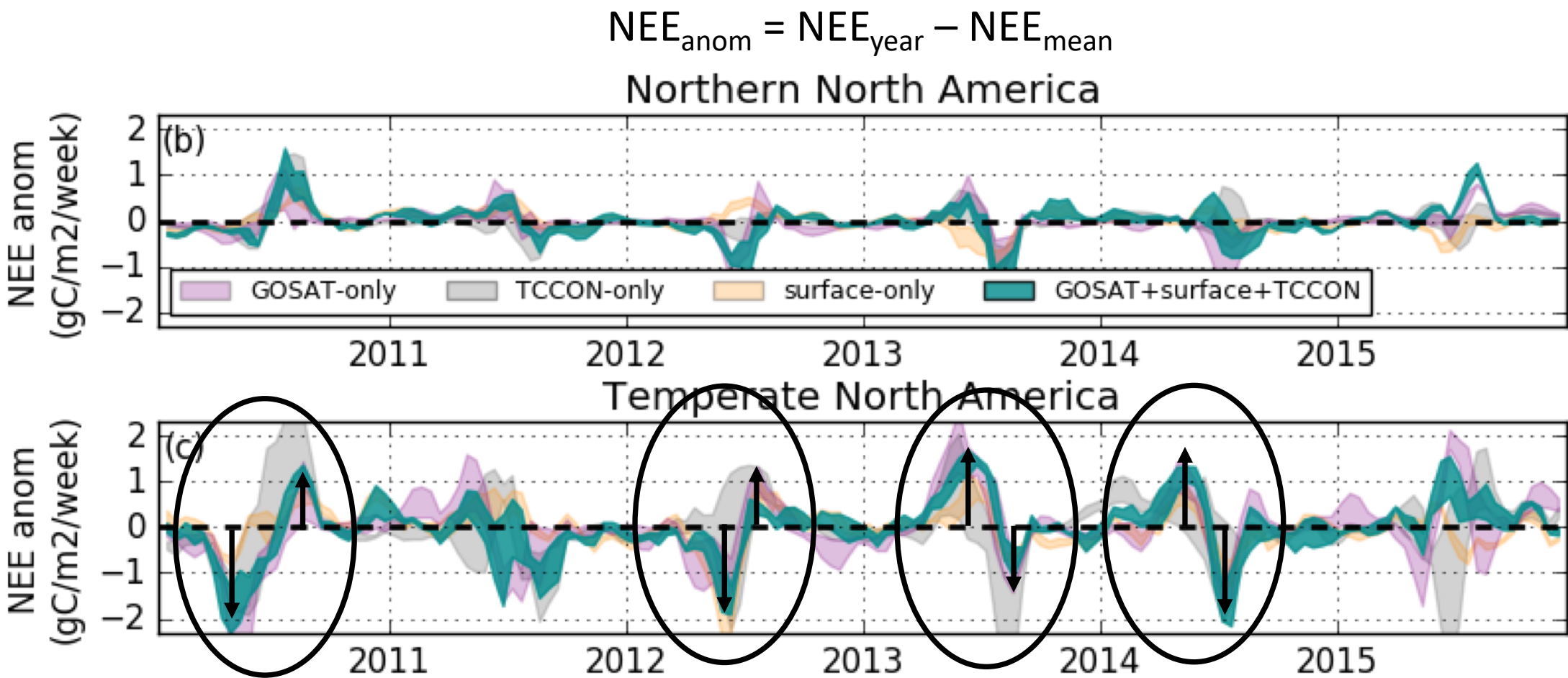
⁴Goddard Space Flight Center, Greenbelt, MD 20771, USA

⁵Earth and Environmental Sciences Area, Lawrence Berkeley National Laboratory, Berkeley, California, USA

⁶Department of Environmental Science, Policy and Management, University of California, Berkeley, California, USA

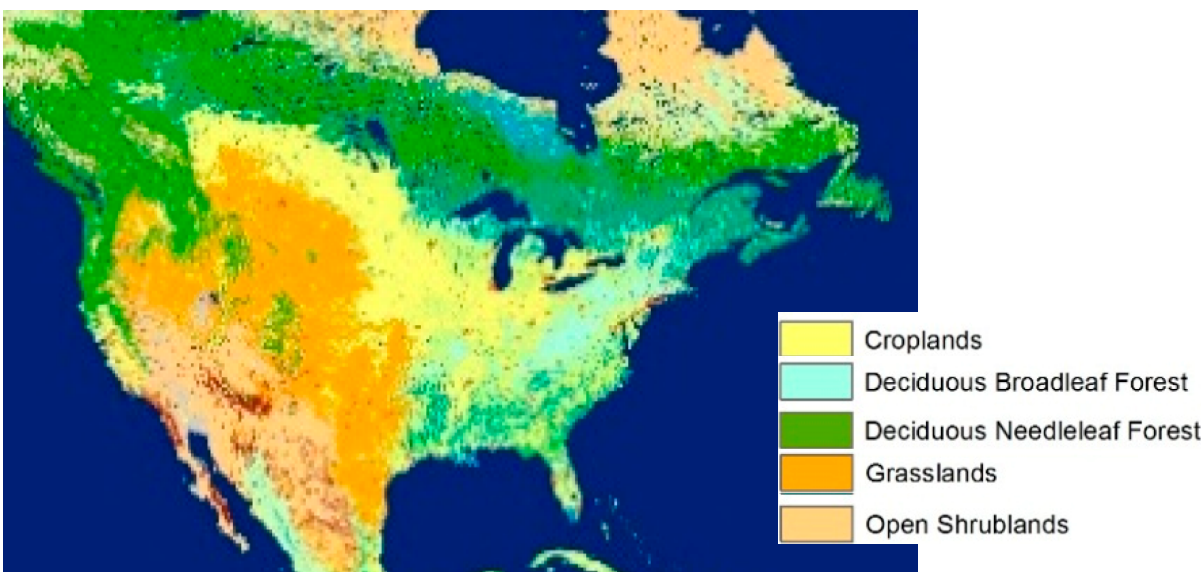
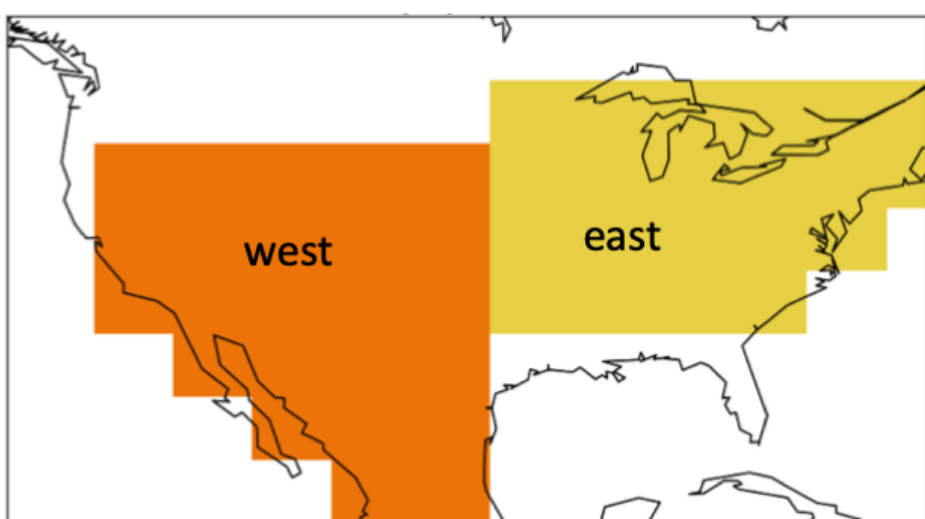
⁷Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA, USA

- Complimentary observation coverage for surface-based and space-based measurements
- Combining data within flux inversion provide increased observational constraints
- Run 4D-Var flux inversions over six years (2010-2015) using an ensemble of three different prior models
- Posterior fluxes show seasonal compensation effects in temperate North America:



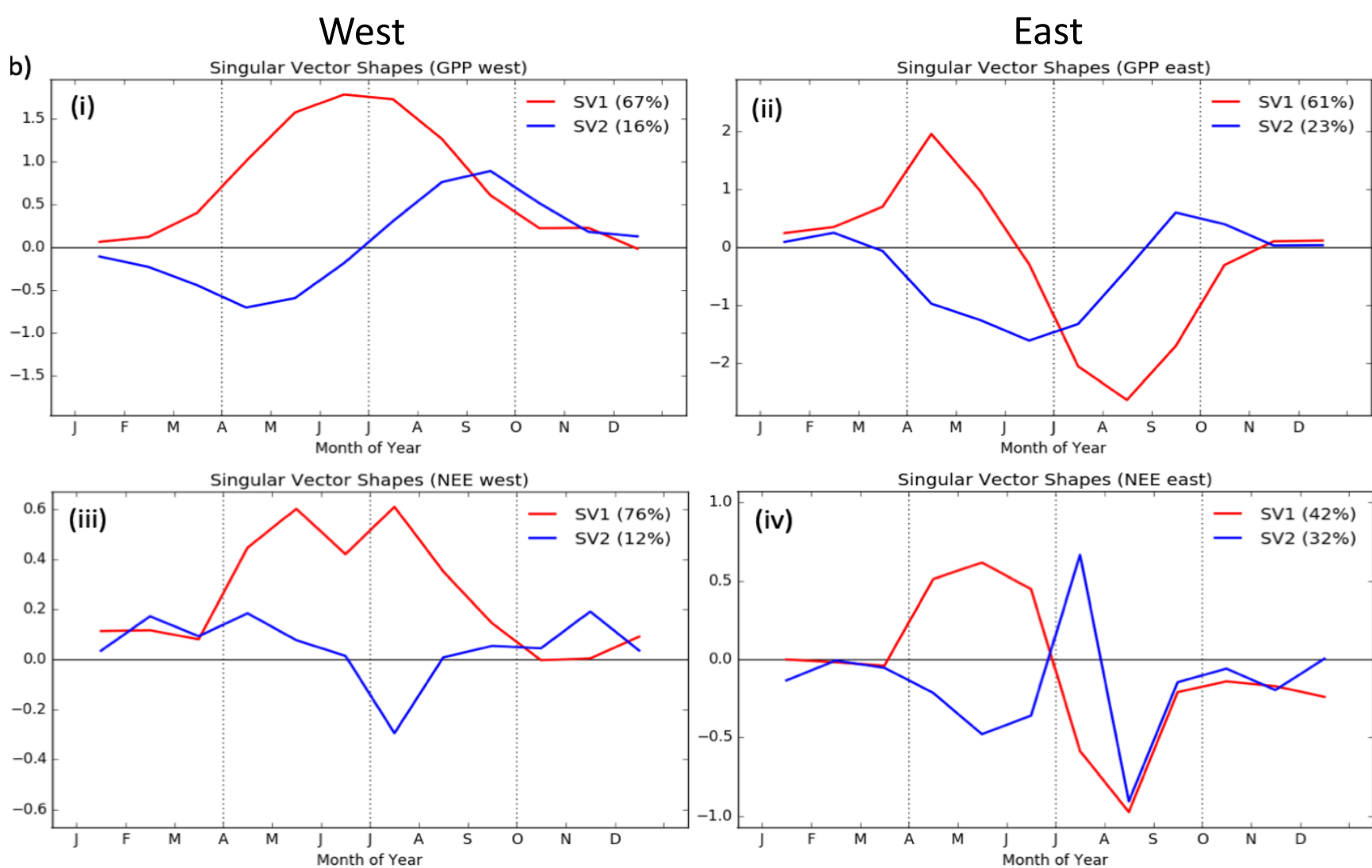
Further examine IAV in NEE and GPP

- Examine six-year IAV in posterior NEE (2010-2015) over North America.
- Examine 17-year of IAV in FluxSat GPP (2001-2017). FluxSat is an upscaled GPP product using MODIS measurements using Fluxnet and SIF measurements.
- Separately examine east (forest, croplands) and west (semi-arid) of North America.



SVD of NEE and GPP anomalies

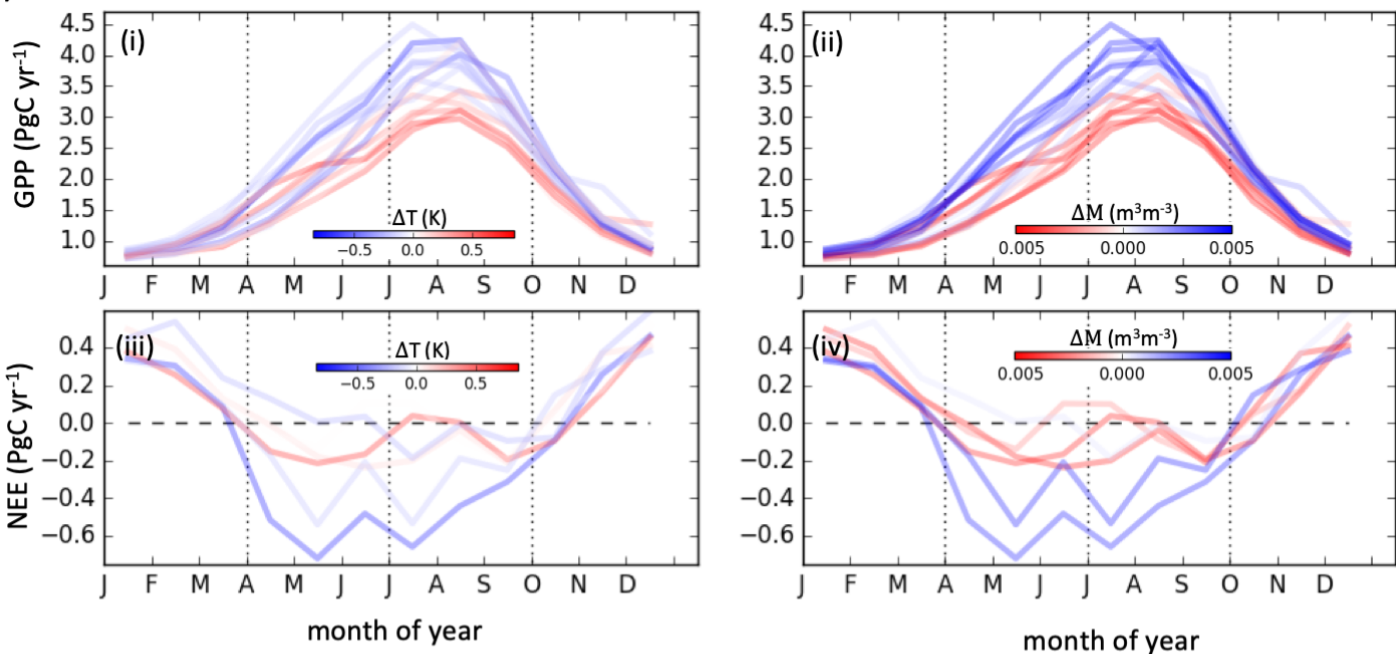
- SVD of month-by-year array of anomalies. → Show dominant modes of variability between years
- Amplification dominates in west. Compensation dominates in east



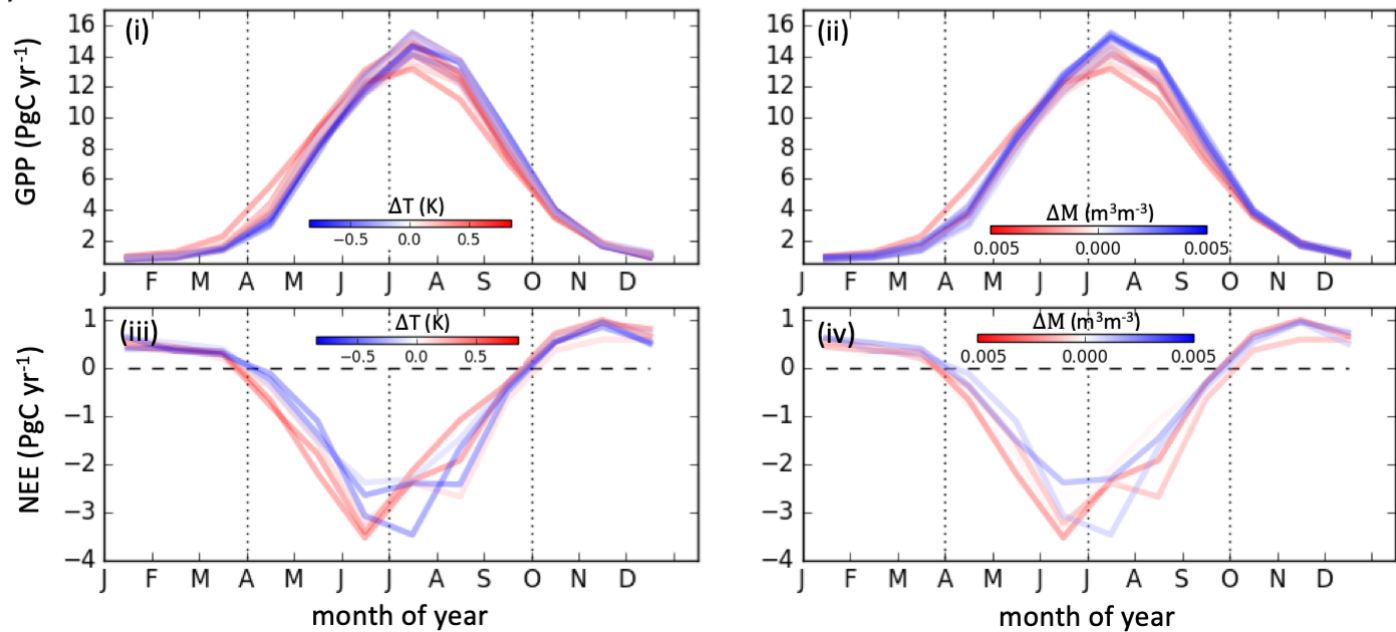
IAV and environmental drivers

- In West, amplification is associated with wetter-cooler conditions
- In East, shift to earlier in the year is associated with warmer spring

(a) Western North America



(b) Eastern North America



For more details:

Byrne et al., Improved constraints on northern extratropical CO₂ fluxes obtained by combining surface-based and space-based atmospheric CO₂ measurements, ESSOAr, doi: 10.1002/essoar.10501108.2

Byrne et al., Outsized contribution of the semi-arid ecosystems to interannual variability in North American ecosystems, ESSOAr, doi: 10.1002/essoar.10502484.1

Acknowledgements:

Brendan Byrne's research was supported by an appointment to the NASA Postdoctoral Program at the Jet Propulsion Laboratory, administered by Universities Space Research Association under contract with NASA. We thank the OCO-2 mission for support.