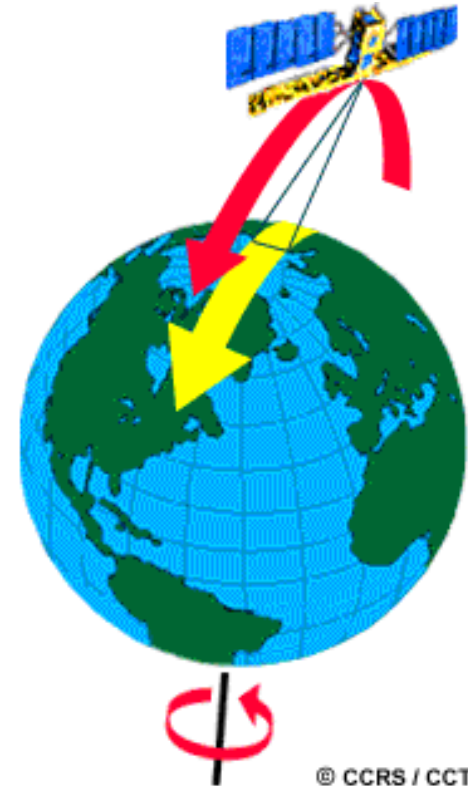


Motivation

- Some of the biggest advances in AI applications are in processing of massive amounts of Earth Observation (EO) data to detect patterns
- CIESIN and YCELP have a long history of including country-level EO-derived indicators in the EPI
- **Questions:** What are the frontiers of EO data processing using AI to develop new or improved country-level indicators? Are there new domains to which EO can be applied with the help of AI?



Past & Experimental Indicators

- 2008 EPI
 - Burned Area – JRC’s L3-JRC product
 - Intensive Cultivation - MOD12Q1 and GLC 2000 land cover
 - Effective Conservation – DMSP-OLS in protected areas
- 2010-2018 EPI
 - Air Pollution Exposure & Exceedances – PM2.5, NO2 – Dalhousie U. → Washington U. St. Louis
- CIESIN experimental EO indicators (NASA ROSES grant 2012-13)
 - Change in chlorophyll-A in the coastal zone (SeaWiFS + MODIS)
 - Biomass burning (NASA’s GFED based on MODIS)
 - NASA SEDAC Satellite-Derived Environmental Indicators

OPEN ACCESS

IOP Publishing

Environ. Res. Lett. 9 (2014) 084013 (12pp)

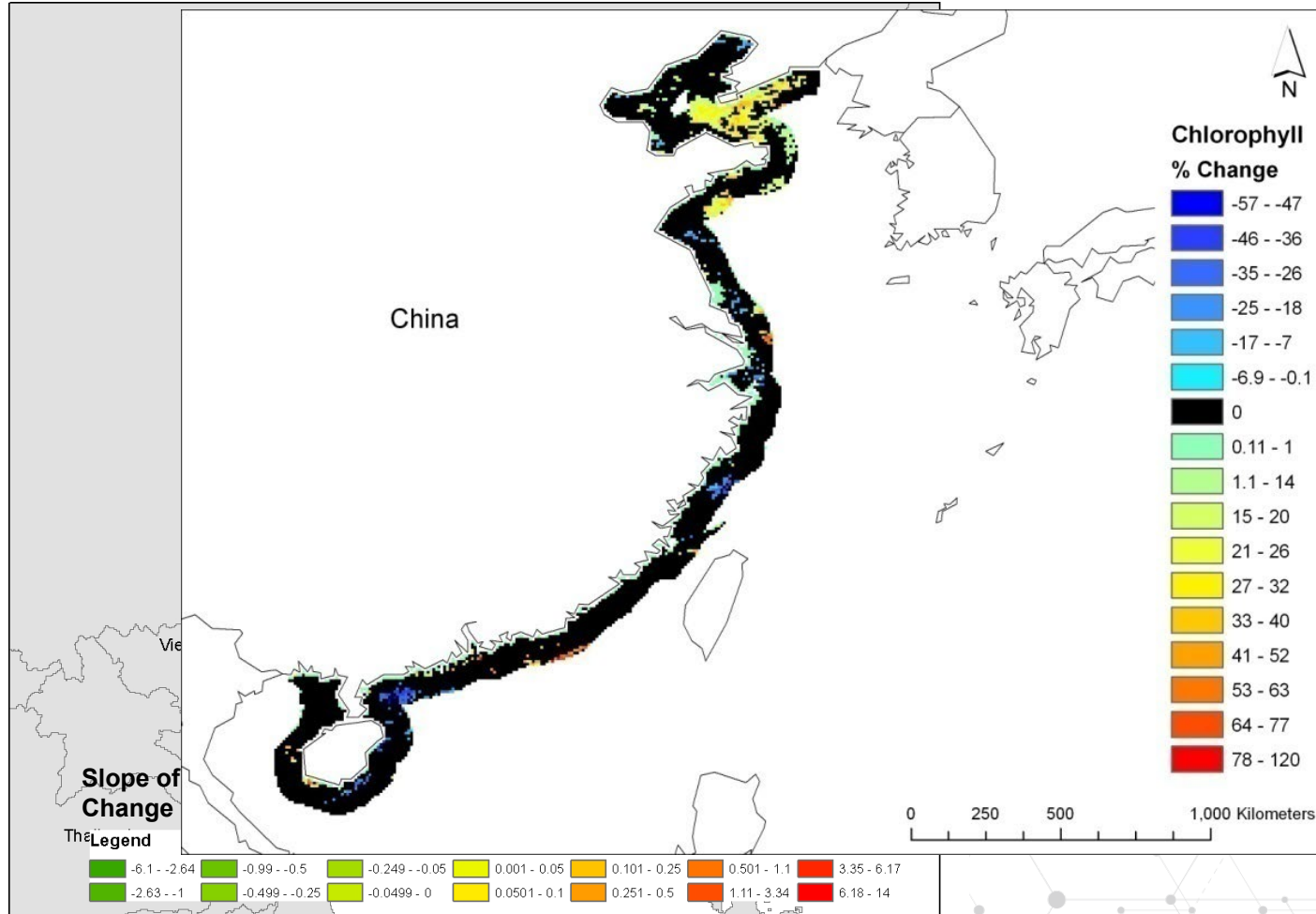
Environmental Research Letters

doi:10.1088/1748-9326/9/8/084013

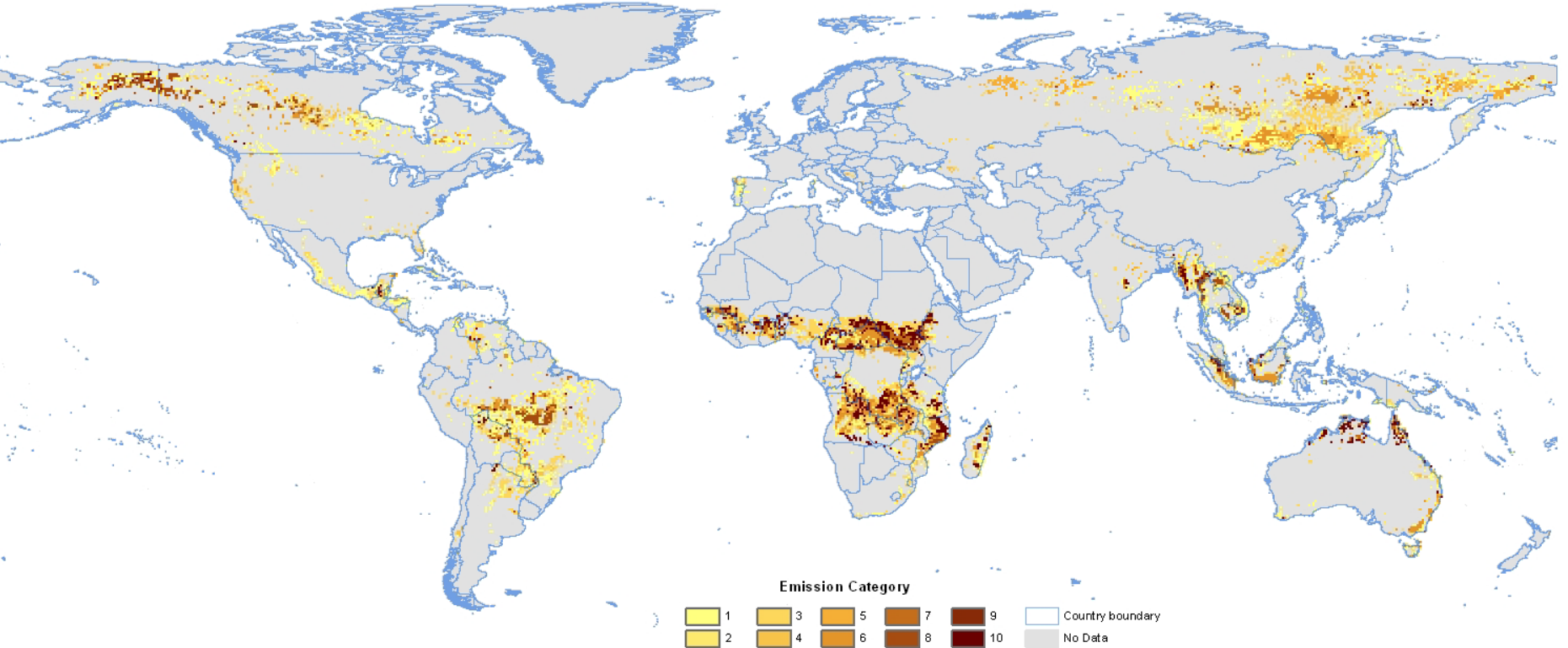
Using satellite data to develop environmental indicators

Alex de Sherbinin¹, Marc A Levy¹, Erica Zell², Stephanie Weber² and Malanding Jaiteh¹

Trend in Chlorophyll-A



Burned Areas – Frequency & Intensity (1997-2009)

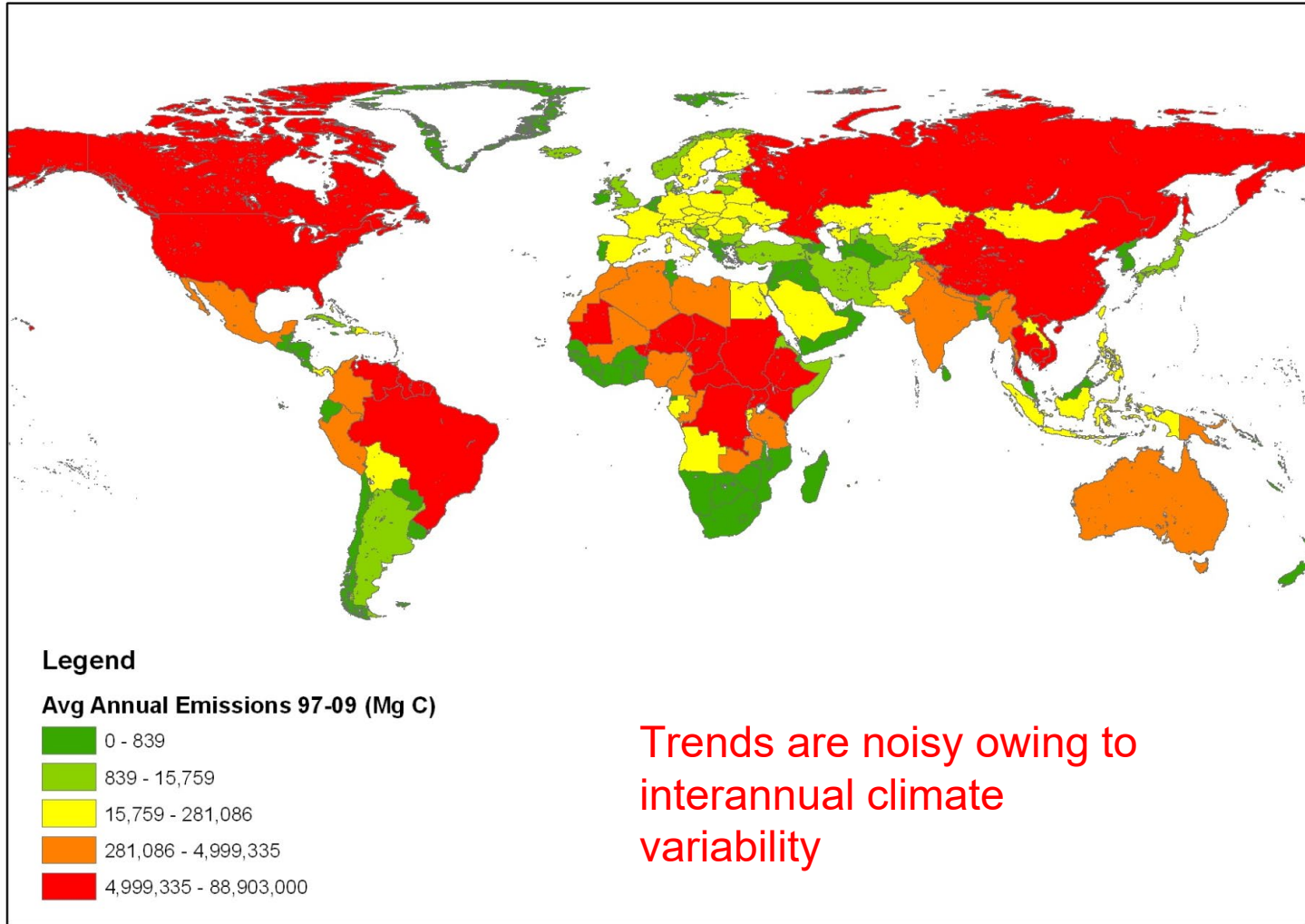


Clusters:

1 = low frequency and low intensity

10 = high frequency and high intensity

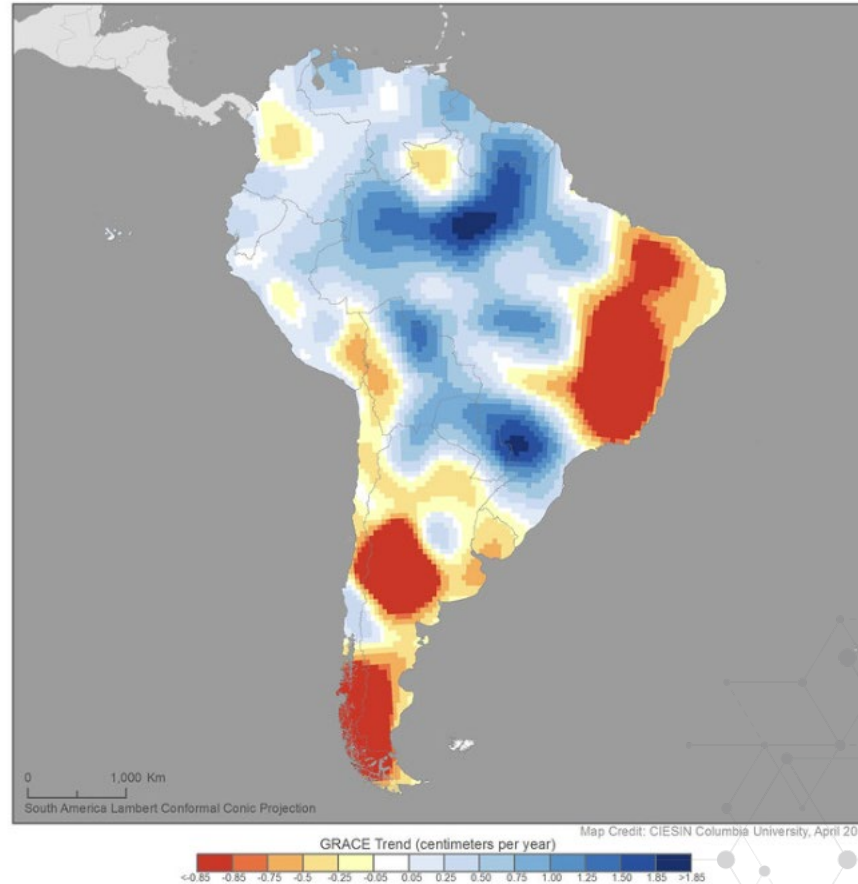
Burned Areas – Average Annual Emissions (1997-2009)



Trends in Freshwater Availability (2002-2016)

Trends in Global Freshwater Availability from the Gravity Recovery and Climate Experiment (GRACE), 2002–2016: South America

Satellite-Derived Environmental Indicators



Current & Future Indicators

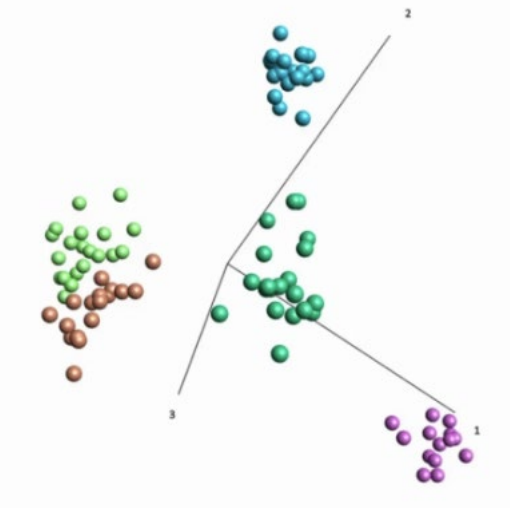
- 2014 EPI onwards
 - Change in forest cover – Global Forest Watch / Matt Hansen @ UMD (Landsat)
- 2020 EPI onwards
 - Change in grassland and wetland extent – ESA (Sentinel 2)
- Plus many other indicators that have EO embedded in them
 - Net Carbon Fluxes Due to Land Cover Change
 - Protected Areas Effectiveness Index*
- Future prospects
 - Identification of unregulated garbage tips in cities
 - Identification of plastics pollution
 - More work on inland water quality

* Uses protected areas and a high resolution land cover and land use classification from DynamicWorld. Based on **AI-driven classification** of Sentinel-2 satellite imagery, Dynamic World provides a 10-m resolution LULC classification in near real time for the entire world

Concluding Thoughts

- Unsupervised classification and machine learning (ML) have long been a part of EO data processing
- What is new is the speed of AI-enabled EO image processing, and the potential for hallucinations

Image Segmentation



Poor Village



Well Off Village



DCNN
Produced



Thanks!

Alex de Sherbinin

adesherbinin@ciesin.columbia.edu

