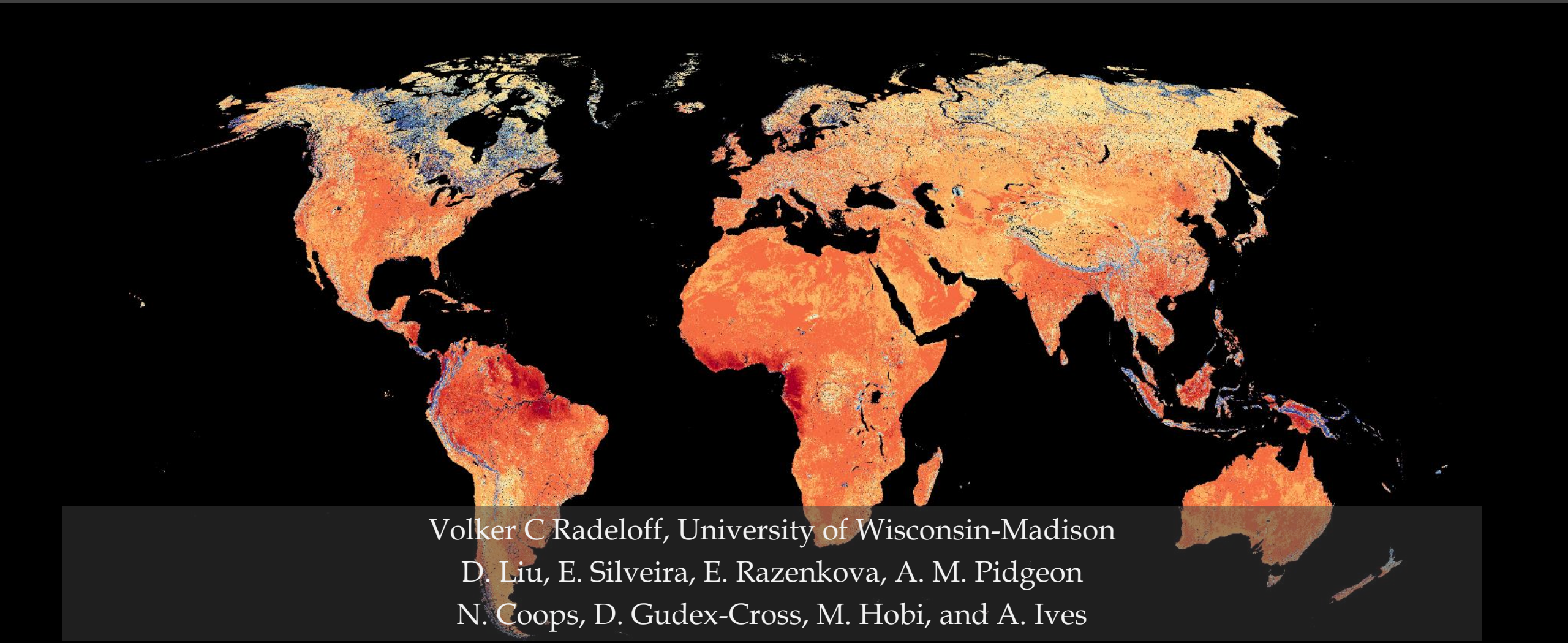
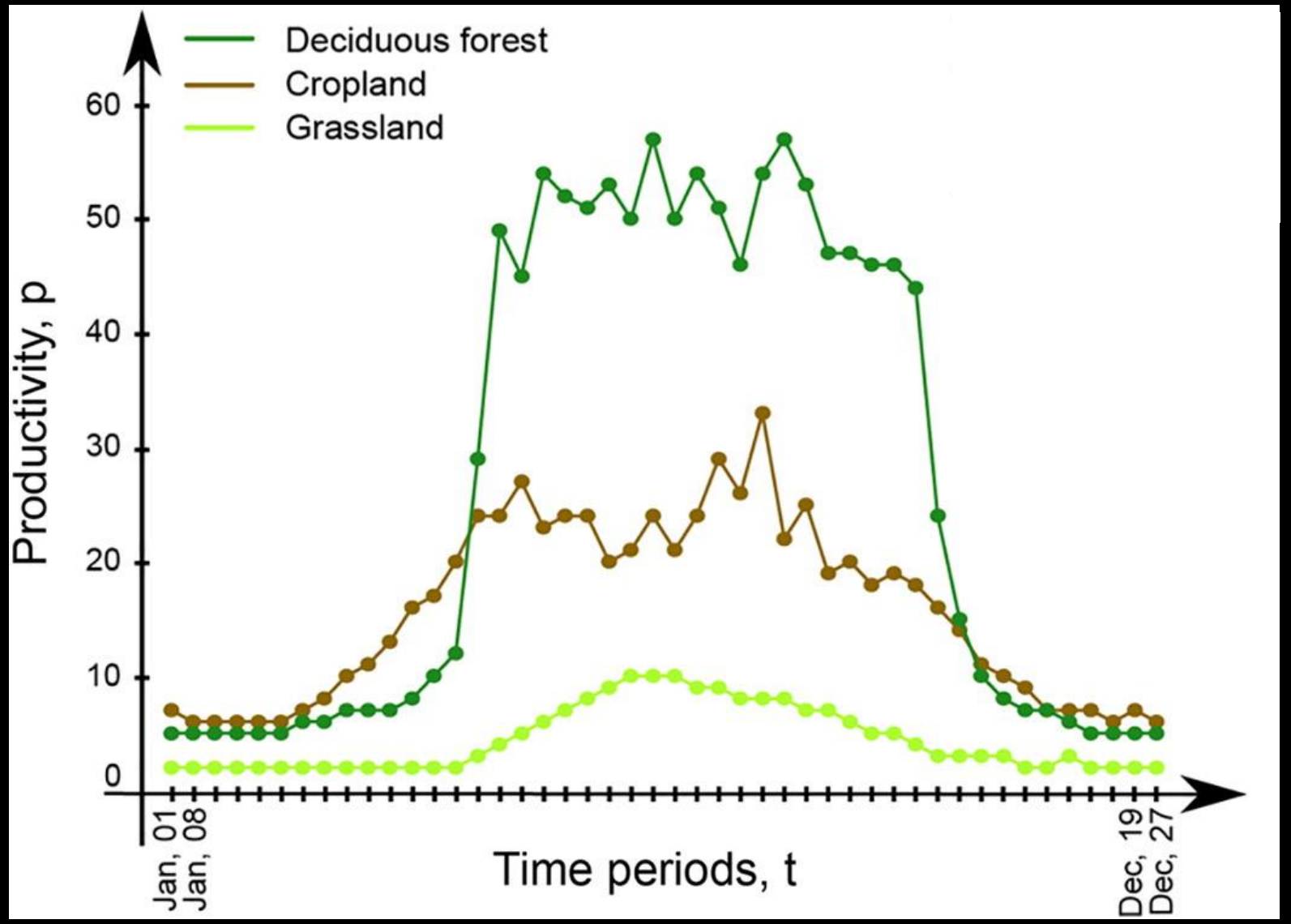
The Dynamic Habitat Indices from Terra, Aqua, Suomi NPP and JPSS data for biodiversity science and conservation



Volker C Radeloff, University of Wisconsin-Madison
D. Liu, E. Silveira, E. Razenkova, A. M. Pidgeon
N. Coops, D. Gudex-Cross, M. Hobi, and A. Ives

Introduction



Introduction

Ecology

Available energy hypothesis

Environmental stress hypothesis

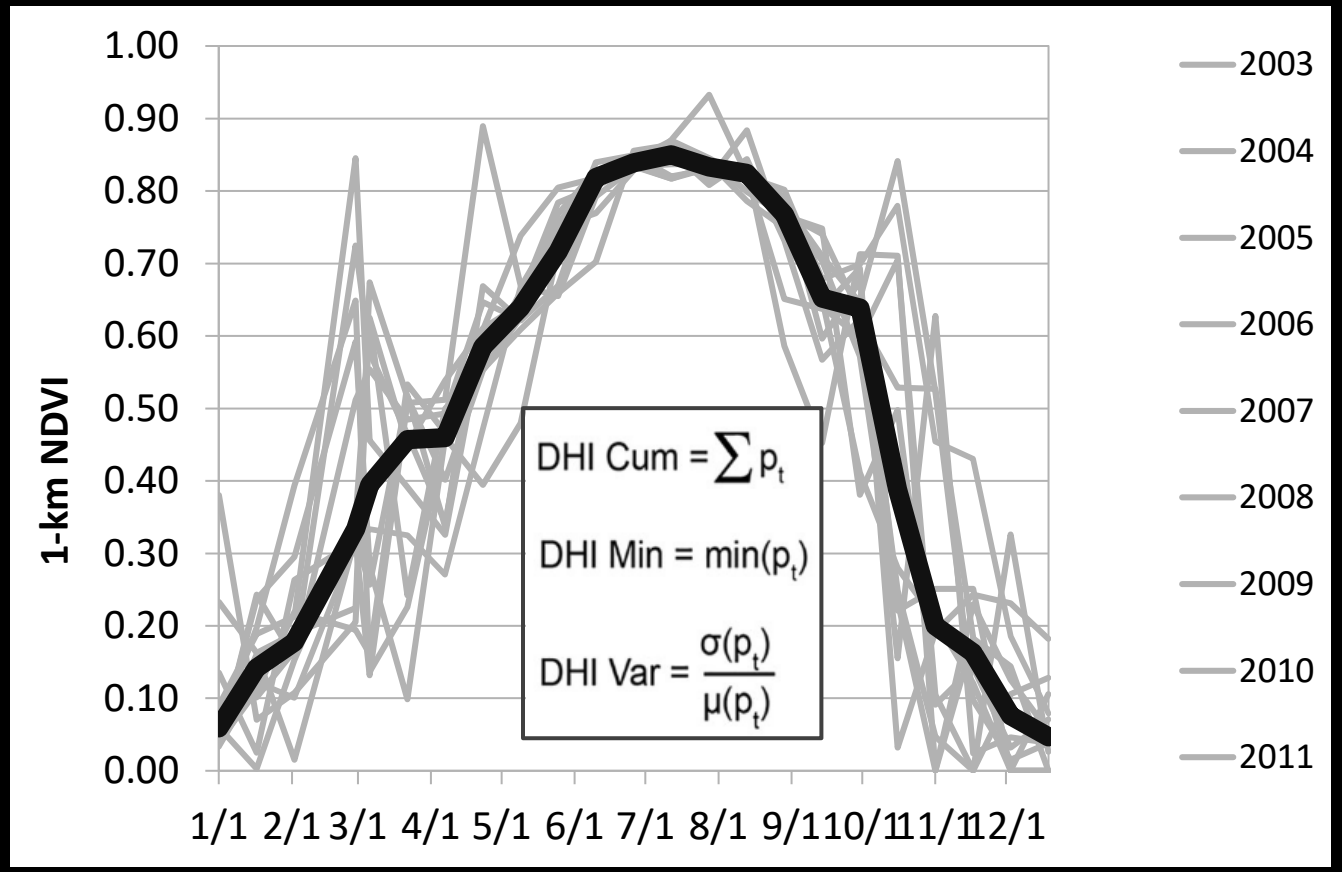
Environmental variability hypothesis

Introduction

Ecology		DHIs
Available energy hypothesis		Cumulative productivity
Environmental stress hypothesis		Minimum productivity
Environmental variability hypothesis		Coefficient of variation

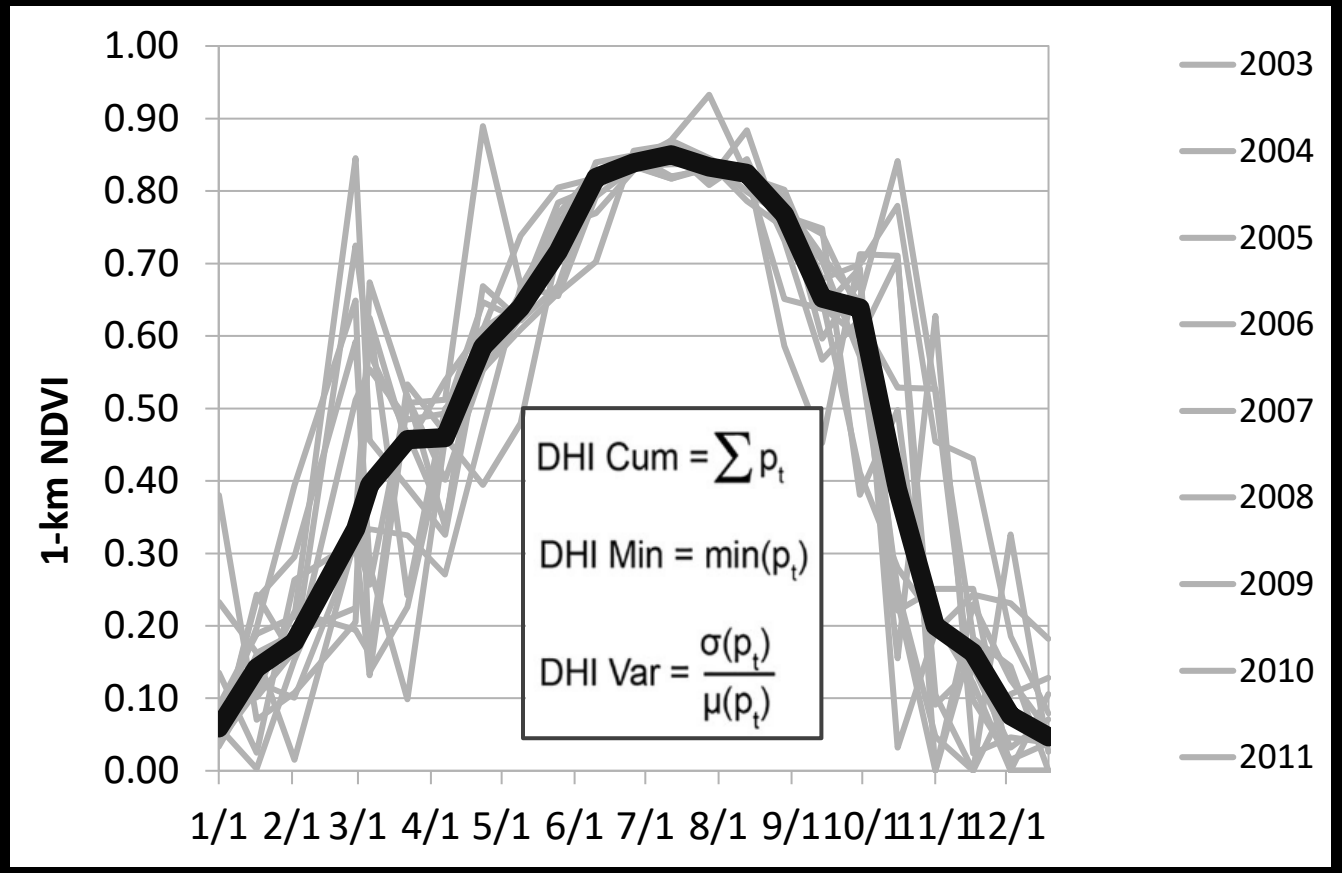
Introduction

Composite DHIs

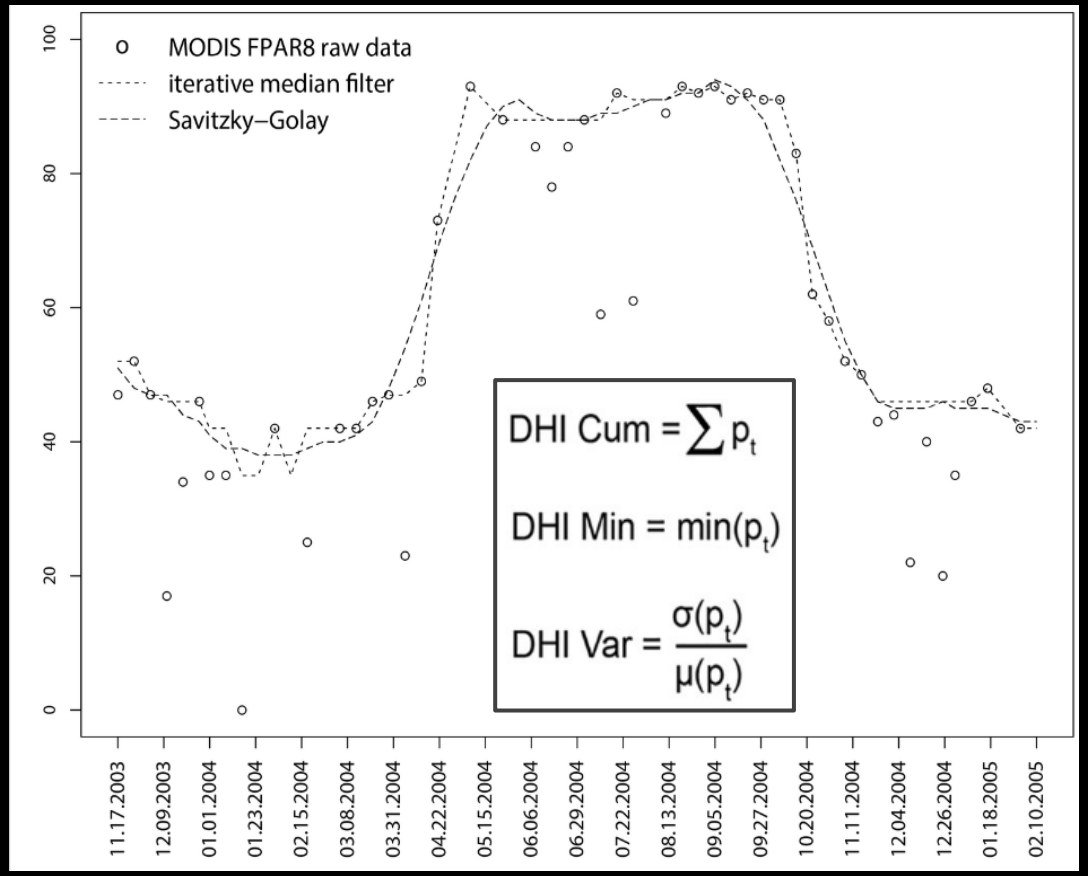


Introduction

Composite DHIs

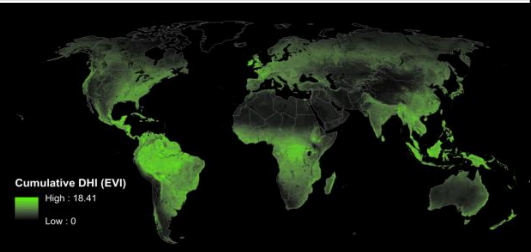
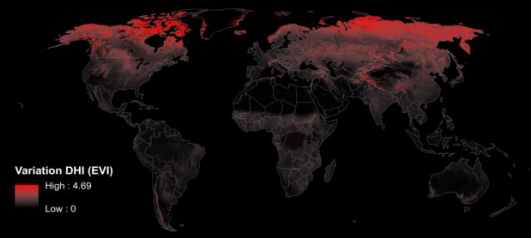


Annual DHIs

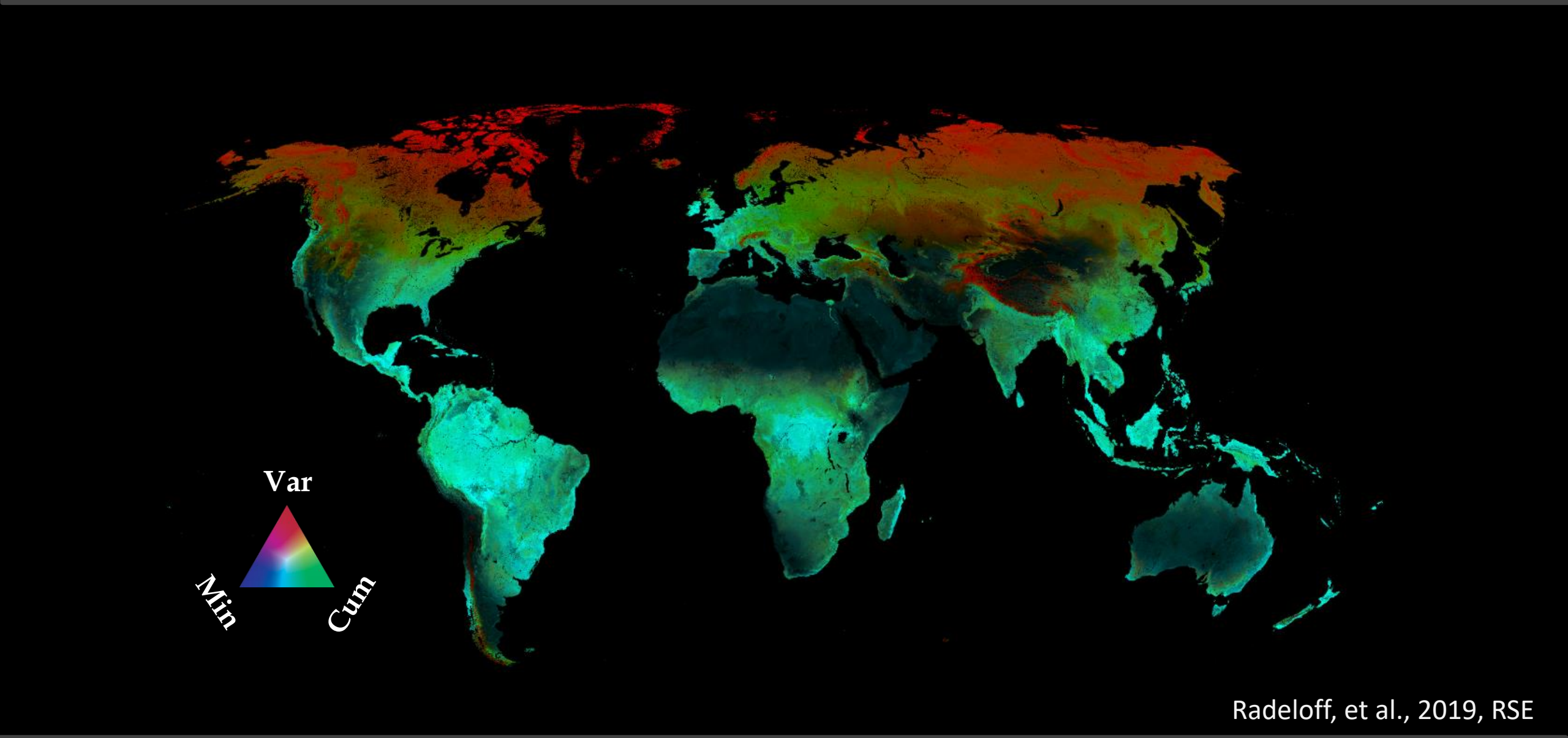


Hobi et al. 2017, 2021
Radeloff, et al., 2019

Introduction

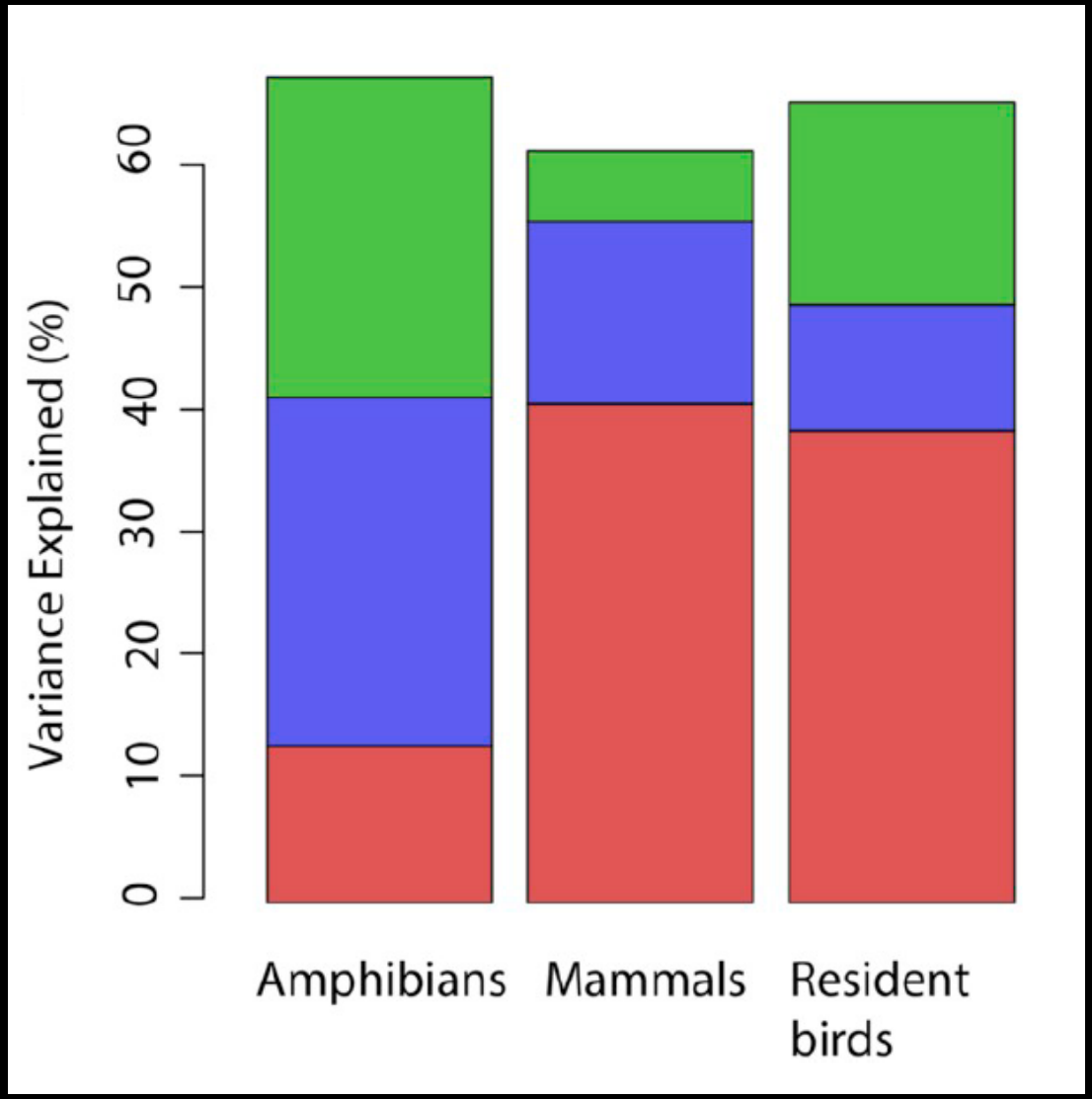
Ecology	DHIs
Available energy hypothesis	
Environmental stress hypothesis	
Environmental variability hypothesis	

Introduction



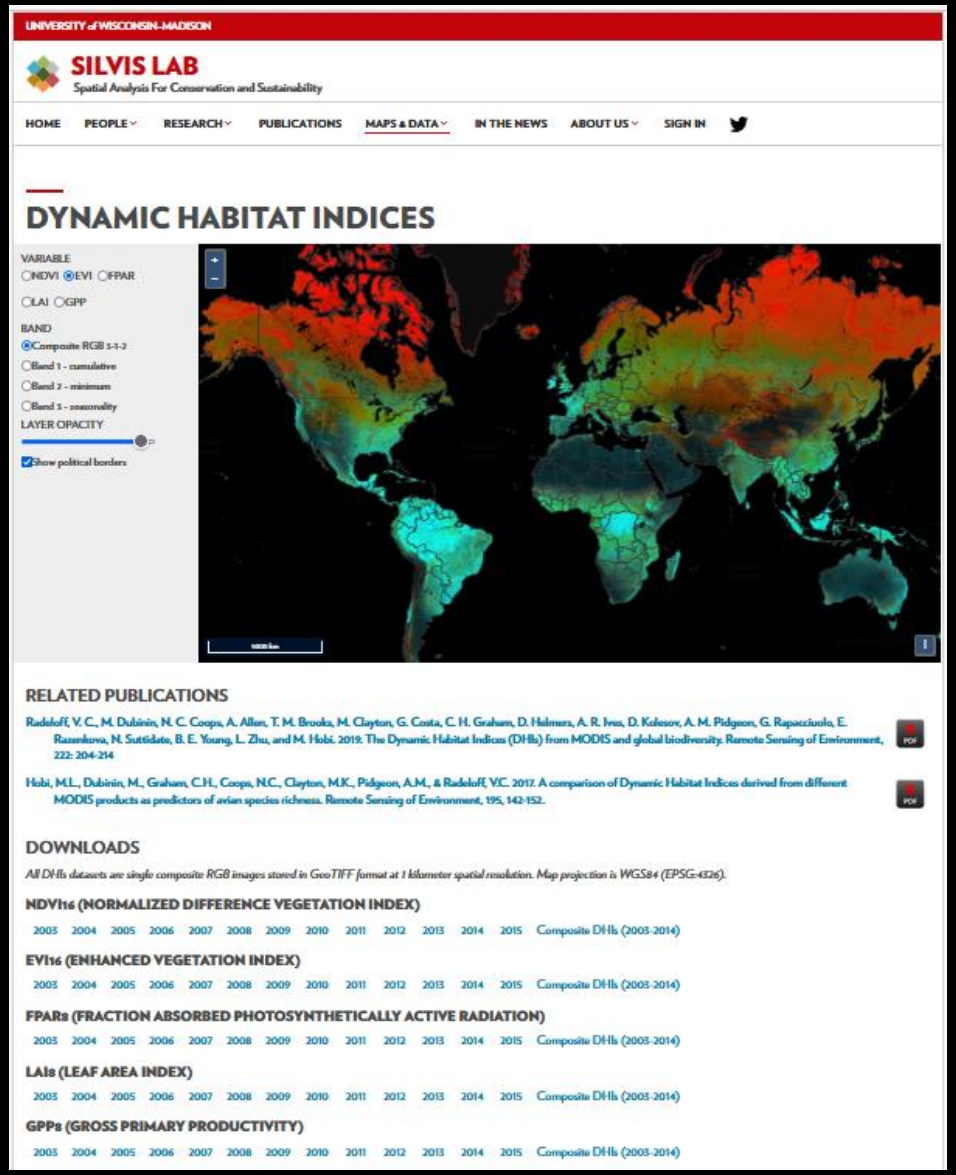
Radeloff, et al., 2019, RSE

Introduction



Radeloff, et al., 2019, RSE

Introduction

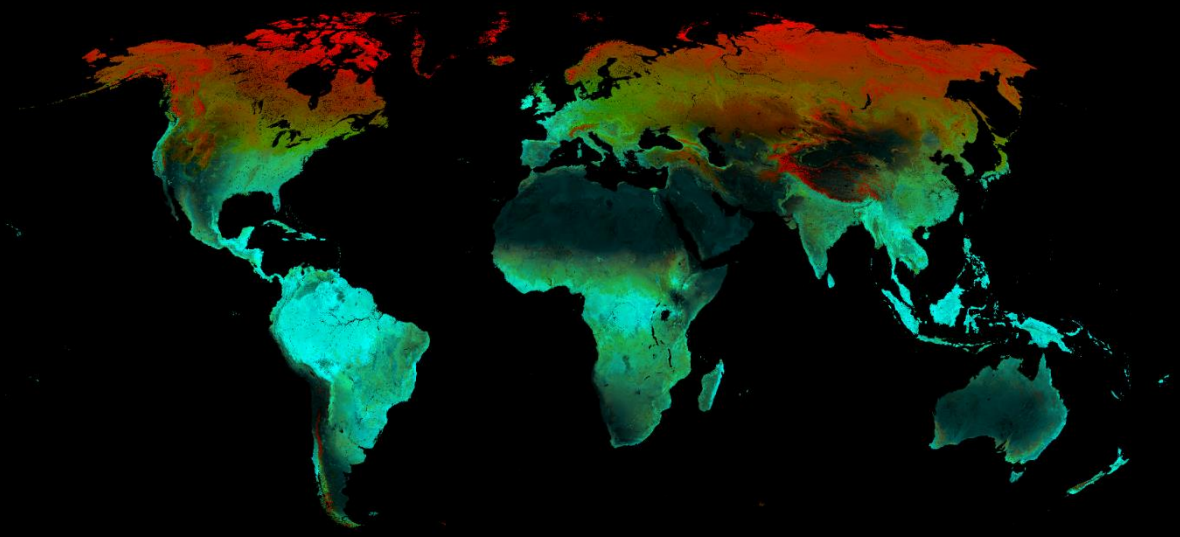


Outline

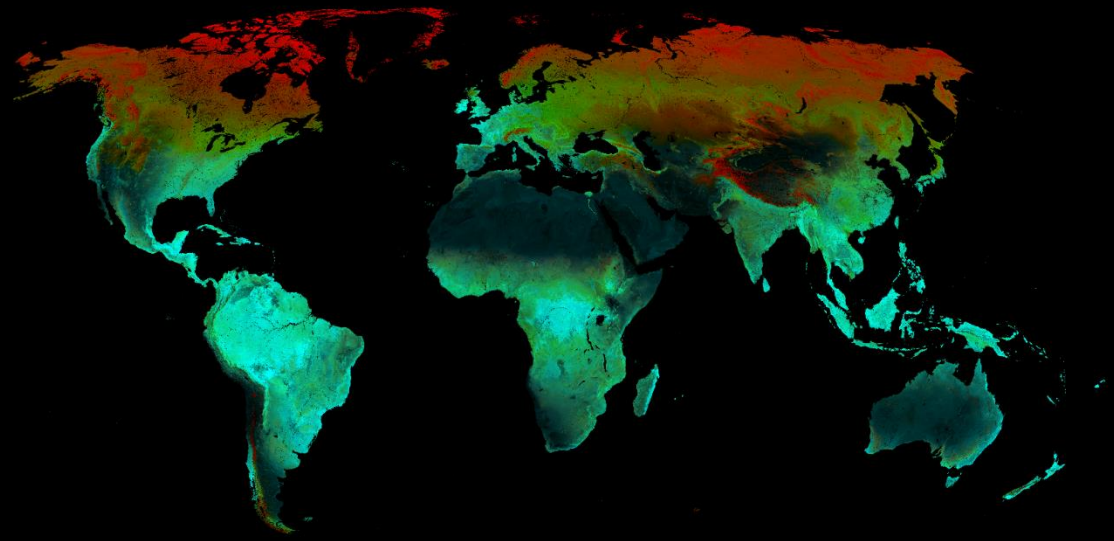
- Part I: DHIs from MODIS collection 5 versus 6
- Part II: DHIs from MODIS C6 versus VIIRS
- Part III: DHIs versus global species richness

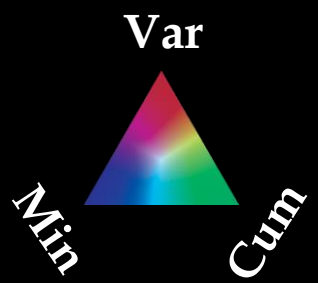
Results

MODIS Collection 5



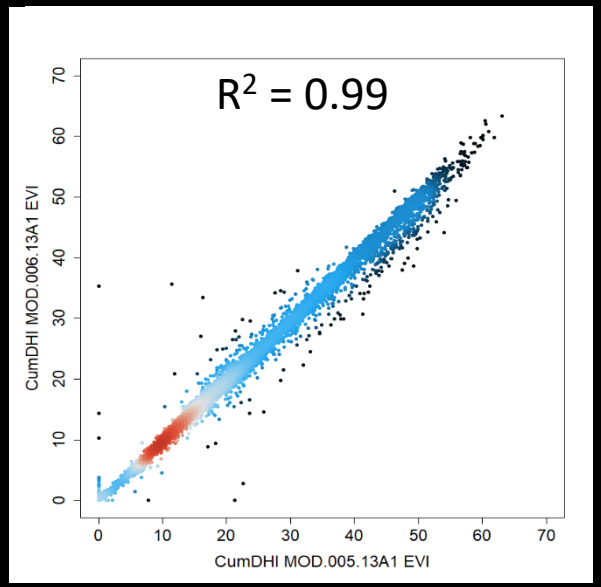
MODIS Collection 6



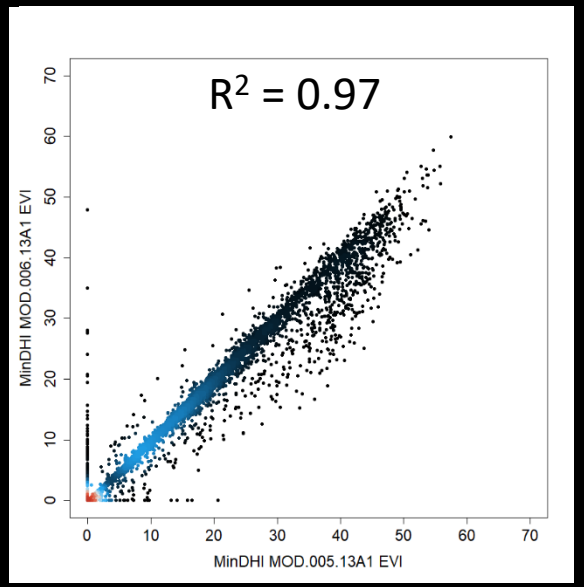


Results

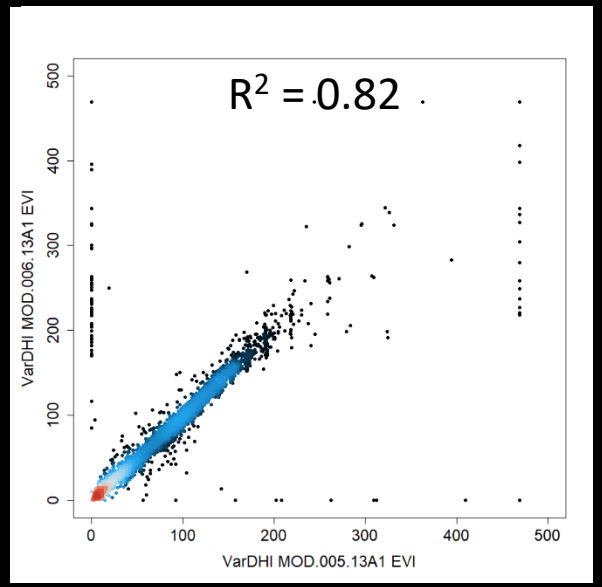
CumDHI



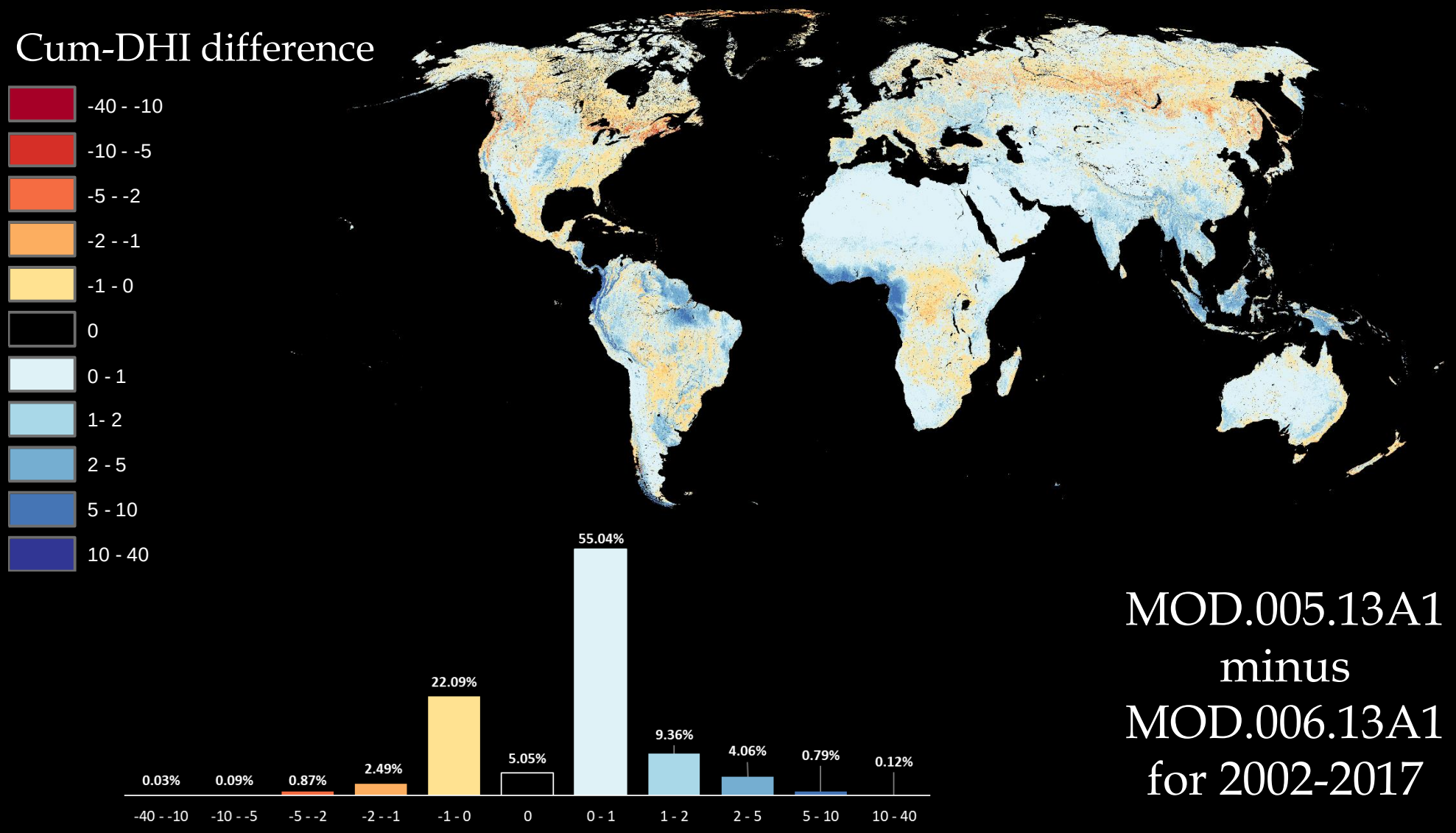
MinDHI



VarDHI

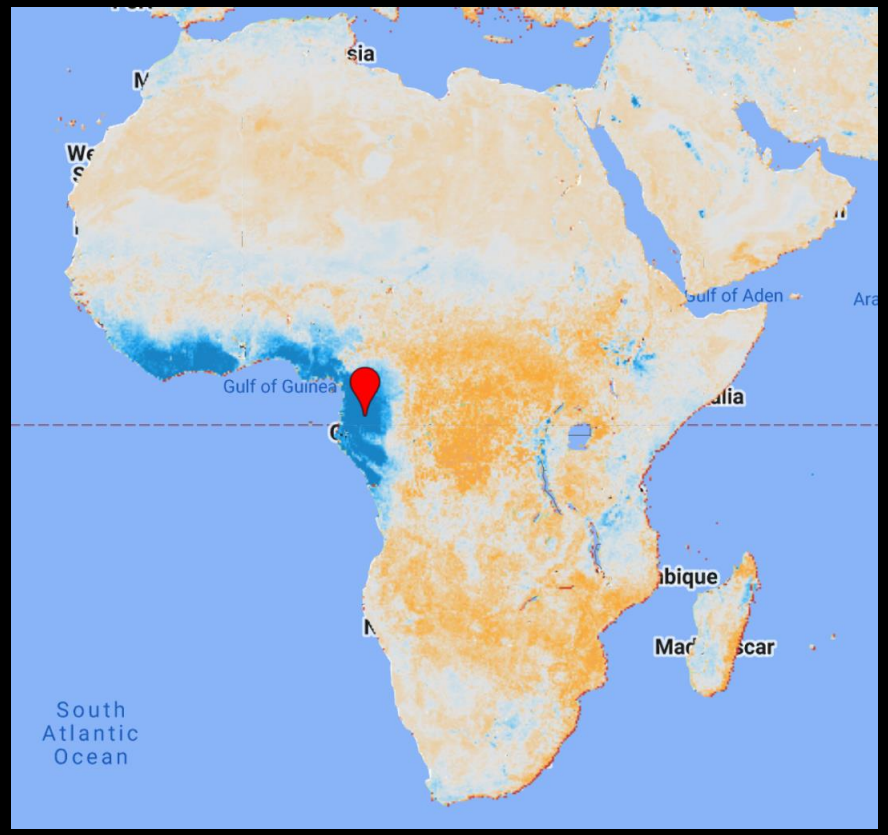


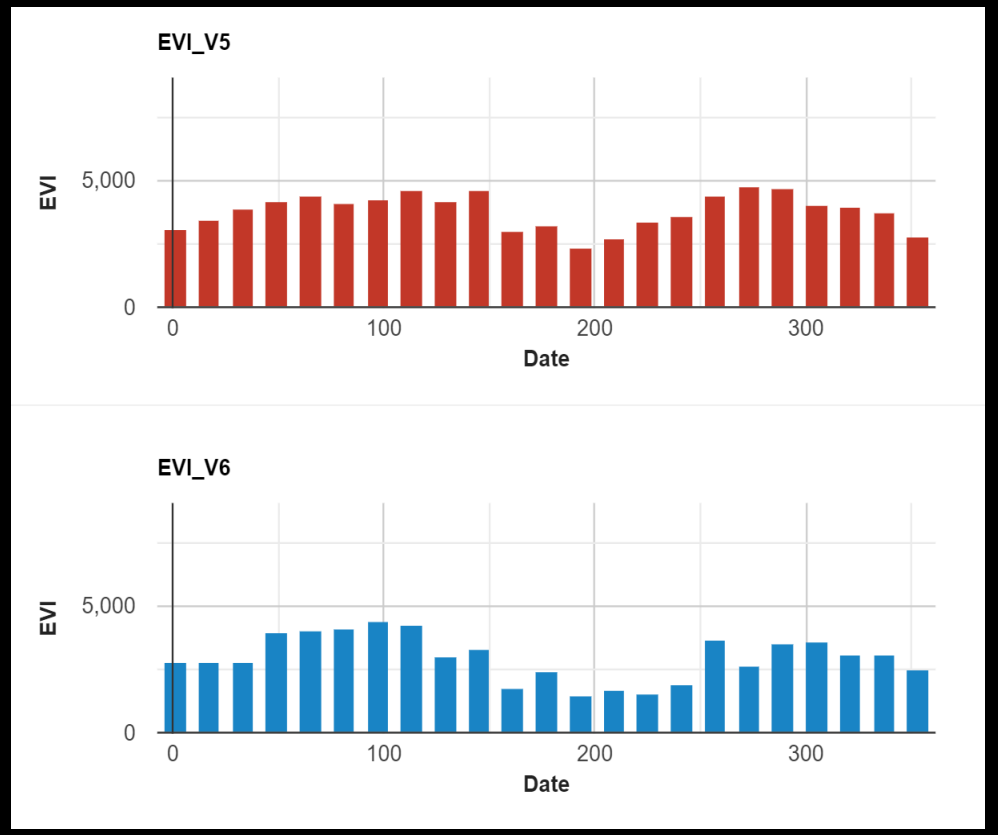
Results



MOD.005.13A1
minus
MOD.006.13A1
for 2002-2017

Results


Gulf of Guinea
Gulf of Aden
South
Atlantic
Ocean


EVI_V5
EVI
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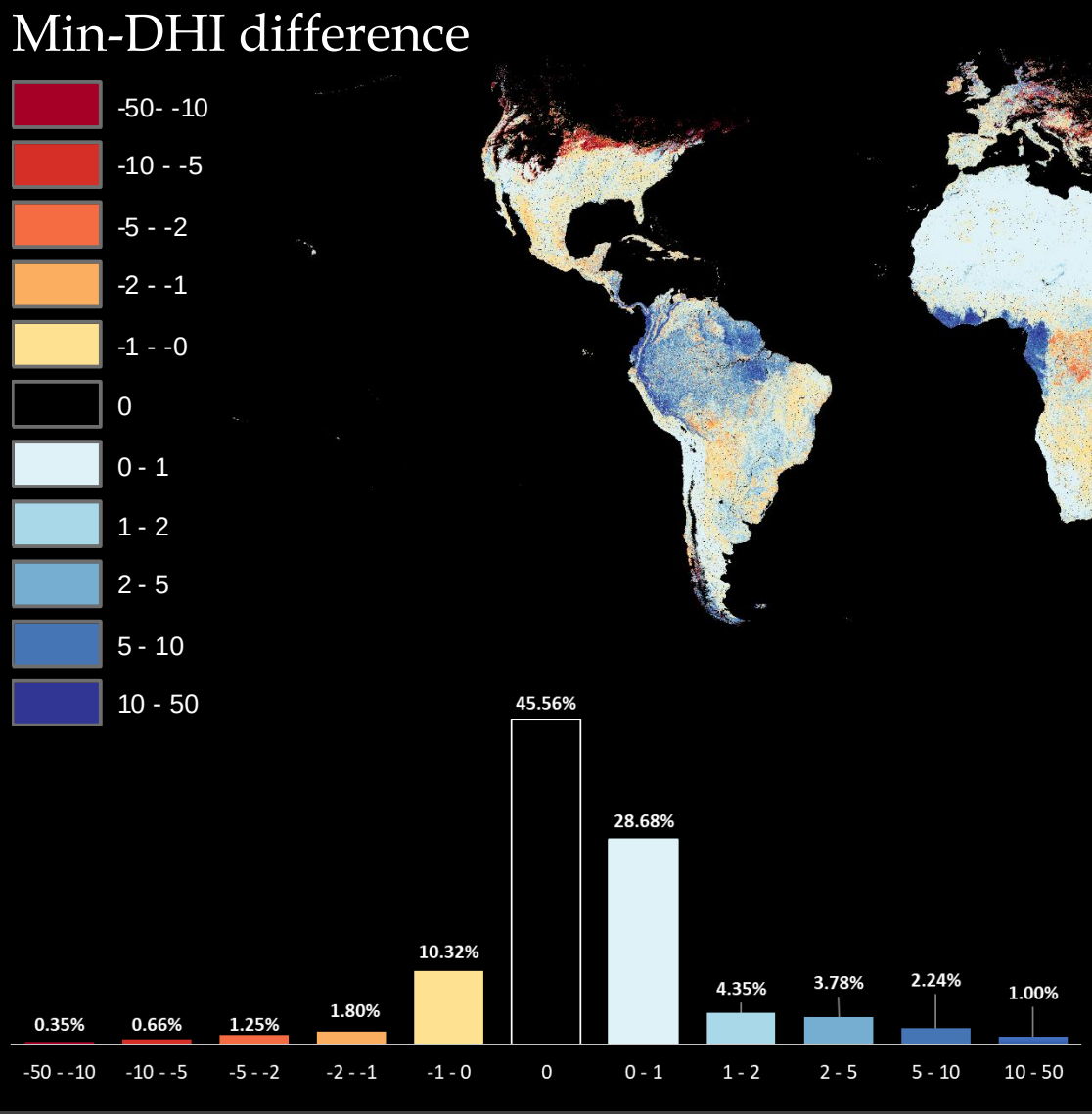
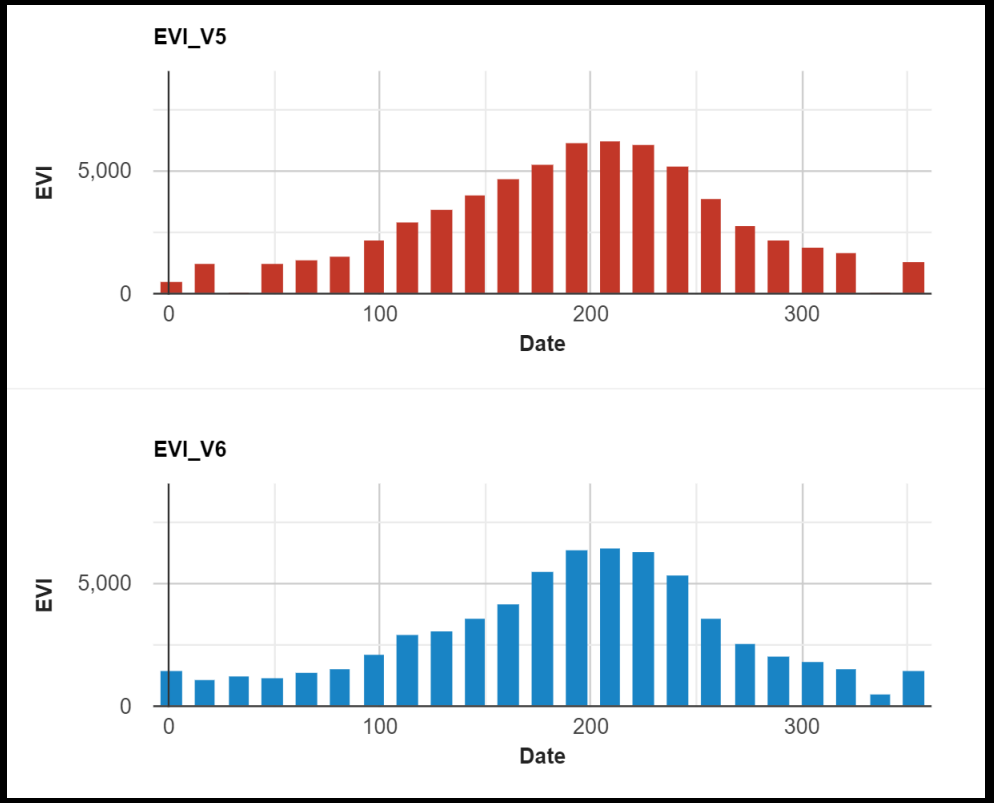
100
200
300
Date
EVI_V6
EVI
5,000
0
0
100
200
300
Date

Results



MOD.005.13A1
minus
MOD.006.13A1
for 2002-2017

Results


EVI_V5
EVI
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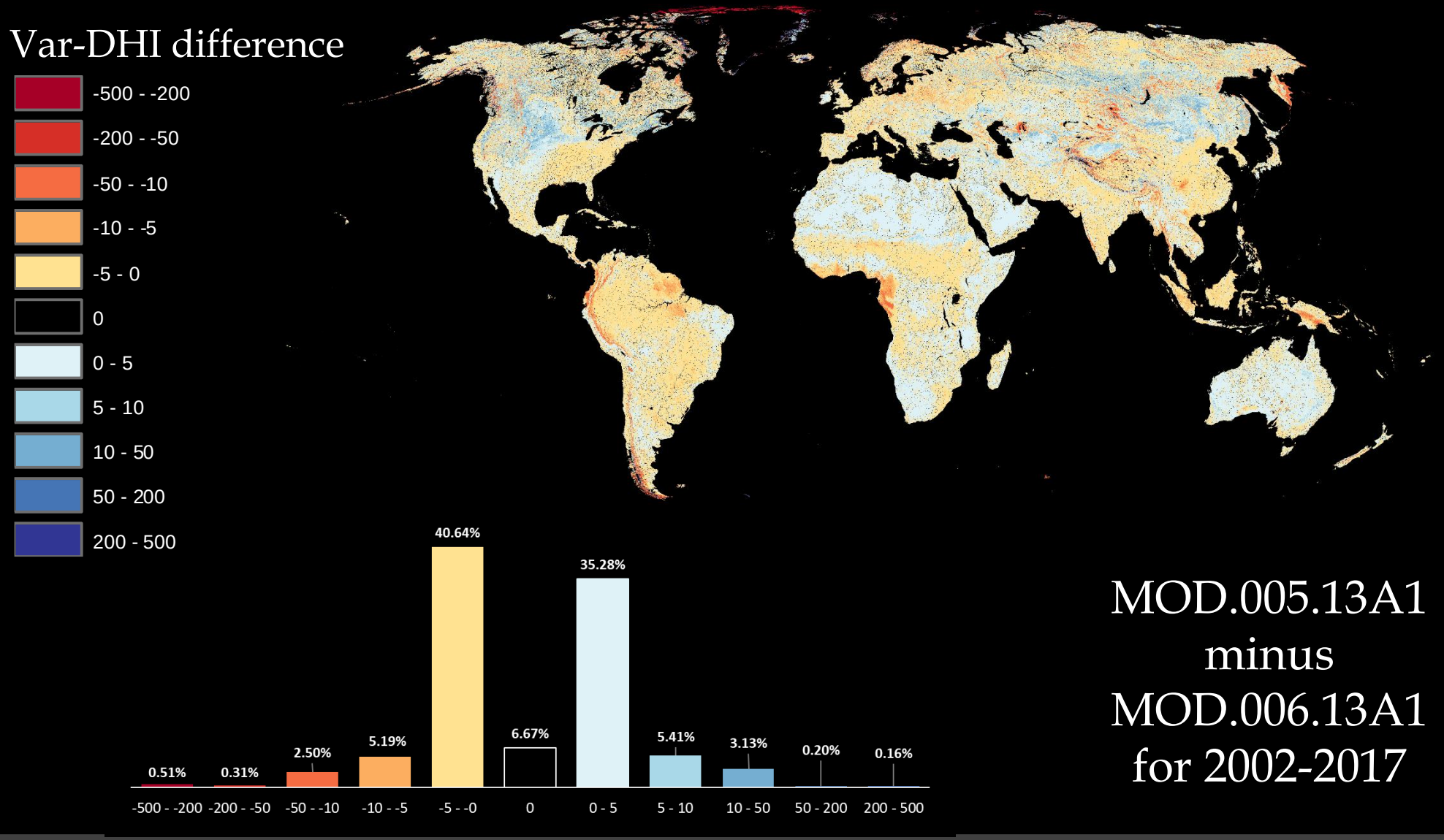
200
300
Date
EVI_V6
EVI
5,000
0
0
100
200
300
Date

Results



MOD.005.13A1
minus
MOD.006.13A1
for 2002-2017

Outline

- Part I: DHIs from MODIS collection 5 versus 6
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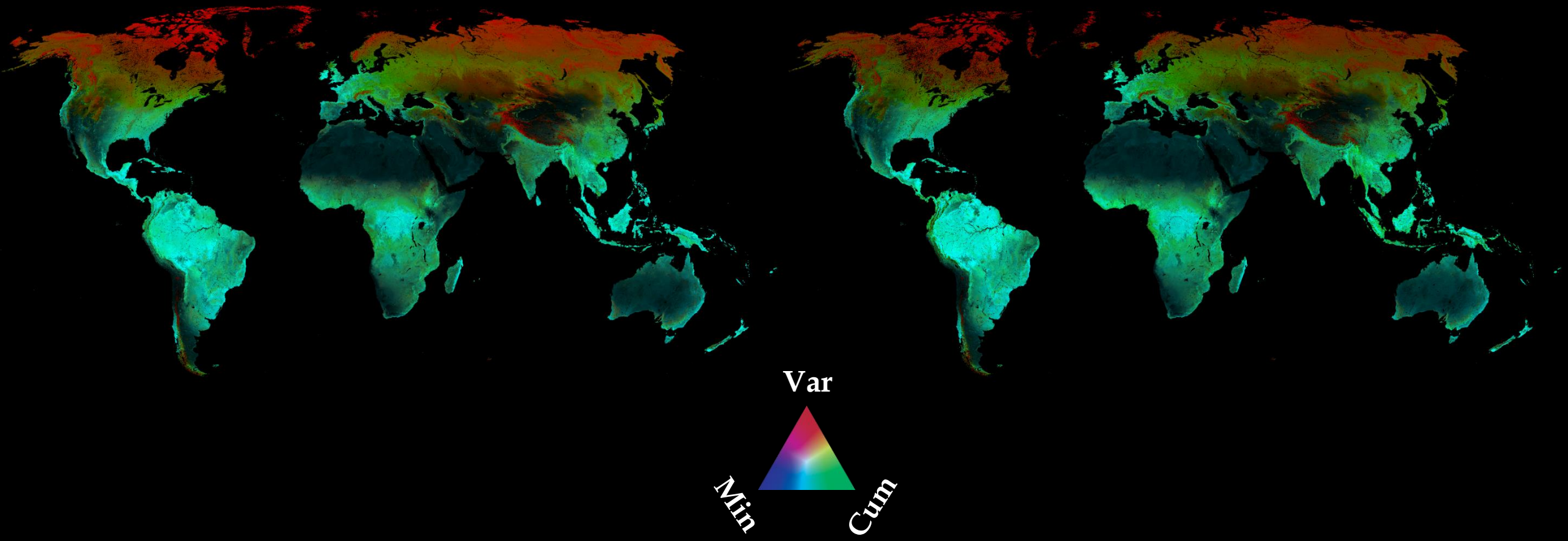
Results

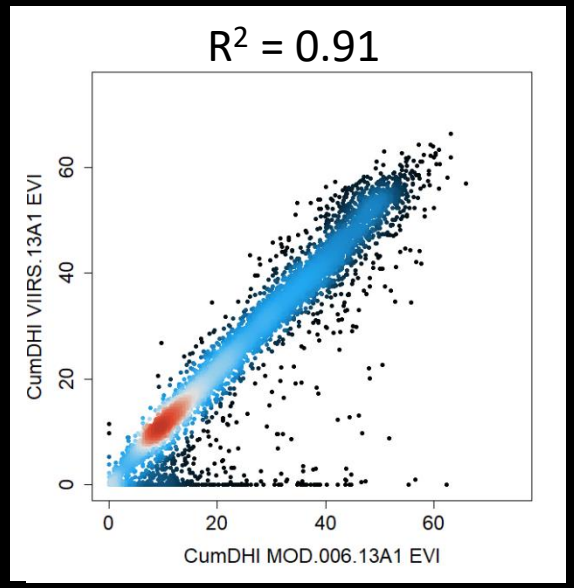
MODIS Collection 6

VIIRS

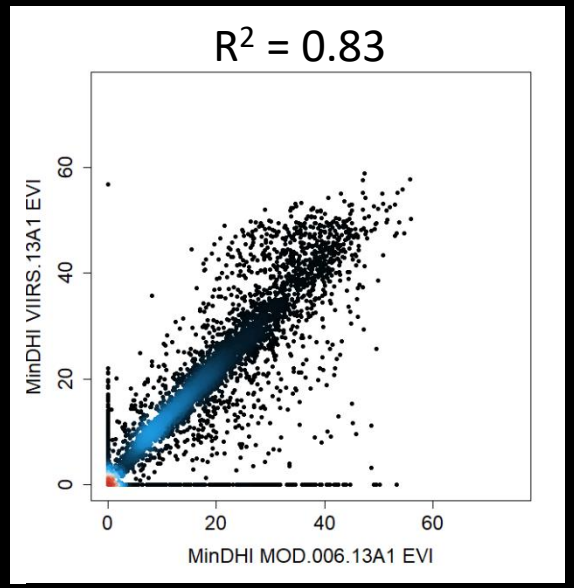


Results

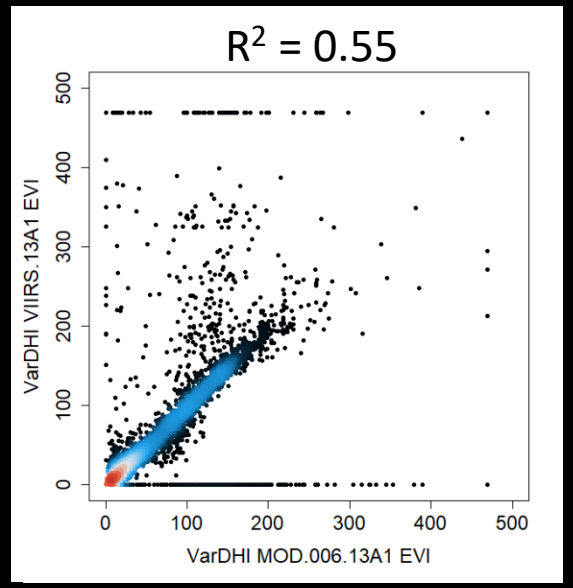
CumDHI



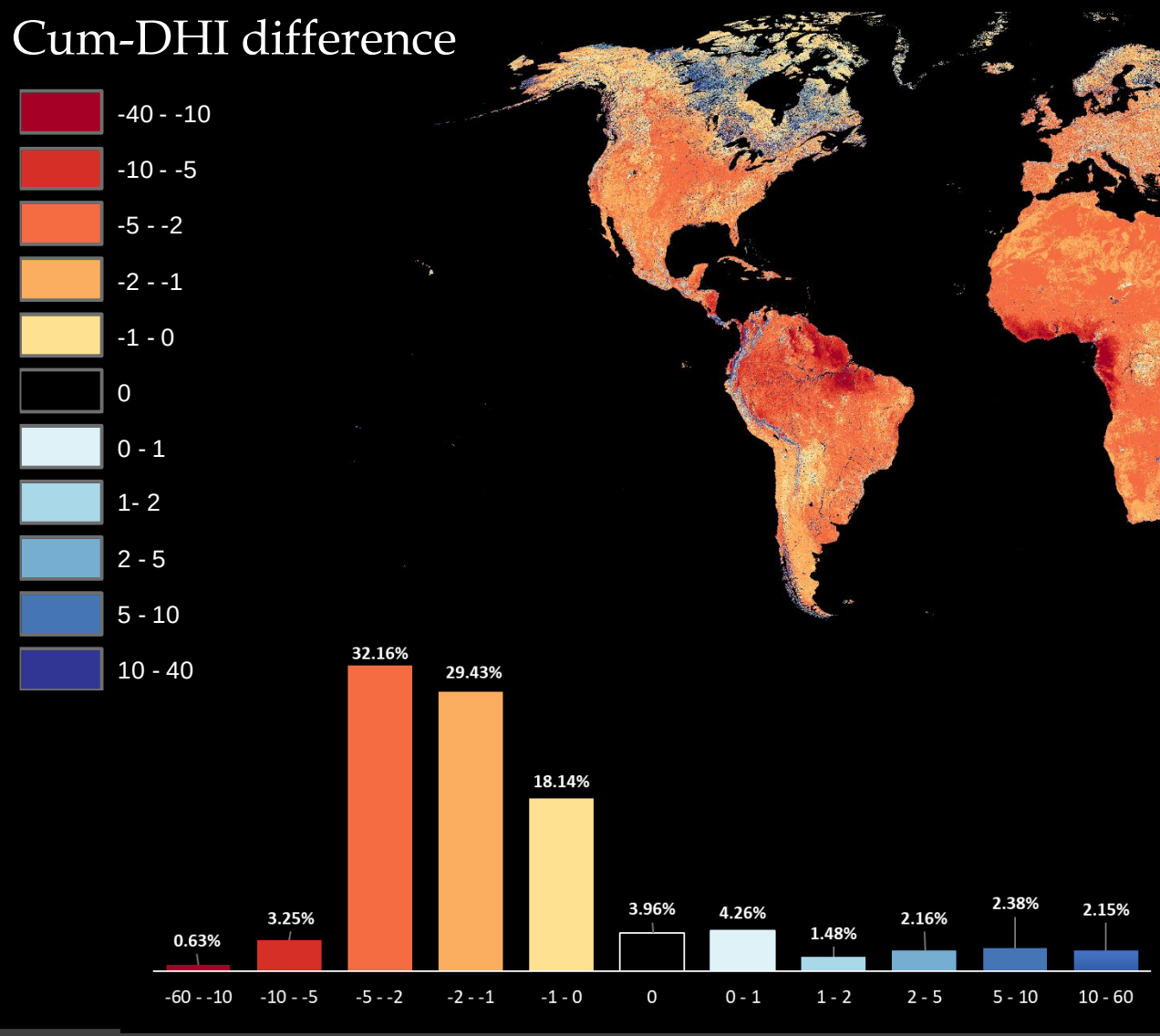
MinDHI



VarDHI

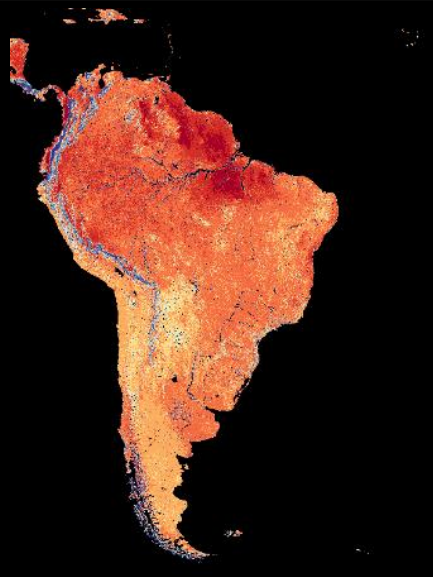


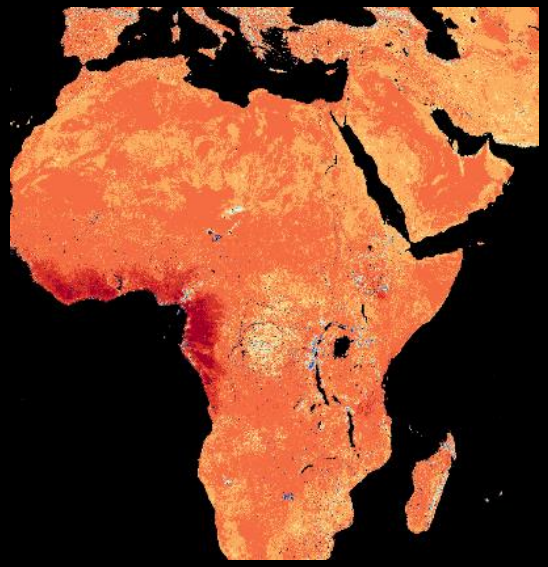
Results

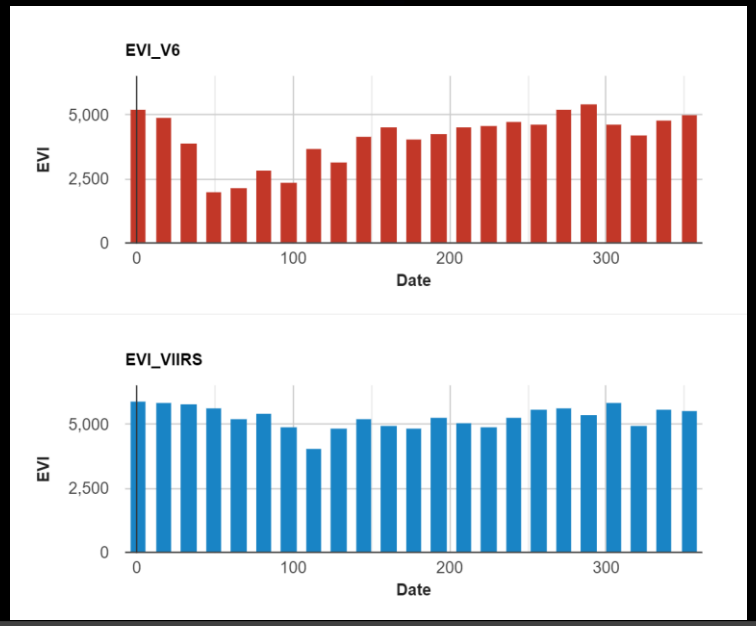


MOD.006.13A1
minus
VIIRS.VNP.13.A1
for 2012-2021

Results



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300
Date
EVI_VIIRS
EVI
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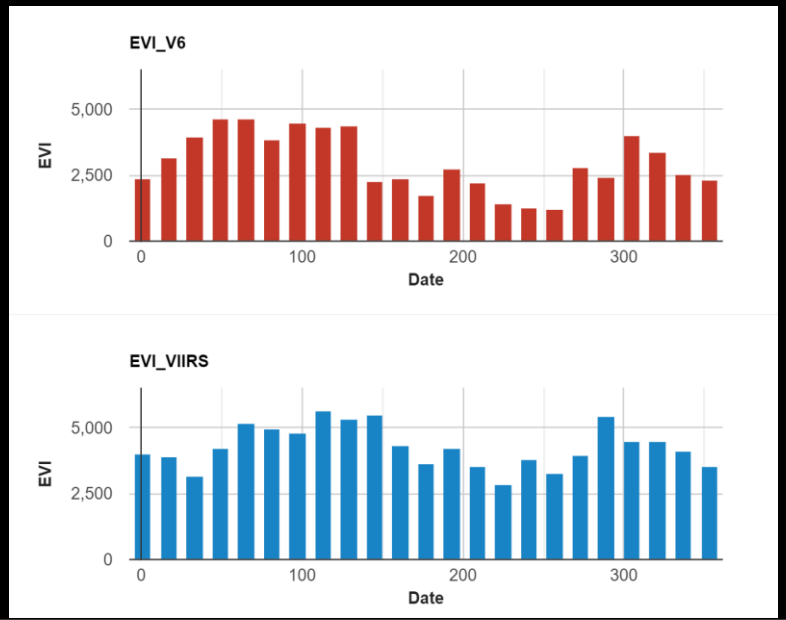
2,500
0
0
100
200
300
Date


EVI_V6
EVI
5,000
2,500
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Date
EVI_VIIRS
EVI
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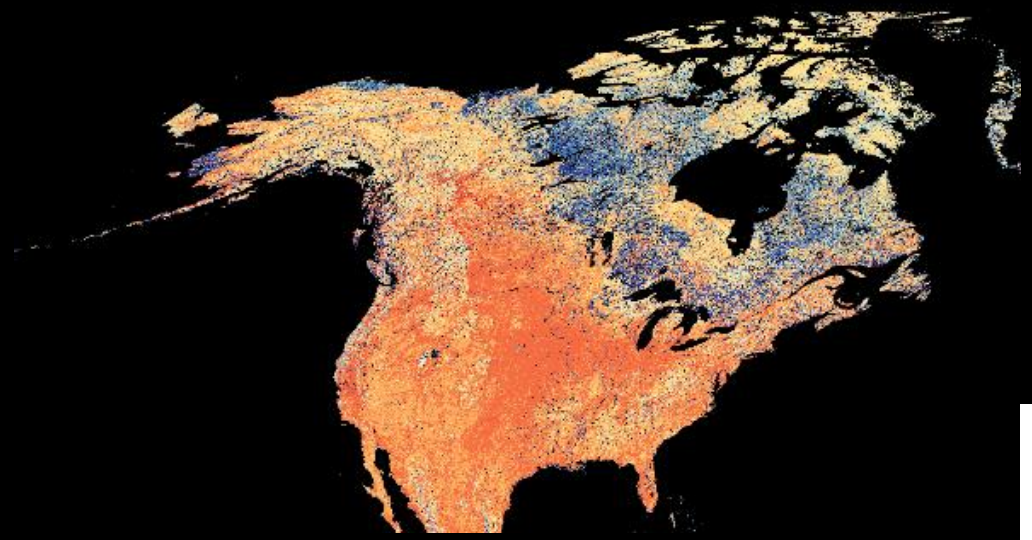
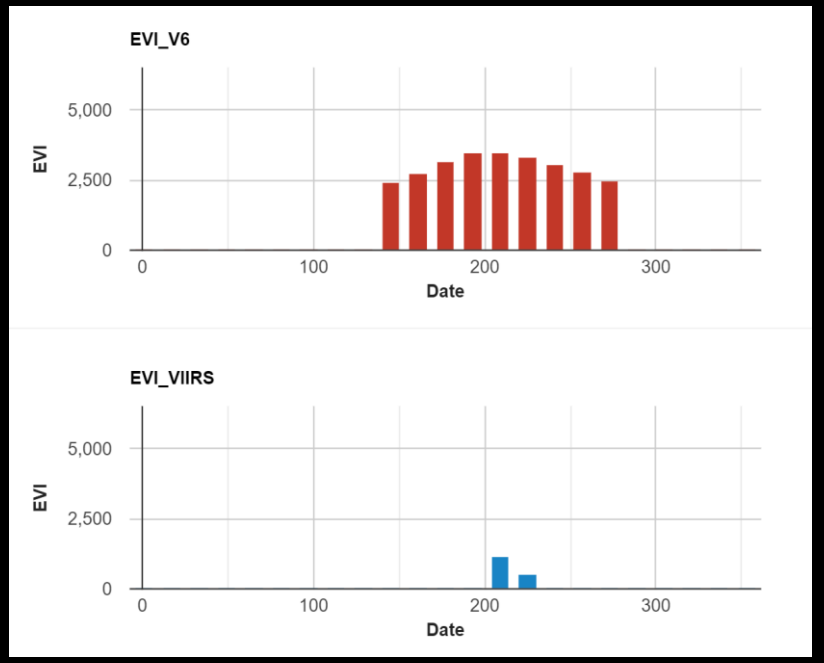
2,500
0
0
100
200
300
Date

Results




EVI_V6
EVI
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2,500
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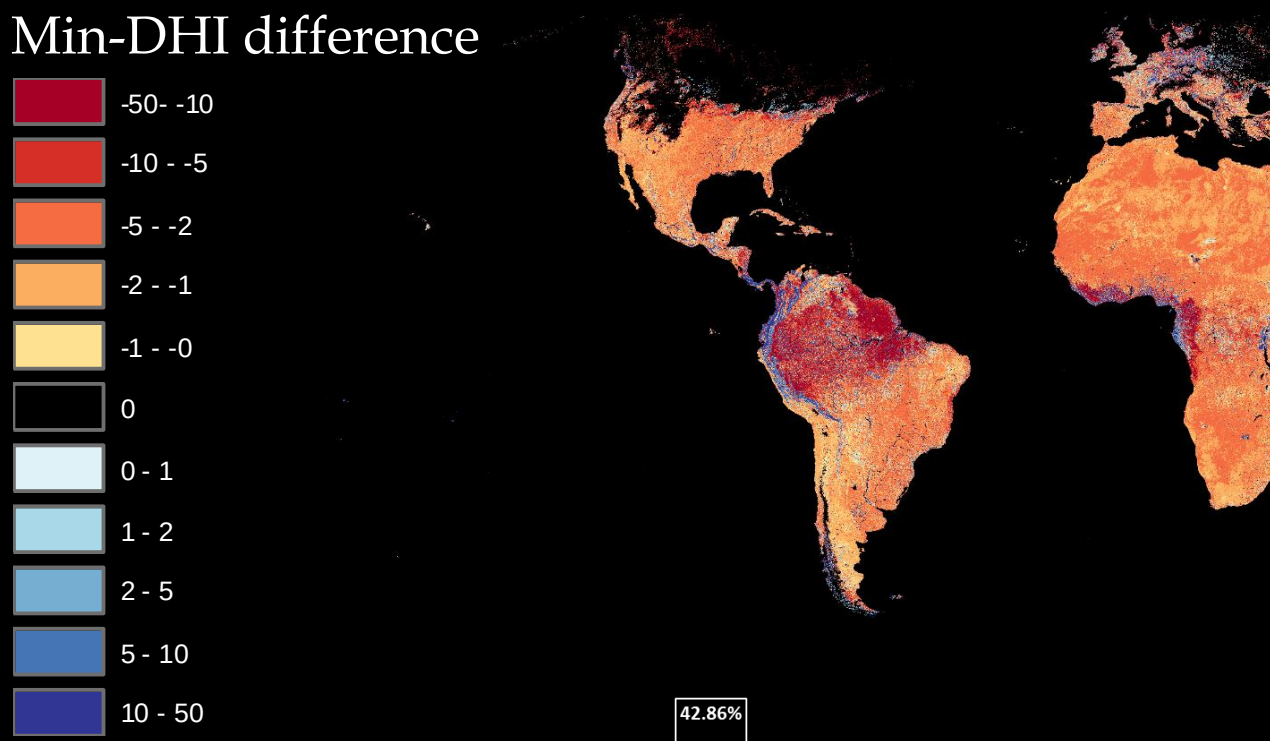
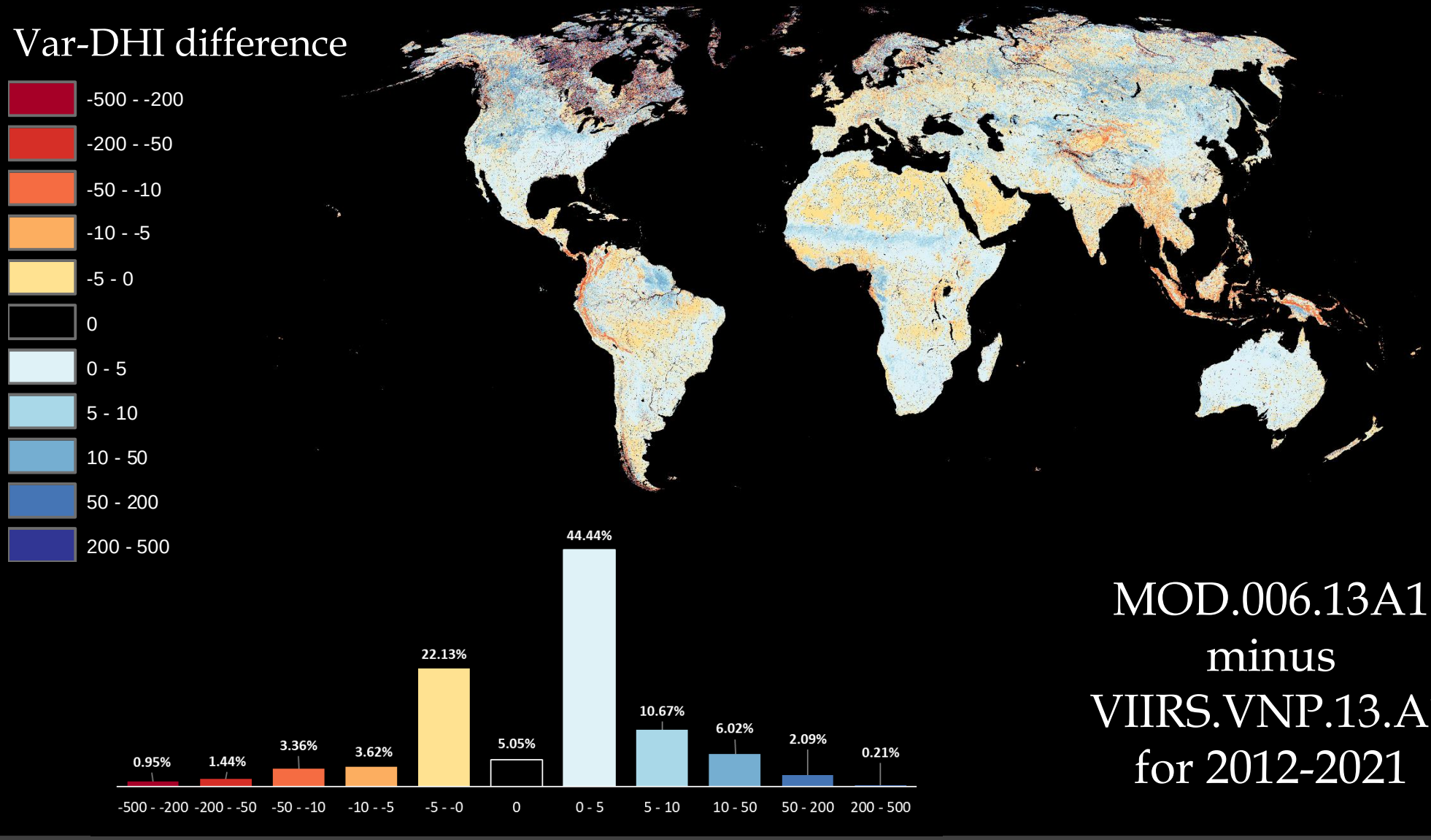
Date
EVI_VIIRS
EVI
5,000
2,500
0
0
100
200
300
Date

Results



MOD.006.13A1
minus
VIIRS.VNP.13.A1
for 2012-2021

Results



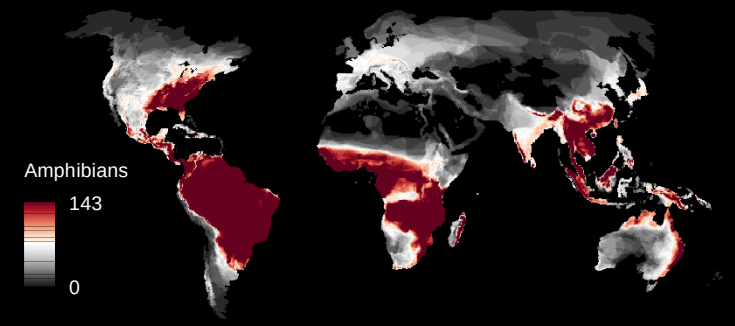
MOD.006.13A1
minus
VIIRS.VNP.13.A1
for 2012-2021

Outline

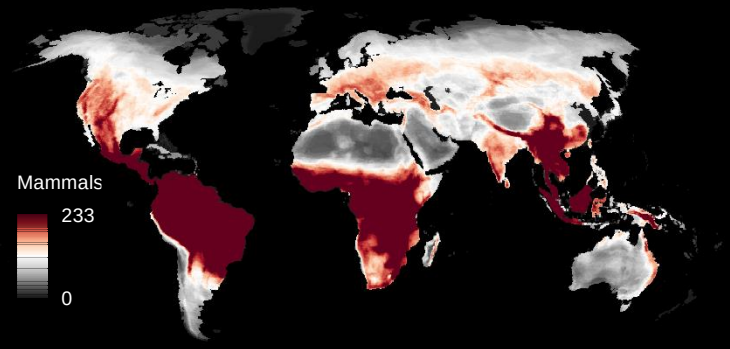
- Part I: DHIs from MODIS collection 5 versus 6
- Part II: DHIs from MODIS C6 versus VIIRS
- Part III: DHIs versus global species richness

Results

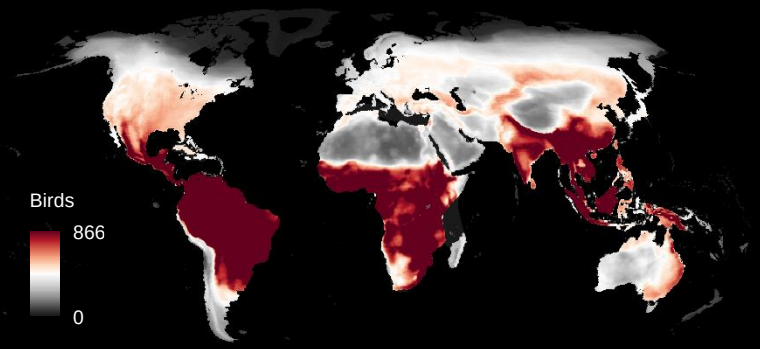
Amphibians



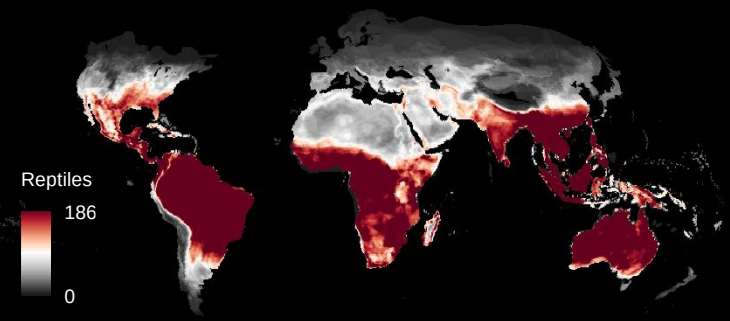
Mammals



Birds

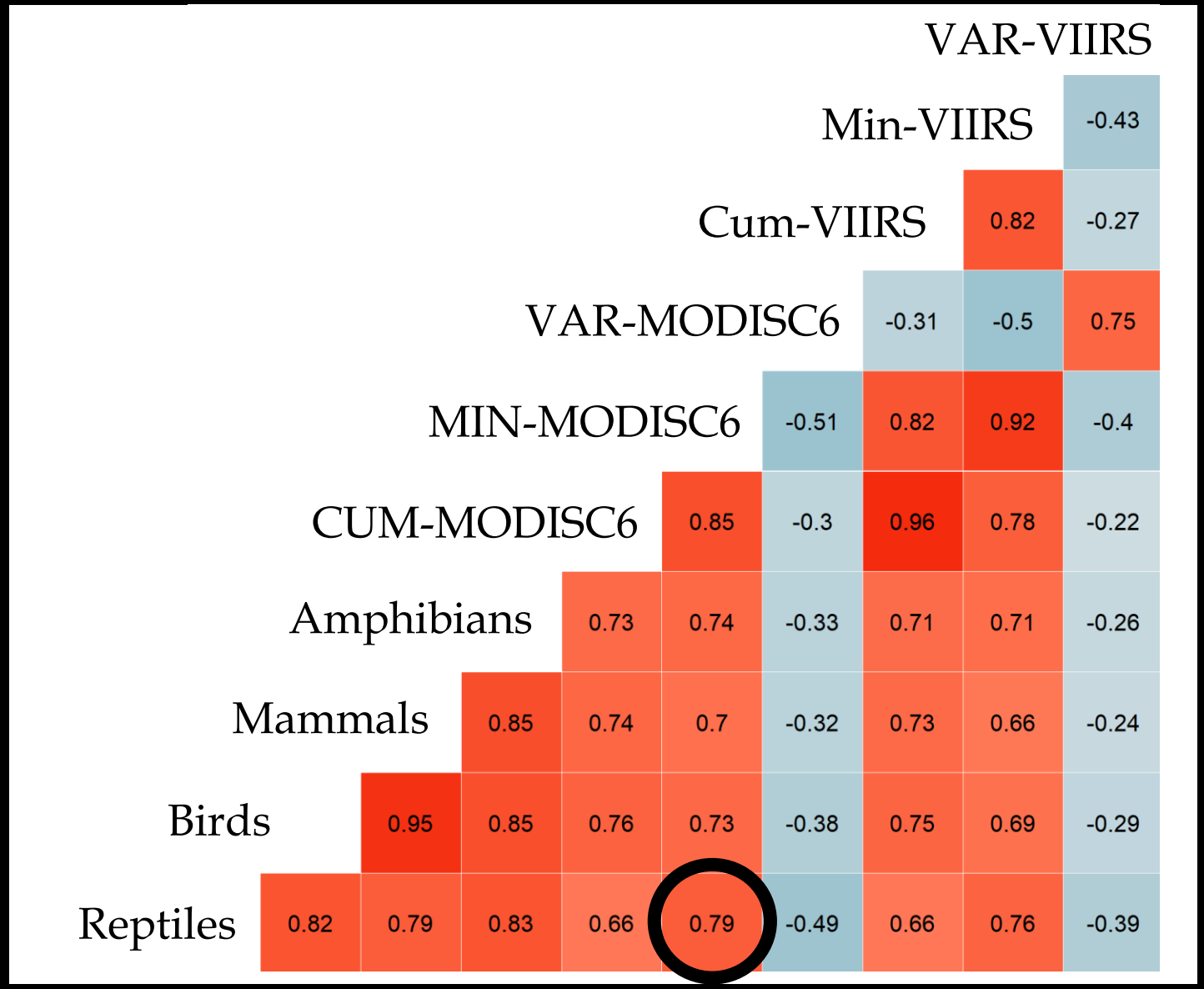


Reptiles

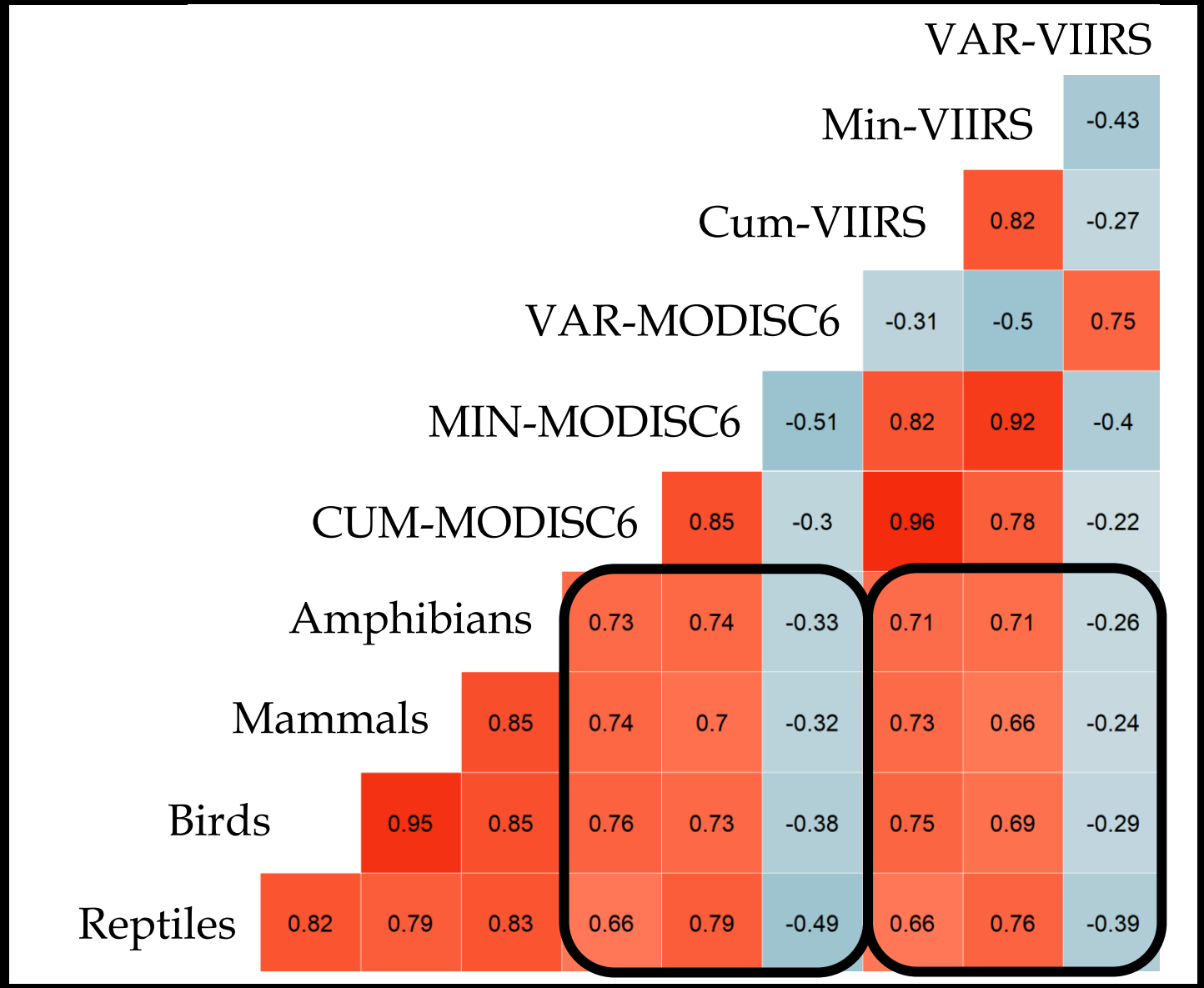


Cox, Young, Bowles, *et al.* *Nature* (2022)

Results


VAR-VIIRS
Min-VIIRS -0.43
Cum-VIIRS 0.82 -0.27
VAR-MODISC6 -0.31 -0.5 0.75
MIN-MODISC6 -0.51 0.82 0.92 -0.4
CUM-MODISC6 0.85 -0.3 0.96 0.78 -0.22
Amphibians 0.73 0.74 -0.33 0.71 0.71 -0.26
Mammals 0.85 0.74 0.7 -0.32 0.73 0.66 -0.24
Birds 0.95 0.85 0.76 0.73 -0.38 0.75 0.69 -0.29
Reptiles 0.82 0.79 0.83 0.66 0.79 -0.49 0.66 0.76 -0.39

Results


VAR-VIIRS
Min-VIIRS -0.43
Cum-VIIRS 0.82 -0.27
VAR-MODISC6 -0.31 -0.5 0.75
MIN-MODISC6 -0.51 0.82 0.92 -0.4
CUM-MODISC6 0.85 -0.3 0.96 0.78 -0.22
Amphibians 0.73 0.74 -0.33 0.71 0.71 -0.26
Mammals 0.85 0.74 0.7 -0.32 0.73 0.66 -0.24
Birds 0.95 0.85 0.76 0.73 -0.38 0.75 0.69 -0.29
Reptiles 0.82 0.79 0.83 0.66 0.79 -0.49 0.66 0.76 -0.39

Conclusions

- Part I: DHIs from MODIS collection 5 versus 6
  - Major differences in some regions!
  - Recommendation: use MODIS collection 6 DHIs
  - Composite DHIs ready for:
    - MODIS 250, 500, 1000-m NDVI and EVI
    - MODIS 500-m LAI, FPAR, and GPP
  - We are happy to share!

Conclusions

- Part II: DHIs from MODIS C6 versus VIIRS
  - Major differences in large parts of the globe
  - Recommendation: use MODIS DHIs for now
  - Composite DHIs ready for:
    - VIIRS 500-m NDVI, EVI

Conclusions

- Part III: DHIs versus global species richness
  - The DHIs predict global richness of all four tetrapod taxa well

Conclusions

- Part III: DHIs versus global species richness
  - The DHIs predict global richness of all four tetrapod taxa well

Hobi, 2017, *Remote Sensing of Environment*
Radeloff, 2019, *Remote Sensing of Environment*
Hobi, 2021, *Ecological Indicators*
Rapacciuolo, 2017, *Global Ecology and Biogeography*
Coops, 2018, *Scientific Reports*
Marin, 2018, *Proceedings of the Royal Society B*
Coops, 2019, *Ecological Indicators*

Rapacciulo, 2019, *Nature Ecology and Evolution*
Suttidate, 2019, *Remote Sensing of Environment*
Razenkova, 2020, *Scientific Reports*
Silveira, 2021, *Remote Sensing of Environment*
Silveira, 2022, *Ecological Applications*
Suttidate, 2021, *Global Ecology and Conservation*
Carroll, 2022, *Ecological Applications*

Conclusions

Richness

- Mammal richness / Xinjang
- Bird diversity / France
- Raptor richness / Americas
- …

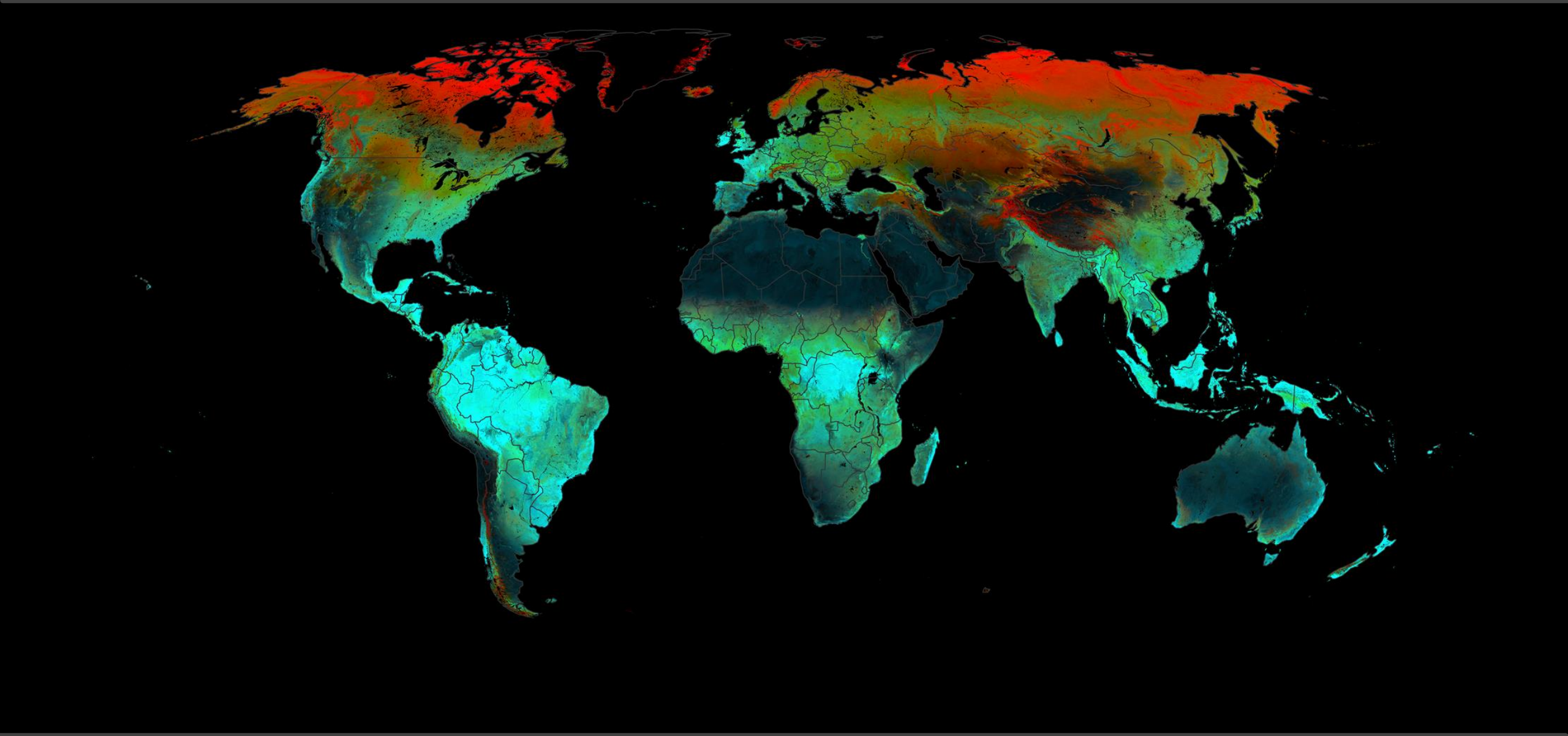
Species distribution models

- Brown Bears / Cantabria
- Andean Condor / Argentina
- Grey Foxes / US
- Philippine Eagle / Philippines
- Purple-winged Ground Dove / Brazil
- Mountain Tapir / Peru
- Madagascar Serpent Eagle / Madagascar
- …

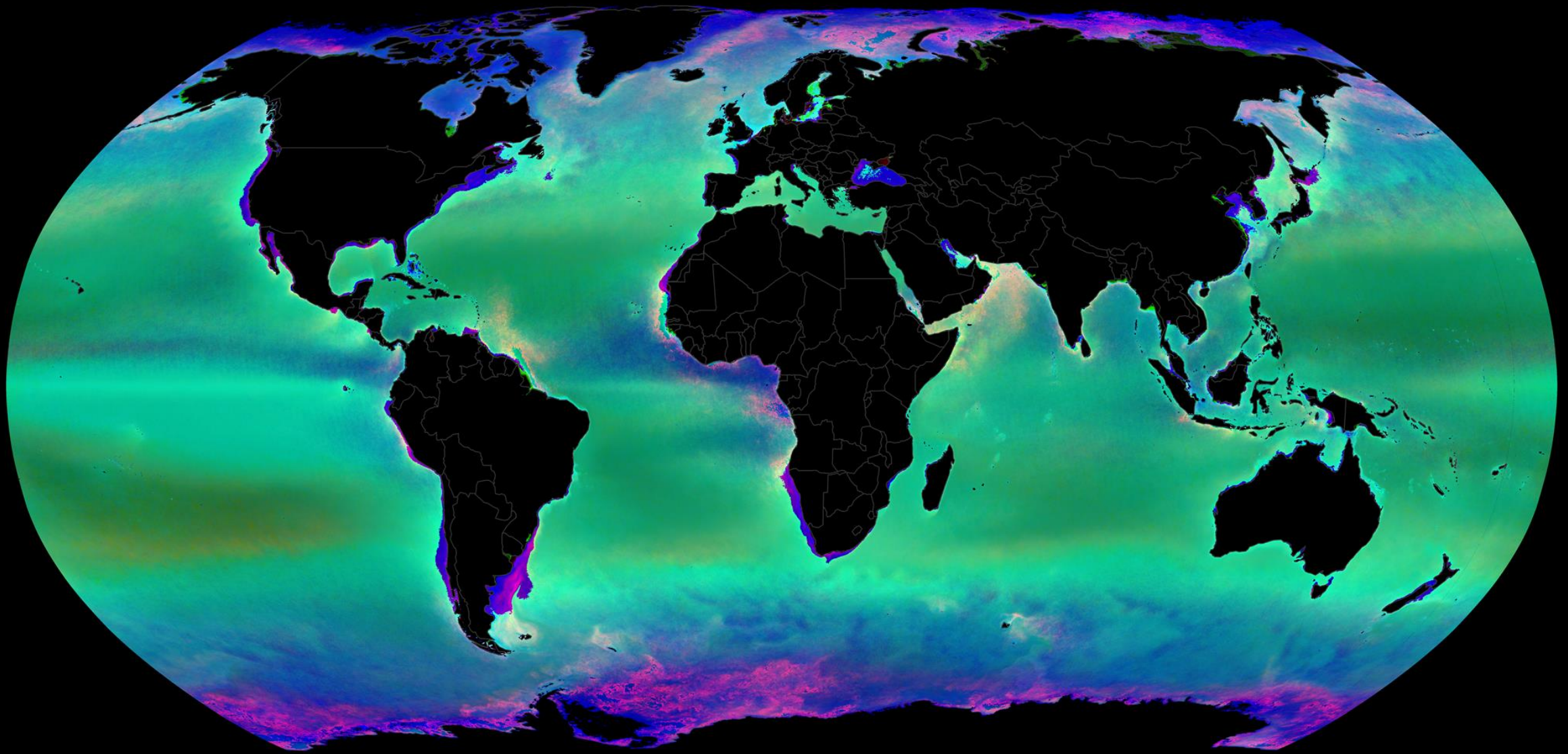




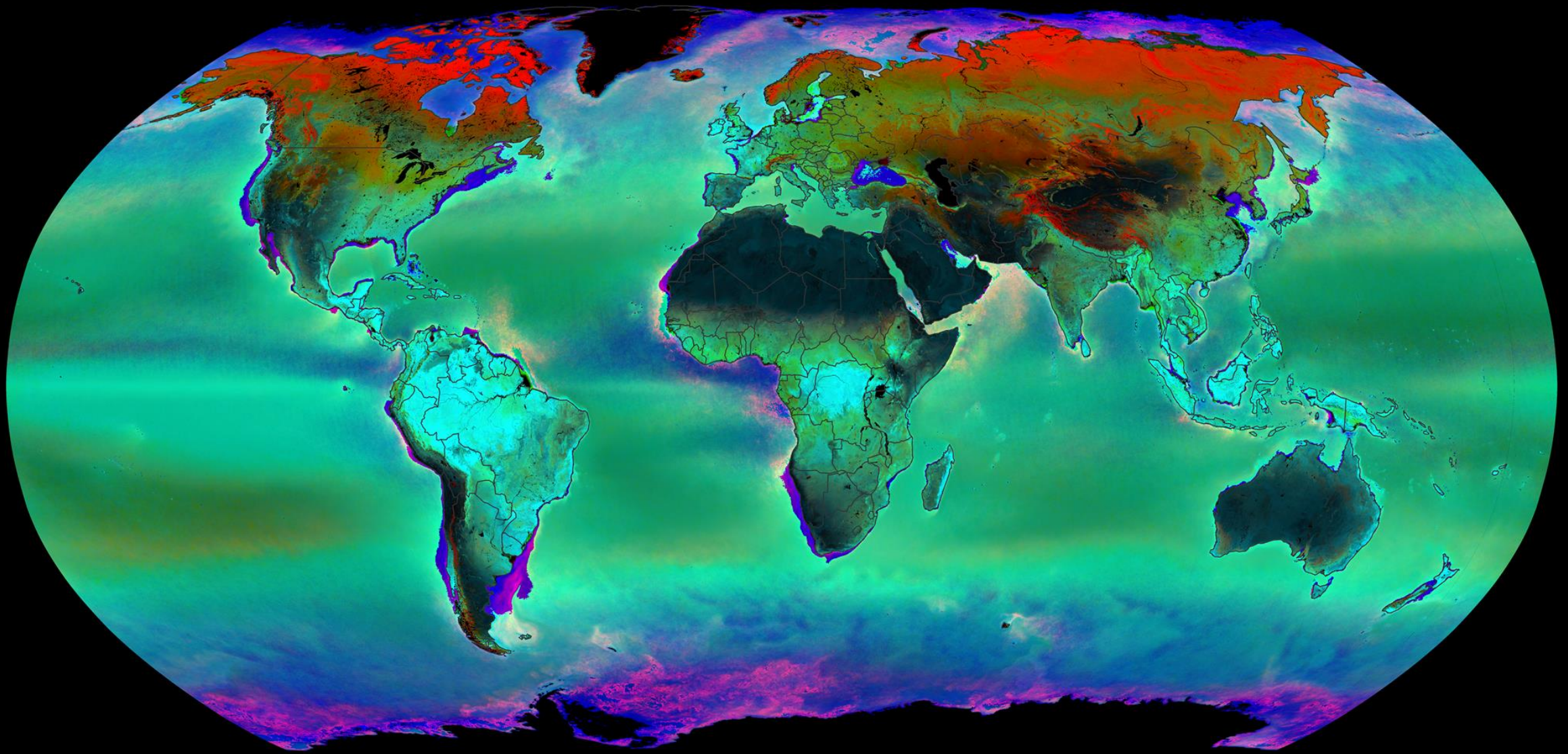
Conclusions



Conclusions



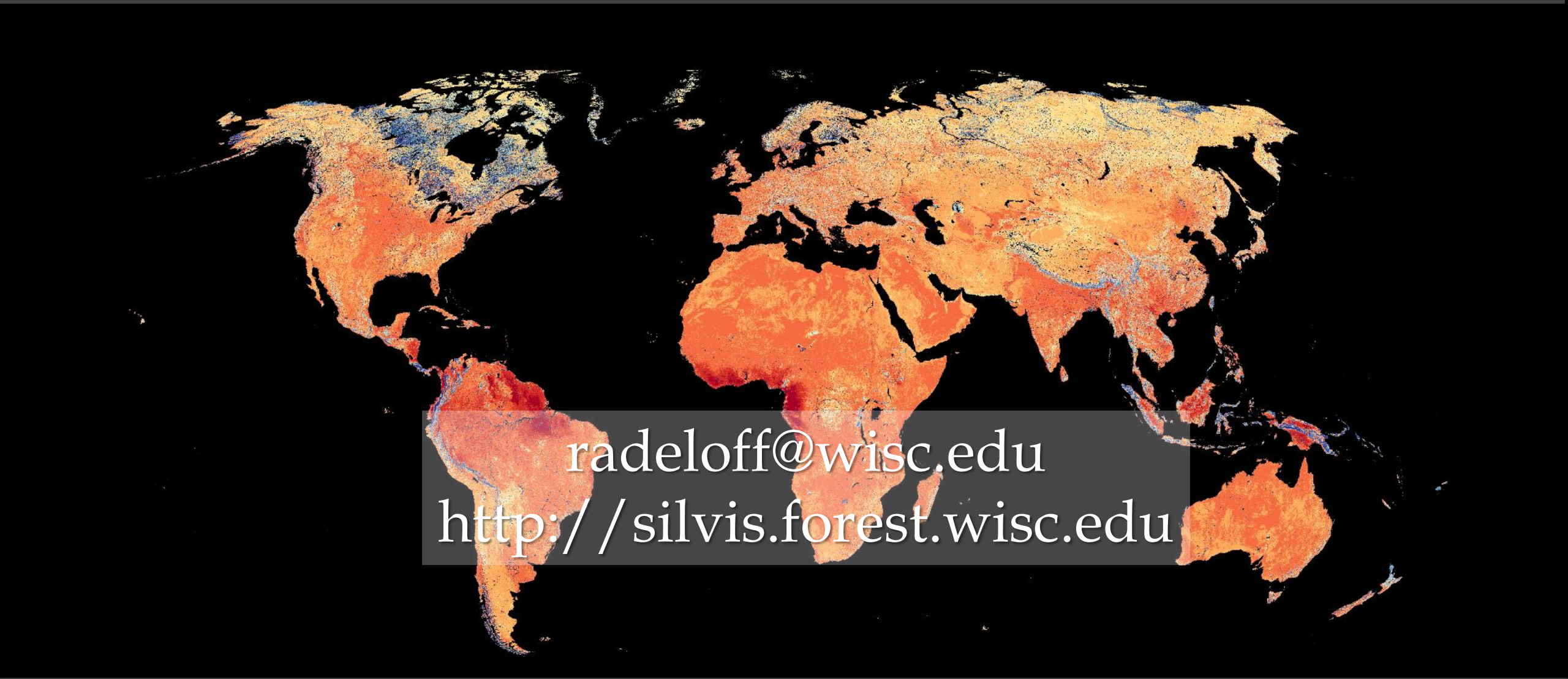
Conclusions



Conclusions

- The biodiversity community has relied on satellite products designed for non-biodiversity purposes
- There is a need for products that are designed for biodiversity science and conservation
- The DHIs are such a product

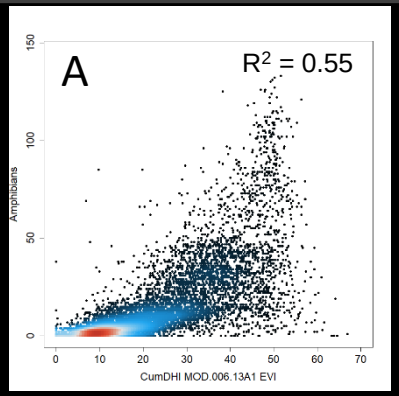
THANK YOU!!!

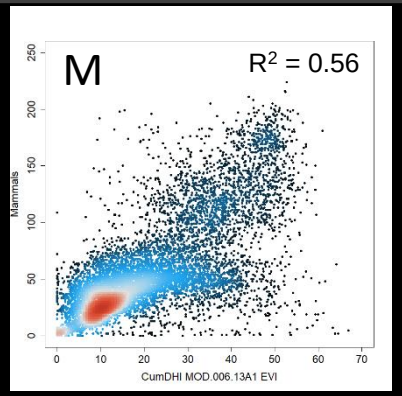


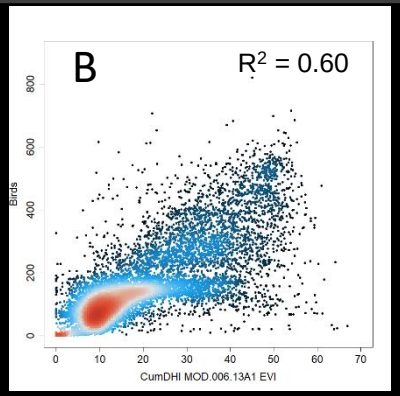
radeloff@wisc.edu
http://silvis.forest.wisc.edu

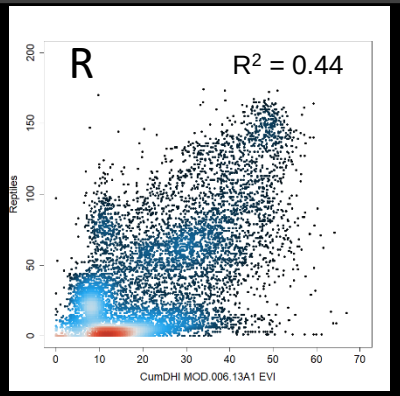
MOD006. 13A1.EVI **DHIs** versus **Richness** (2002-2021)

CumDHI

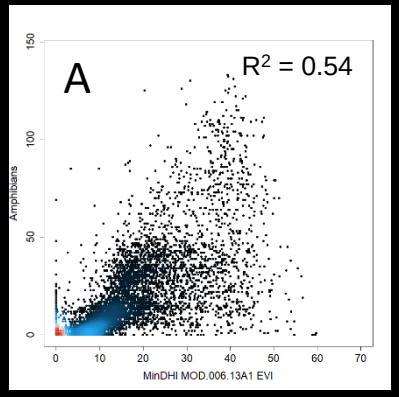


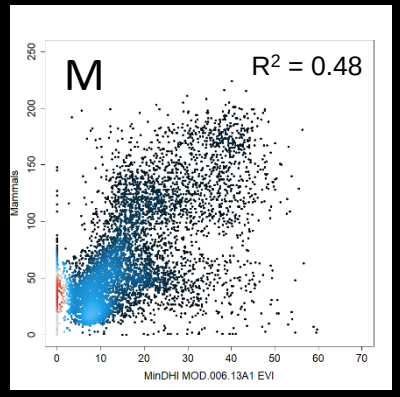


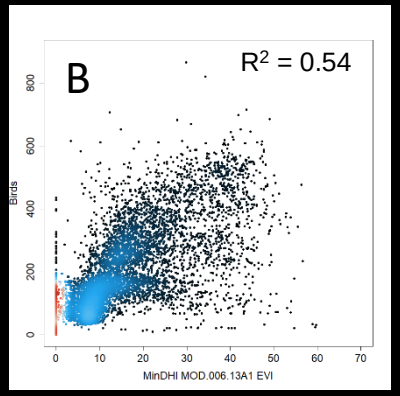


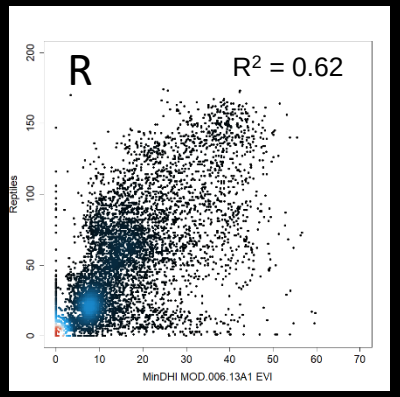


MinDHI









VarDHI