# Intrinsic vegetation memory as a proxy of engineering resilience may be an oversimplification.

PRESENTER: Erik Kusch

VARYING RELATIONSHIPS BETWEEN VEGETATION MEMORY AND CLIMATE VARIABILITY IN ACROSS GLOBAL DRYLANDS

Erik Kusch<sup>1</sup>, Richard Davy<sup>3</sup>, Roberto Salguero-Gómez<sup>4</sup>, Alistair Seddon<sup>2</sup>

<sup>1</sup>Aarhus University<sup>, 2</sup>University of Bergen, <sup>3</sup>Nansen Environmental and Remote Sensing Center, <sup>4</sup>University of Oxford

### BACKGROUND

- Vegetation memory determines how plants react to environmental changes
- Especially strong across dryland regions (e.g. due to water limitations)
- Compartmentalized:
  - **Intrinsic (**"How vegetation influences itself over time")

 $\rightarrow$  Usually treated as an inverse proxy of recovery rates

• **Extrinsic (**"How the environment influences vegetation over time")

→ Usually understood as an inverse proxy of ecosystem

### **TAKE-HOME MESSAGES**

- **1.** Assuming **intrinsic vegetation memory as a** direct **proxy of recovery rates may be flawed.** 
  - . Global generalisations of vegetation response to soil moisture aspects are not possible (at this point).
- . Novel climate reanalysis products offer more informative climate parameters than the previously used.

#### **RESULTS**

-0.24

-0.20

-0.16

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NDVI[t-1] (Intrinsic Memory)







- resistance
- **Characterized through:**
- **Strength (**"How strong does the system react to an anomaly?")
- **Sign (***"Does a positive anomaly benefit the system?"***)**
- **Length (***"How long does the system react to an anomaly?"***)**
- **Source (***"Which kind of anomaly does the system react to?"***)**



#### **Extrinsic Vegetation Memory:**

- Memory Length [Months]
- Memory Strength and Sign
- Memory Source
- Intrinsic Vegetation Memory: Memory Length at 1 month Memory Strength and Sign - Autoregressive Memory Source t-1

## **RESEARCH QUESTIONS**

- 1. How can we distinguish intrinsic and extrinsic vegetation memory?
- 2. Can the use of novel climate products enhance our understanding of vegetation memory when compared to legacy products?
- 3. How well can we establish causal links between measures of plant



Air Temperature (Inverse Resistance)

**1.** It is difficult to distinguish intrinsic and extrinsic vegetation memory.

Relative Importance of Vegetation Responses





function or vegetation life history traits and vegetation memory?

## **METHODS**

- Data sets:
  - **AVHRR GIMMS NDVI (**9x9km, 1982 2015, Monthly**)**
  - **ERA5 (**30x30km, 1950 TODAY, Hourly**)**
  - Air Temperature (implemented as instantaneous effect) Tair January 1981 Tair January 1981



Introducing: R package **KrigR** which handles: (1) Downloading & Processing Era5(-Land)/UERRA Data to user specifica (2) Downloading & Processing USGS GMTED 2010 Data as covariates in (3) Kriging spatial data using multiple cores for faster computation (3) Kriging spatial data using multiple cores for faster computation → Find the R Package on Git **2.** Vegetation memory processes differ greatly between regions.



**3.** Vegetation anomalies explained previously through intrinsic memory can be understood through soil moisture information.





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