Loss of Amazon rainforest resilience confirmed from single-sensor satellite data

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Indicators of resilience change

- ▹ Variance
- Autocorrelation AC1
- Spatial correlation for coupled systems



Dakos et al, 2010

Amazon rainforest: spatially coupled

 Moisture advection



Zemp et al, 2017

A conceptual model



3

A conceptual model

time of emergence



4

Remote sensing of vegetation

Vegetation Optical Depth (VOD) ~ biomass

	2002 - 2011	2012 - 2020
Sensor	AMSR-E	AMSR2
Band	C & X	C1 & C2

No artifacts from

- > Optics (clouds, saturation, ...)
- Merging (Smith et al. 2023)



Trends in spatial correlation





Coherence of indicators



all indicators increasing2 indicators increasing1 indicator increasingno indicator increasing

Coherence of indicators

AMSR-E





Conclusions

- Spatial correlation is a good indicator of CSD in coupled systems
- Single-sensor VOD
- > 2002 2011: pronounced resilience loss
- > 2012 2020: resilience loss mainly in southwest of Amazon basin
 - Regions with high dependence on recycled water
 - Highly spatially coupled
 - > Spatial correlations do show strong signs there

References

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