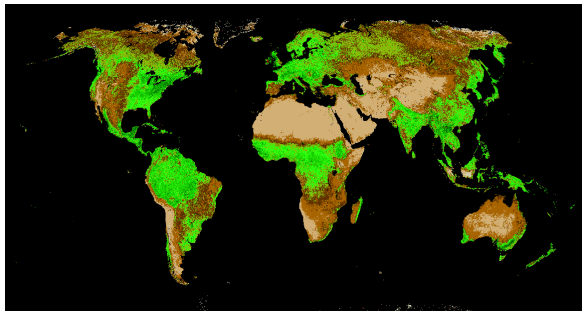
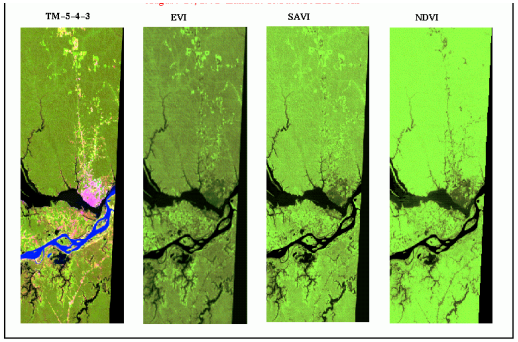


MODIS Vegetation Indices



Alfredo Huete

Kamel Didan

Tomoaki Miura

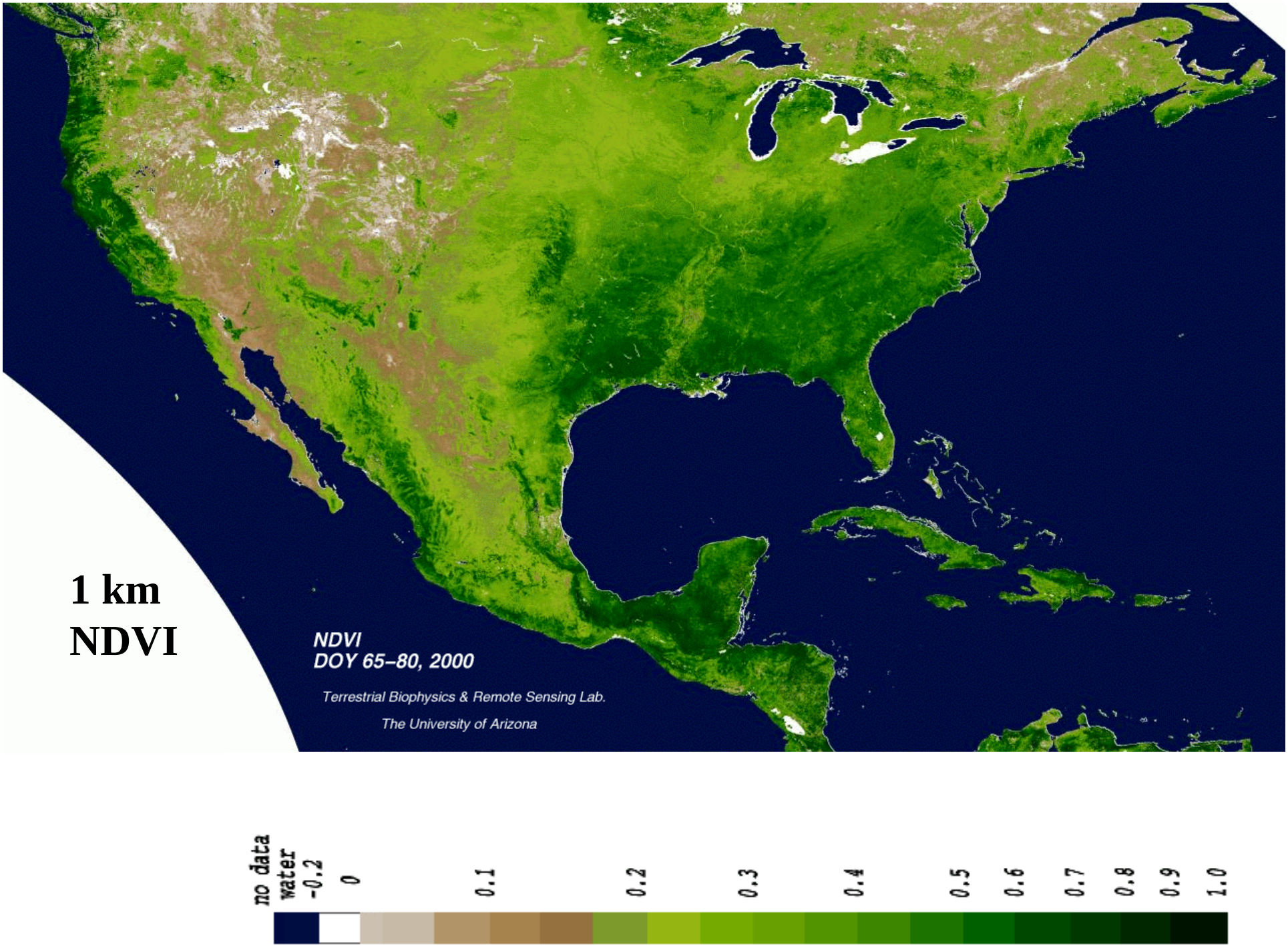
Wim van Leeuwen

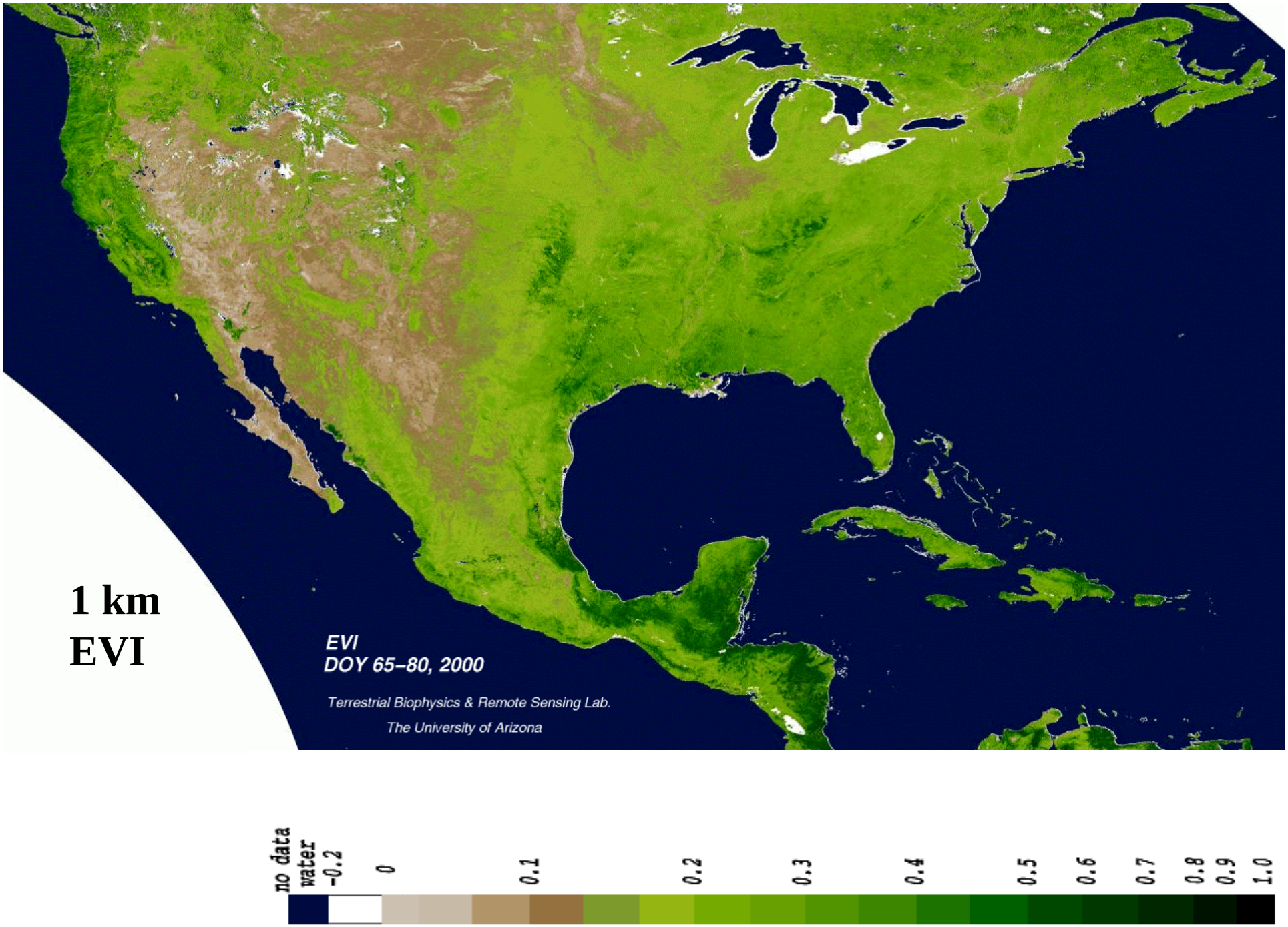
Terrestrial Biophysics and Remote Sensing lab

University of Arizona

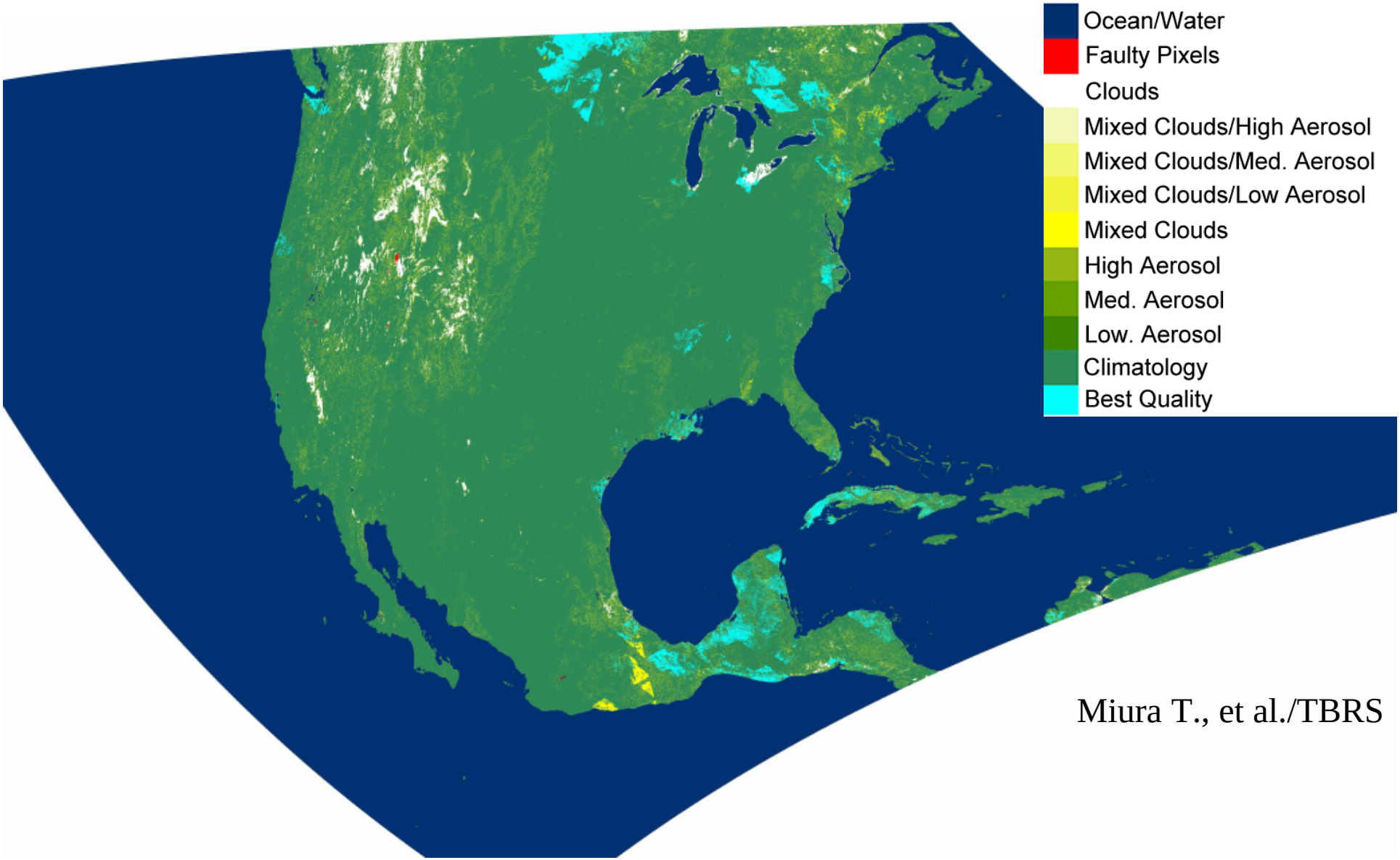
MODIS Standard VI Products
MOD 13A2
1 km and 16-day

- Normalized Difference Vegetation Index (NDVI)
- Enhanced Vegetation Index (EVI)
- Quality Analysis (QA) Image


1 km
NDVI
NDVI
DOY 65–80, 2000
Terrestrial Biophysics & Remote Sensing Lab.
The University of Arizona
no data
water
-0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

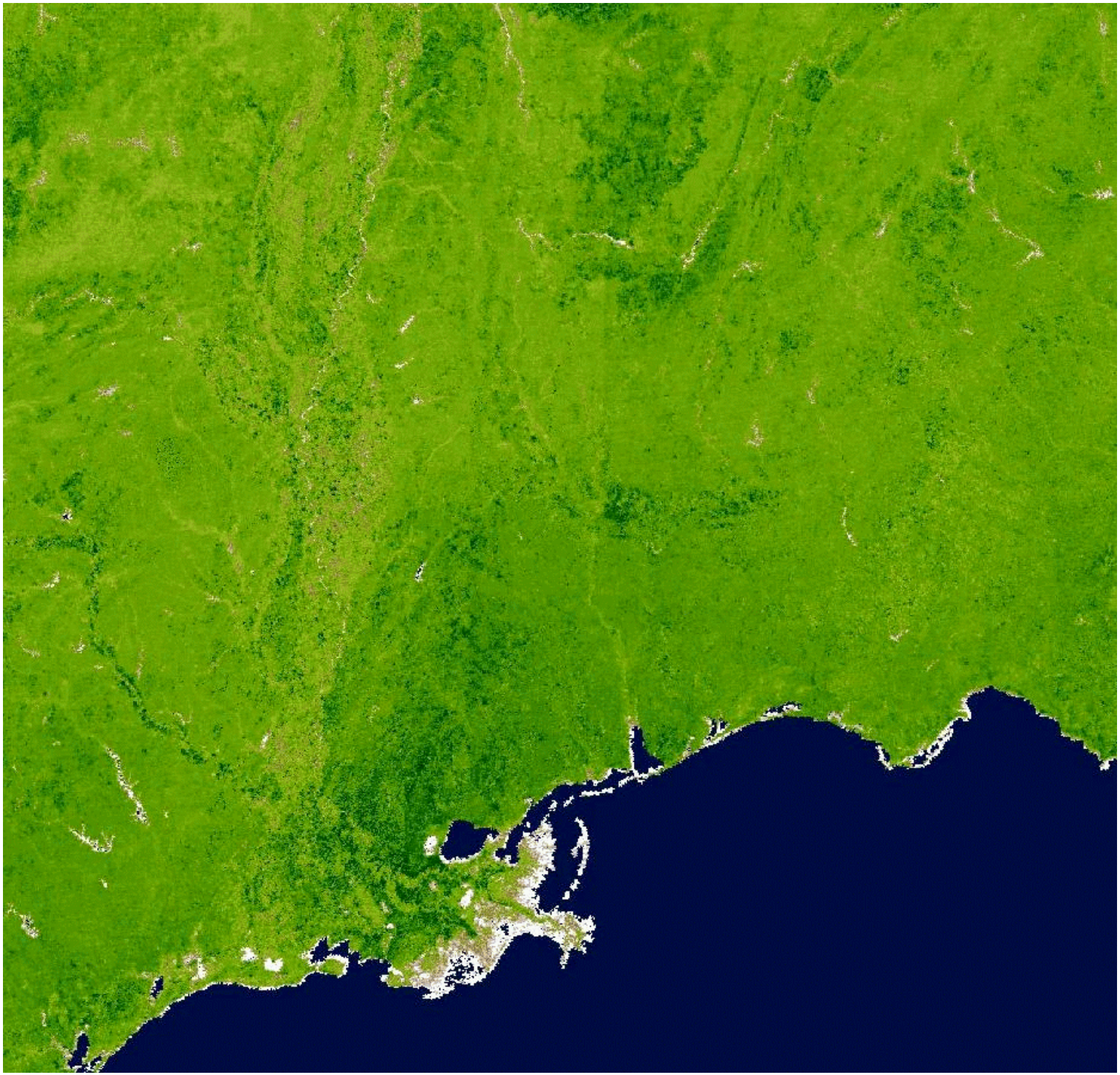

1 km
EVI
EVI
DOY 65–80, 2000
Terrestrial Biophysics & Remote Sensing Lab.
The University of Arizona
no data
water
-0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

NDVI QA



Miura T., et al./TBRS

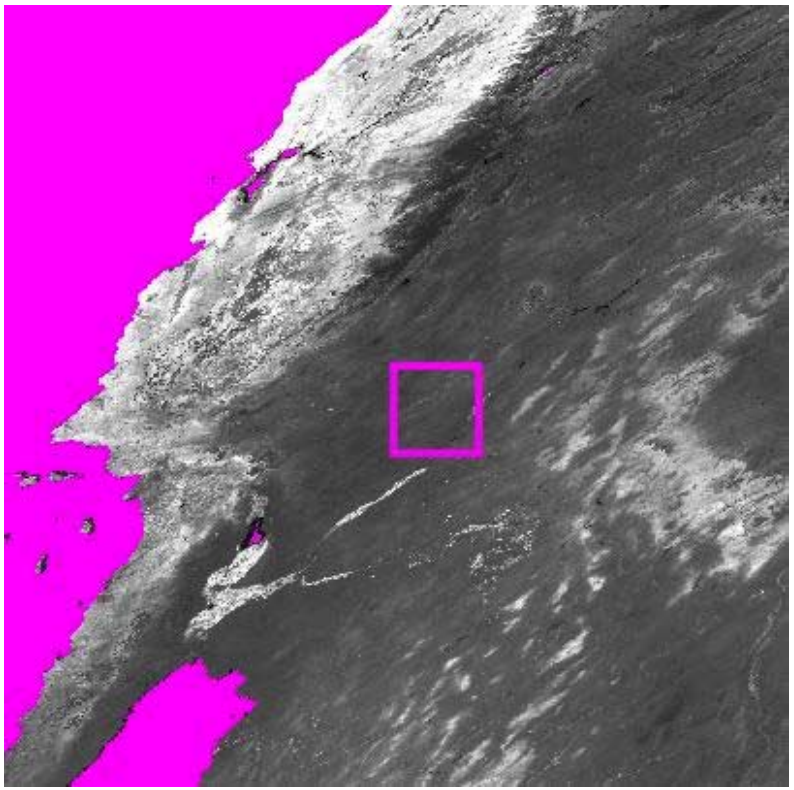
EVI,
1km

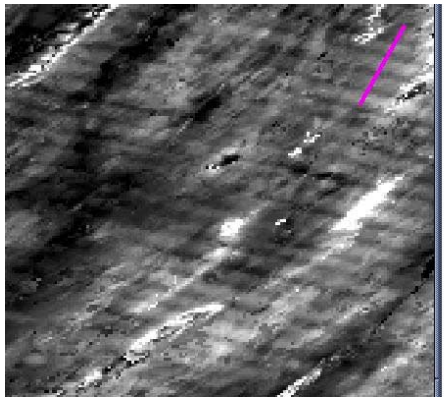


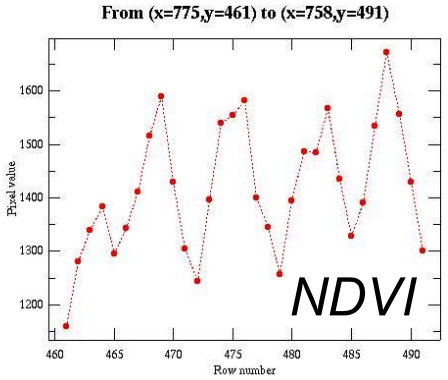
MOD13A2: Scan Noise

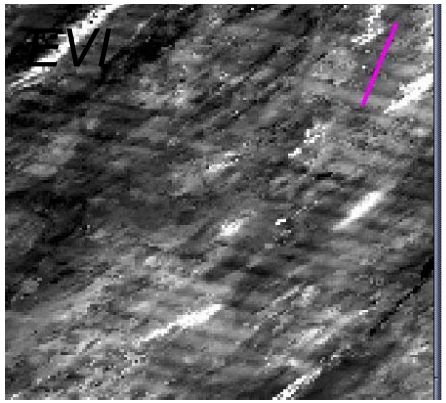
Case No.	SD_MOD13_00131b
Tile ID	MOD13A2.A2000065.h08v05.hdf
SDS	NDVI, EVI, and View Zenith Angle

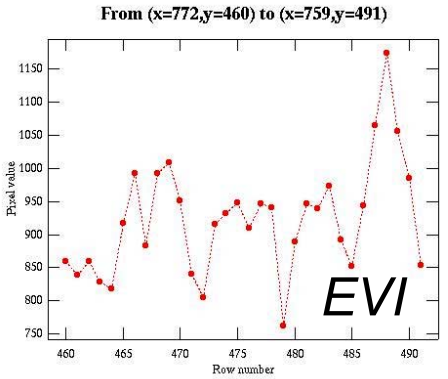
Description: The striping observed in L1B propagates into NDVI and EVI. The effects of the striping on the compositing algorithm can also be seen in the average view zenith angle SDS.

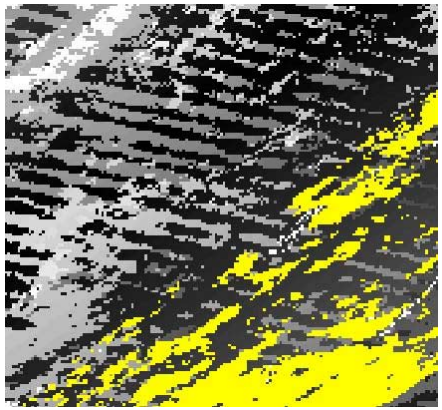










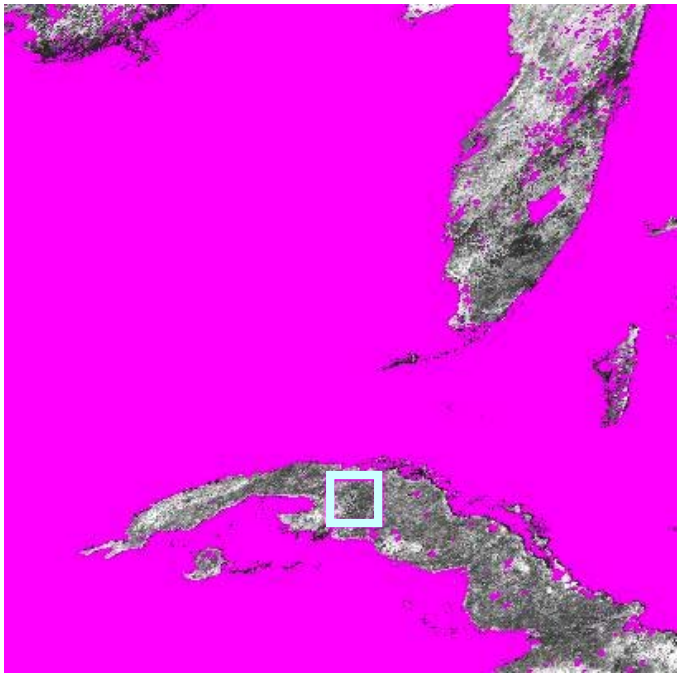


View Zenith Angle

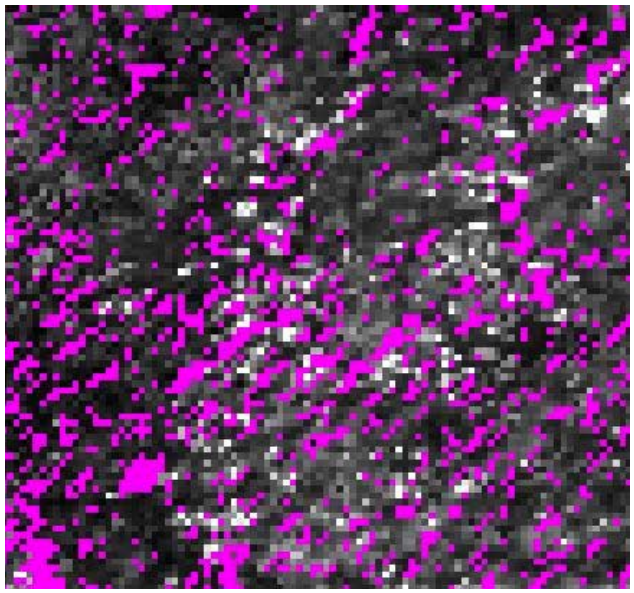
MOD13A2: Blue Reflectance and EVI

Case No.	TM_MOD13A2
Tile ID	MOD13A2.A2000081.h10v06.hdf
SDS	EVI and Blue Reflectance

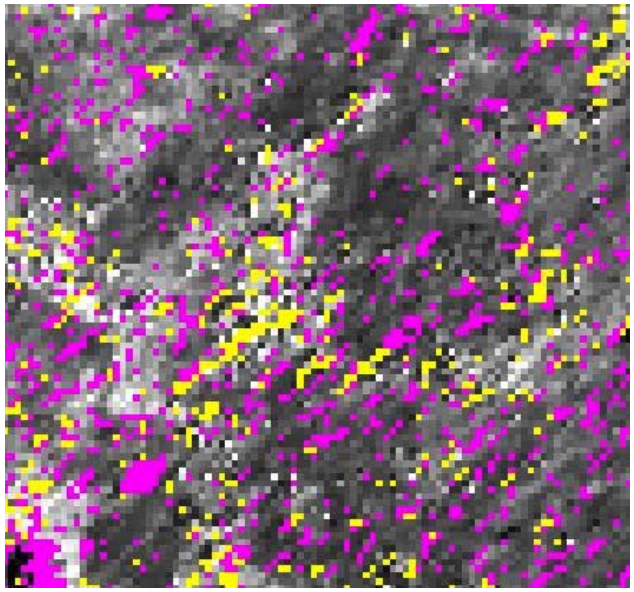
Description: Composite Blue reflectance have many missing data, which propagate to EVI. The missing blue reflectance was caused by both the blue band quality and the compositing algorithm. The compositing algorithm has been updated by Kamel Didan and a new code is currently being baselined at MODAPS.

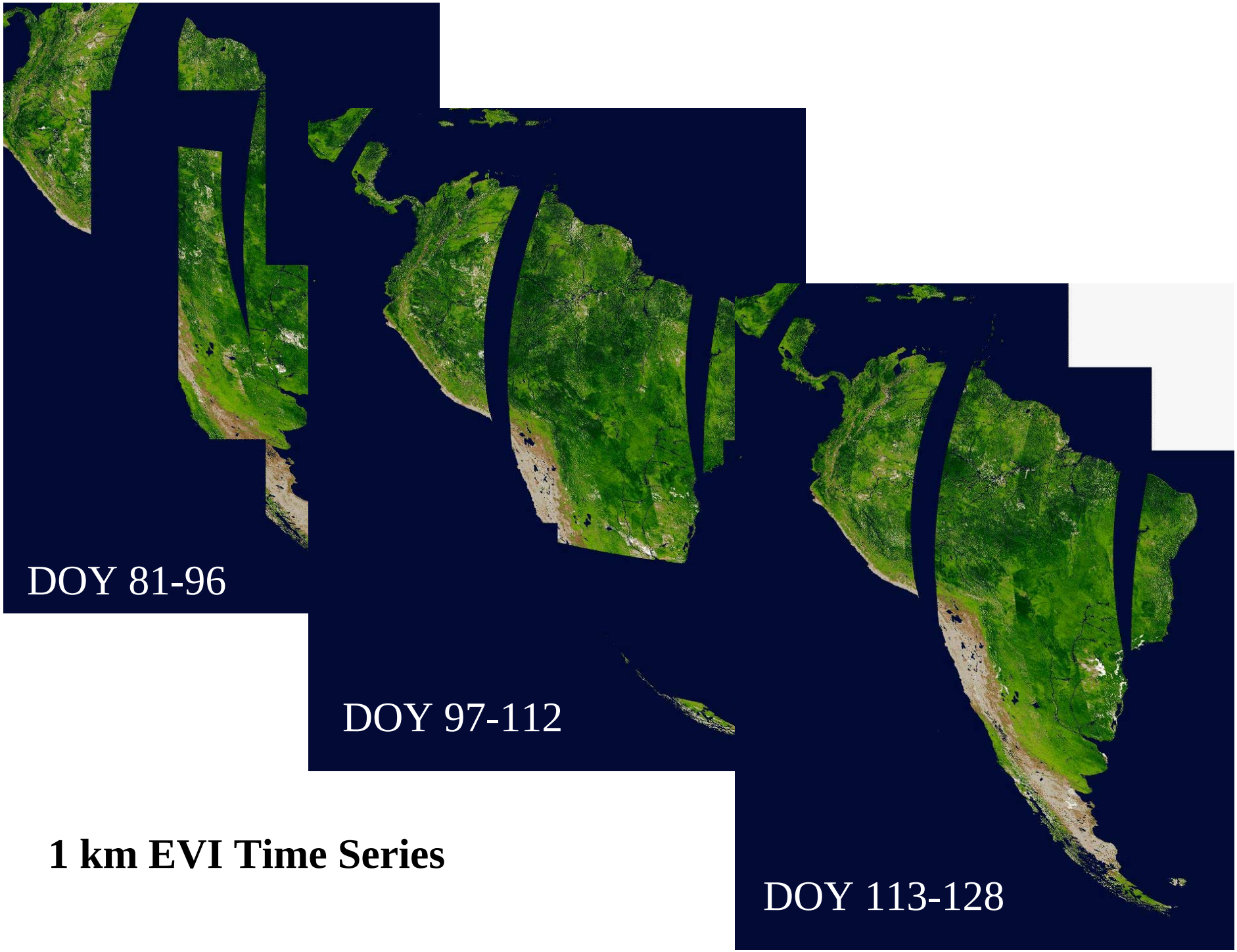


Blue Reflectance

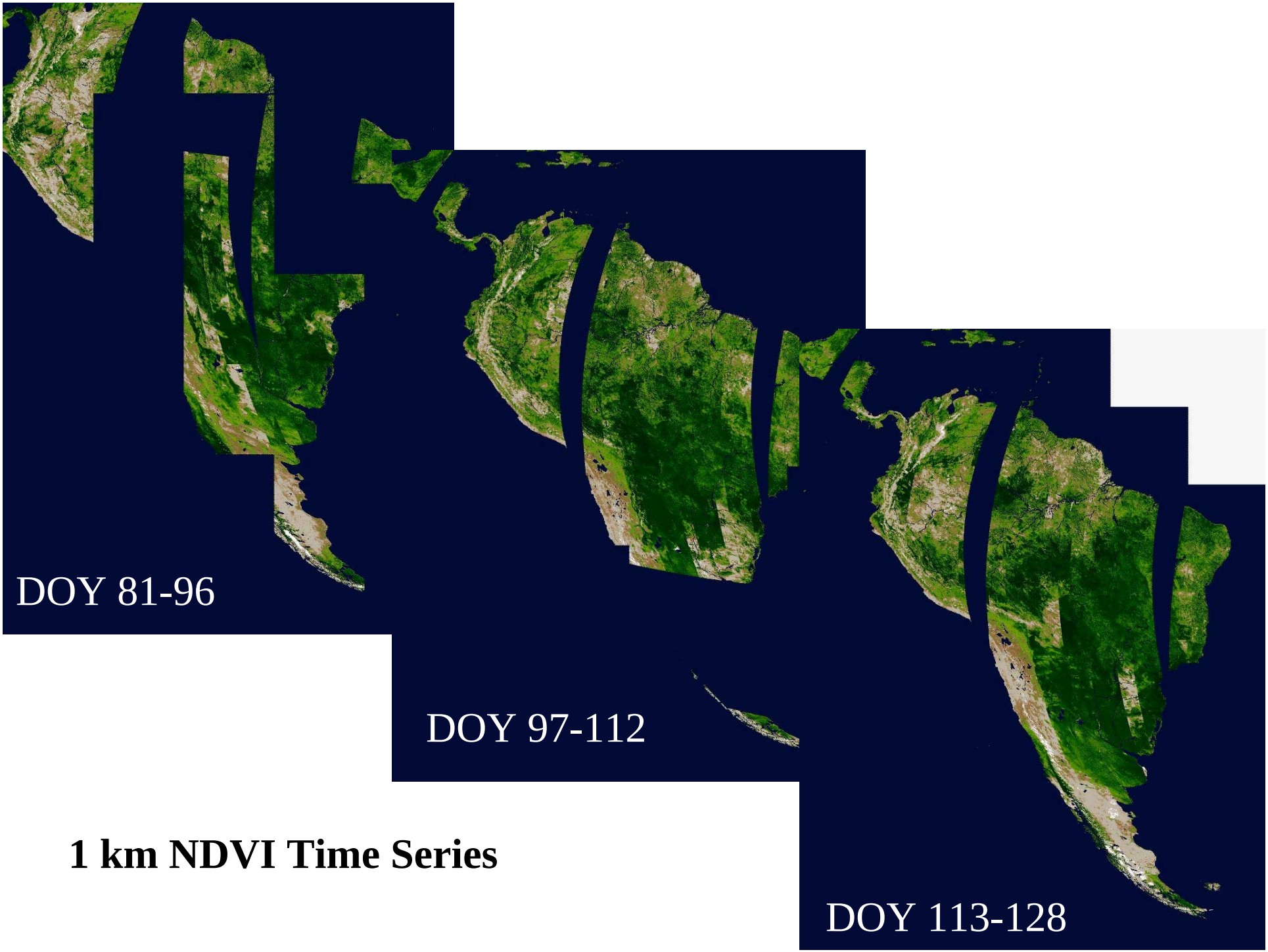


EVI

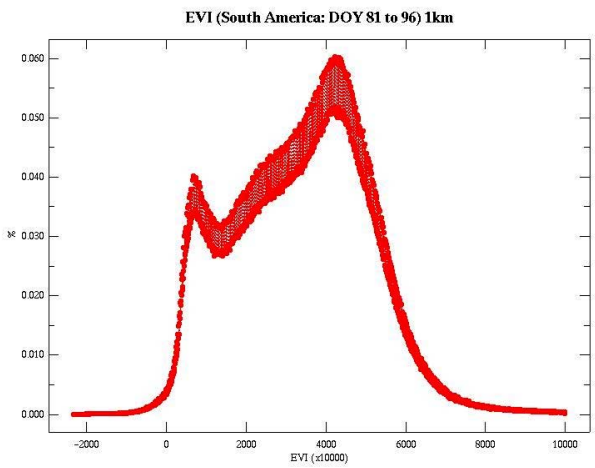


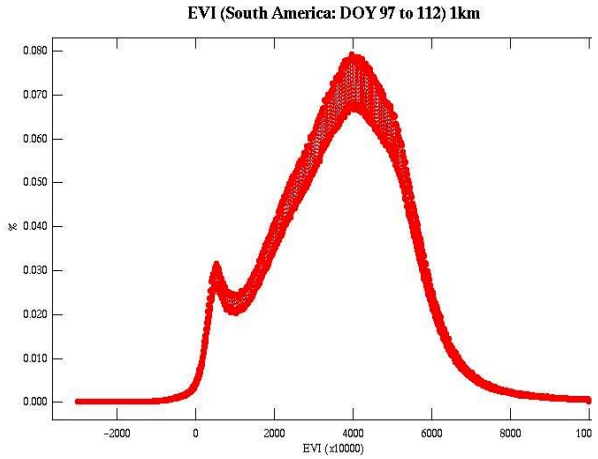


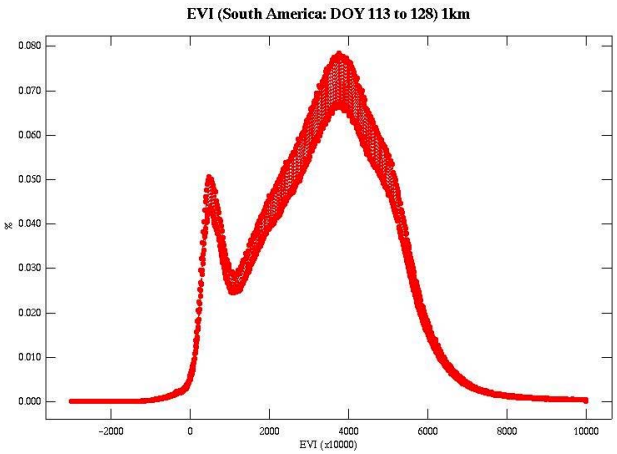
1 km EVI Time Series



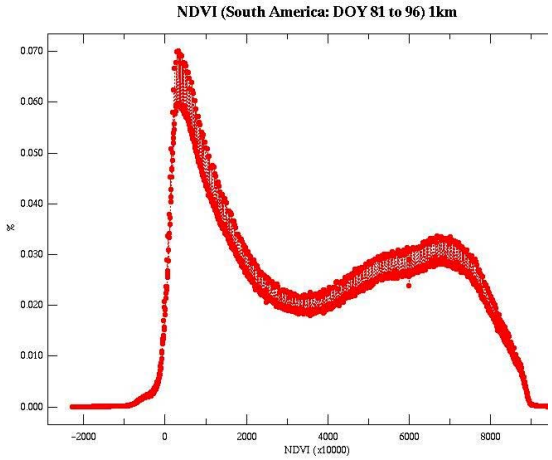
1 km NDVI Time Series

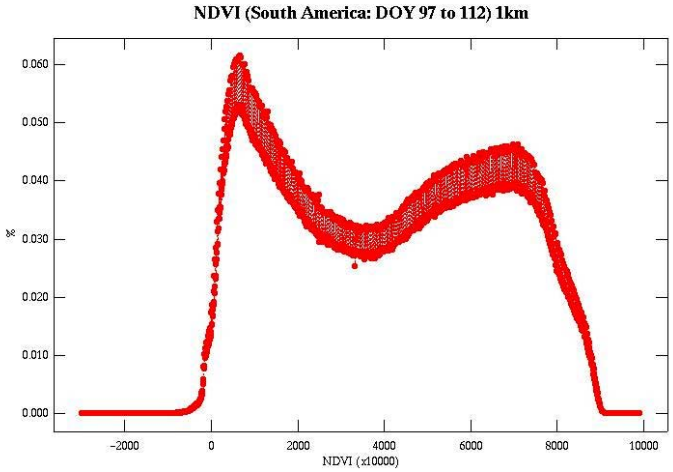


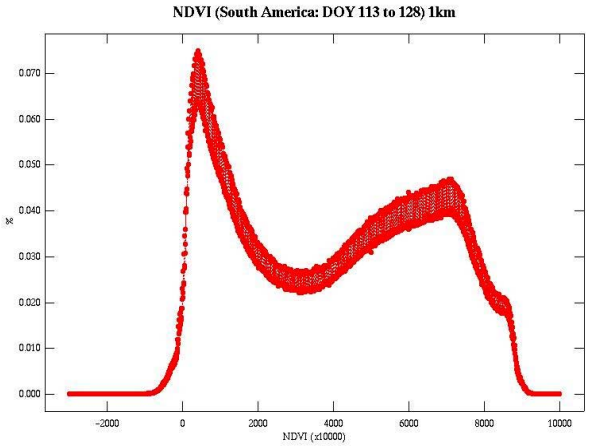




1km EVI Time Series →





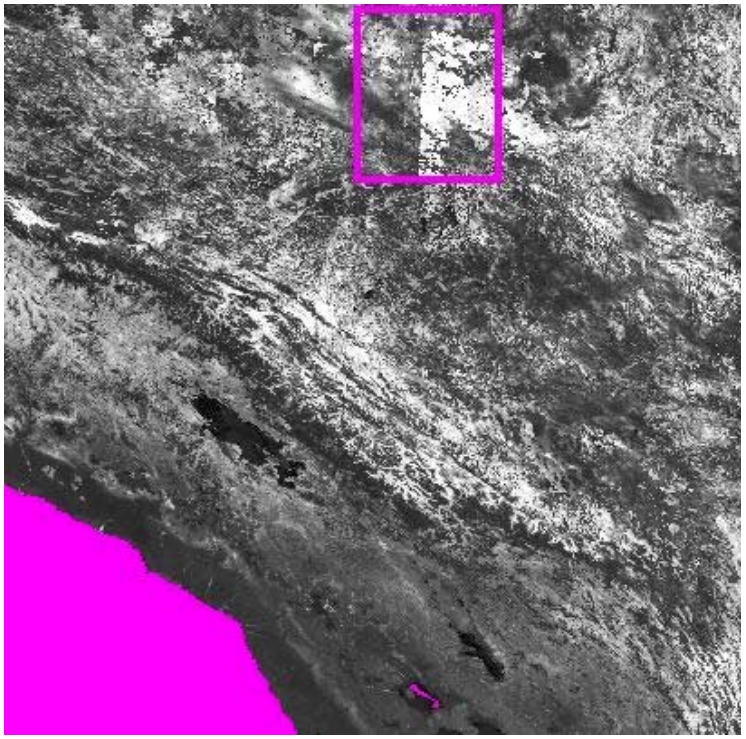


1km NDVI Time Series →

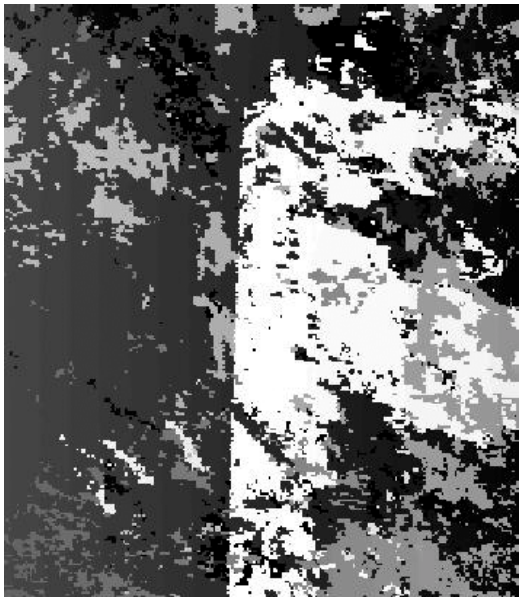
South America

MOD13A2: No. Orbits and Cloud Cover

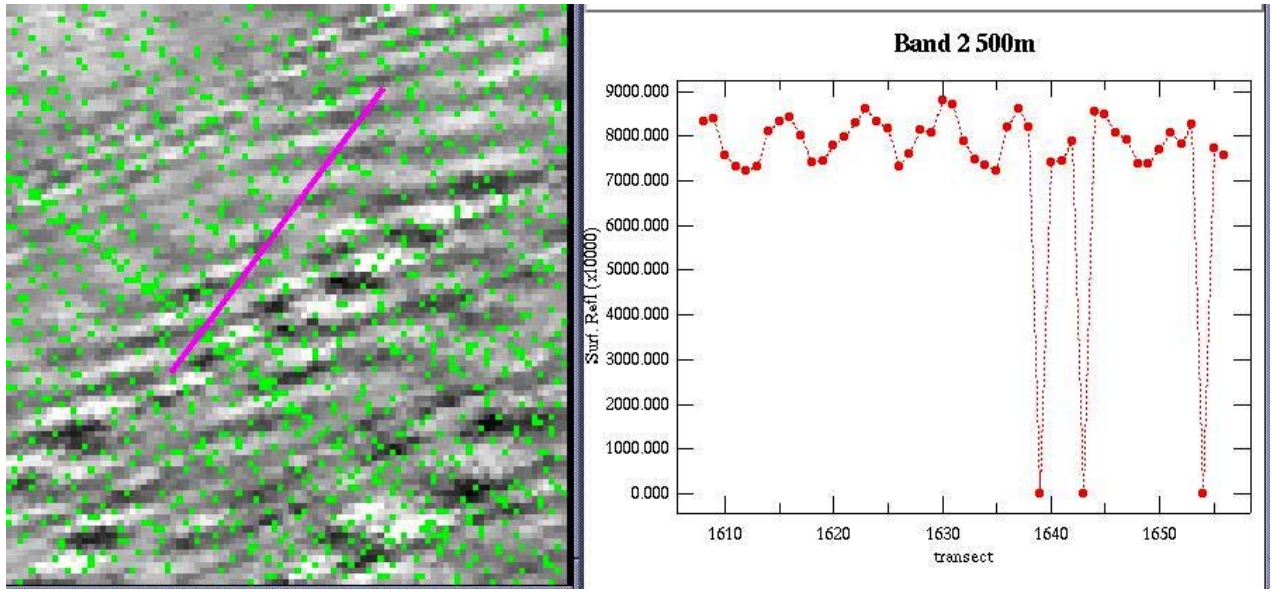
Case No.	TM_MOD13A2
Tile ID	MOD13A2.A2000065.h11v10.hdf
SDS	NDVI, EVI, and View Zenith Angle
Description: A combined effect of a small number of orbits (observations) and frequent cloud cover creates spatial discontinuities in the composite VI images.	

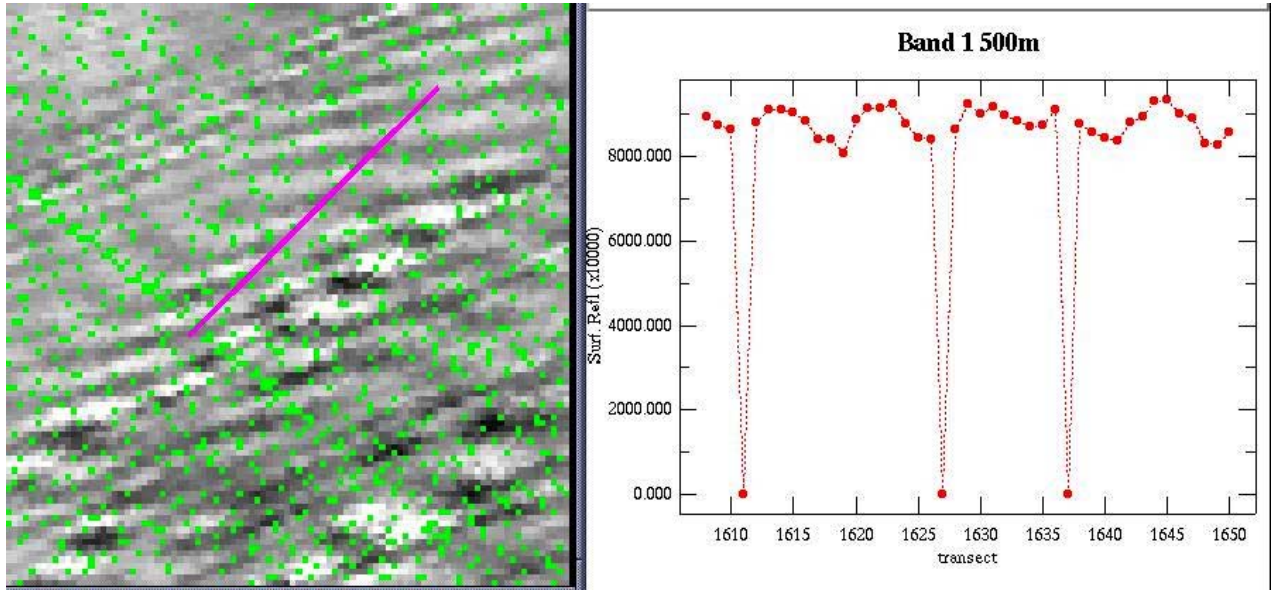


NDVI



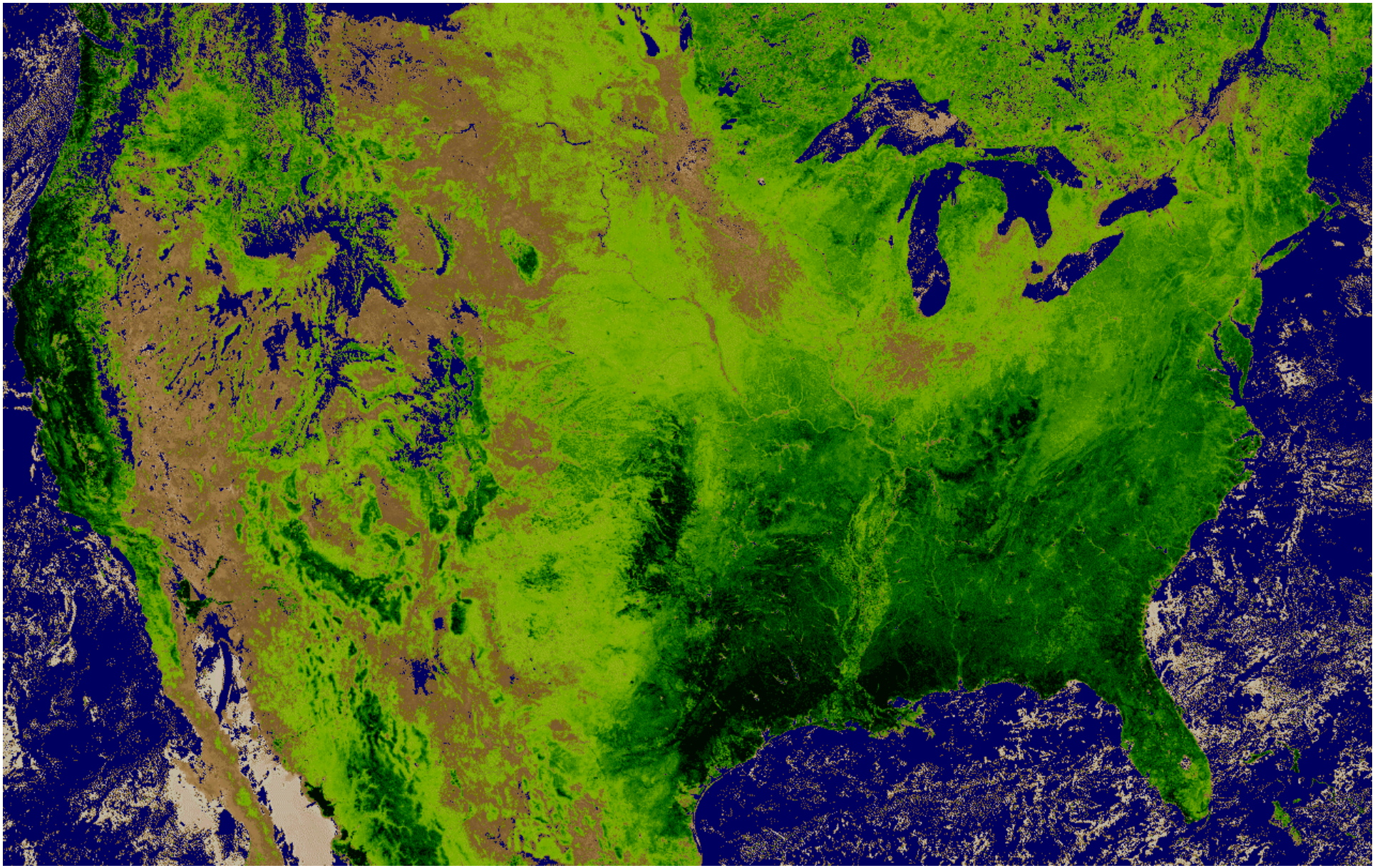
View Zenith Angle


Band 2 500m
Surf. Refl (x10000)
9000.000
8000.000
7000.000
6000.000
5000.000
4000.000
3000.000
2000.000
1000.000
0.000
1610
1620
1630
1640
1650
transect


Band 1 500m
Surf. Refl (x10000)
8000.000
6000.000
4000.000
2000.000
0.000
1610
1615
1620
1625
1630
1635
1640
1645
1650
transect

MODIS - AVHRR Comparisons

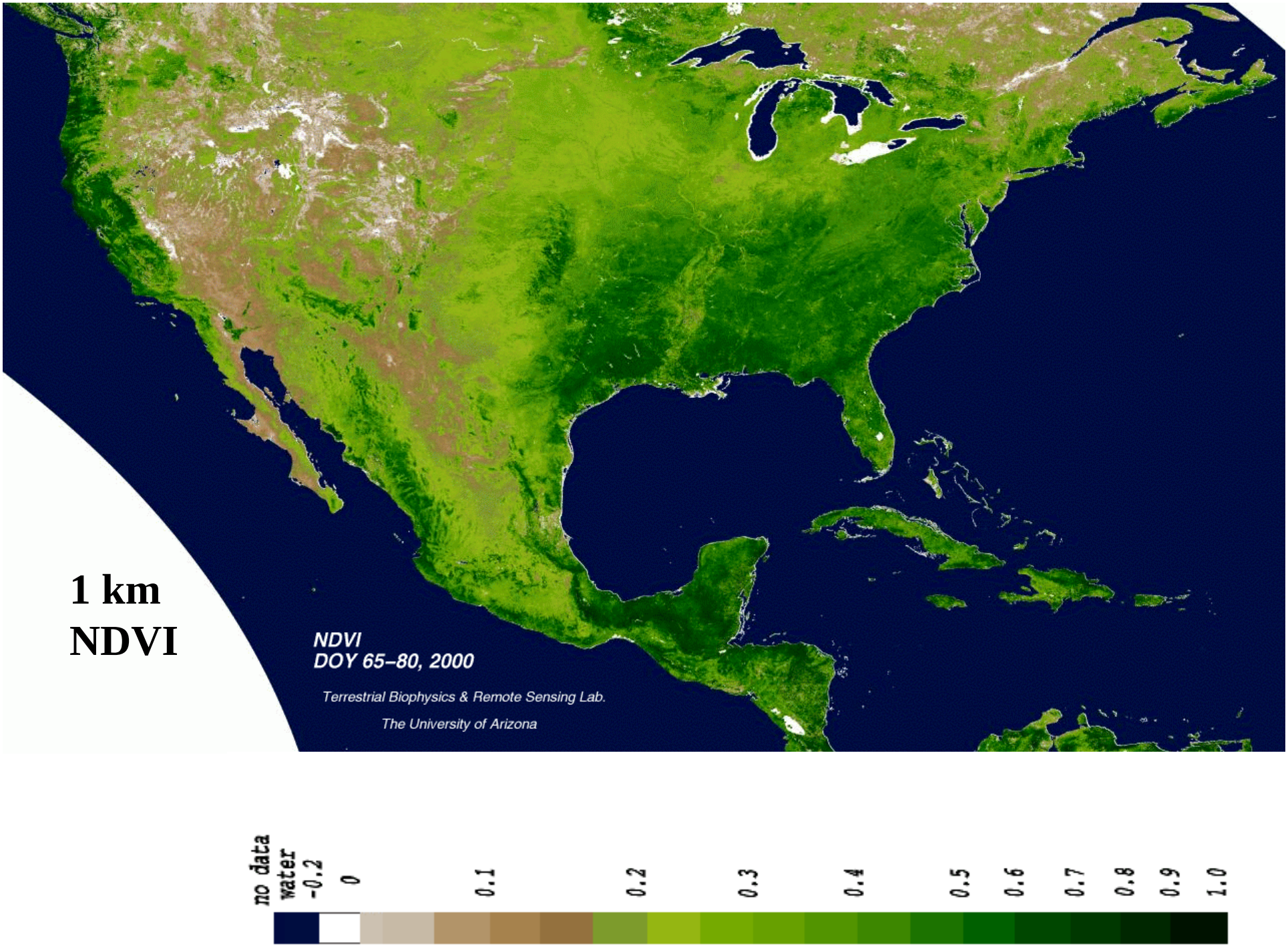
- NDVI Continuity
  - narrower ‘red’ MODIS band with increased chlorophyll sensitivity (band 1),
  - narrower ‘NIR’ MODIS band with less water vapor absorption (band 2)



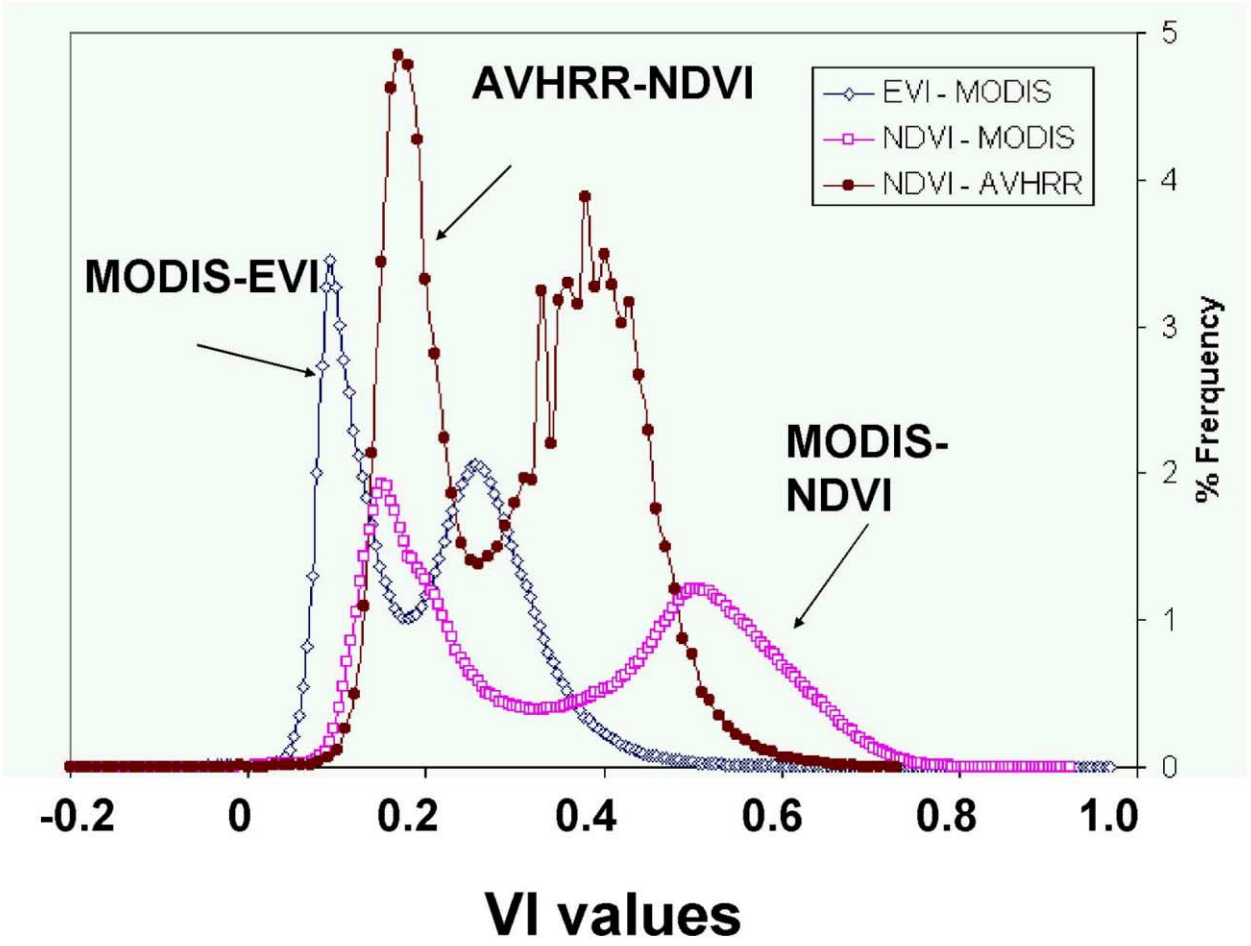
AVHRR NDVI 2 week, 1km Composite

mid-March 2000

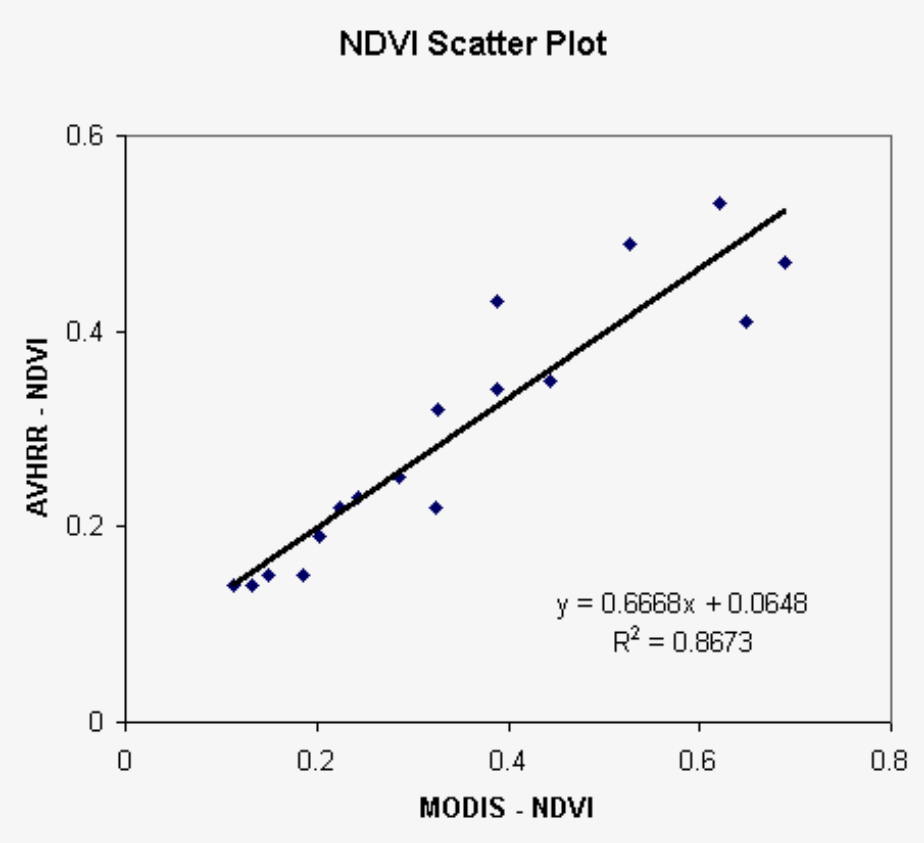
USGS, EDC

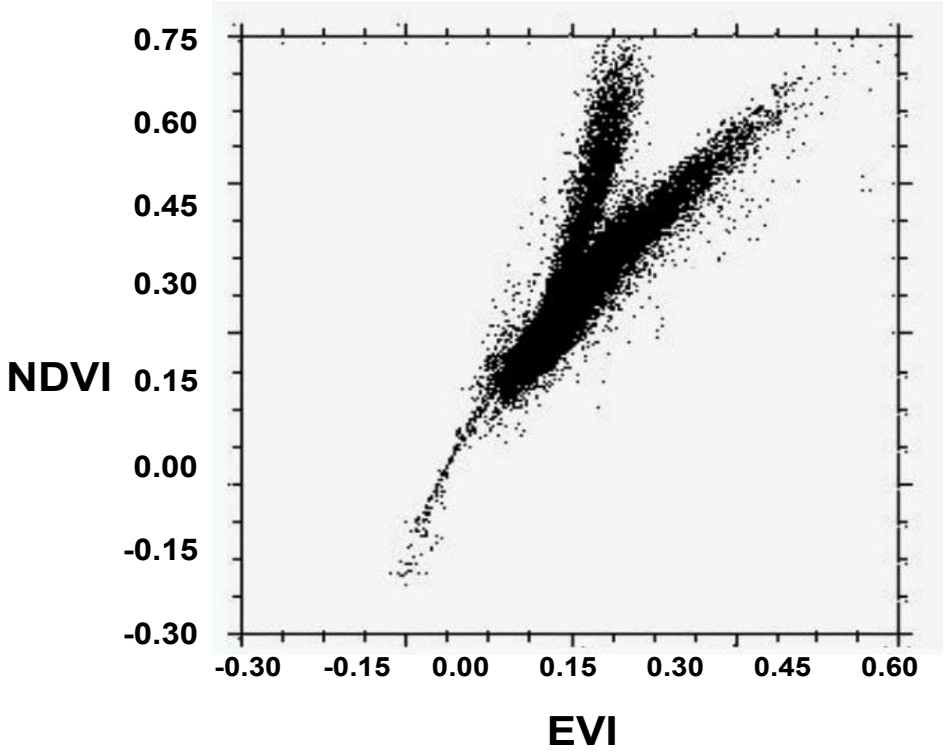

1 km
NDVI
NDVI
DOY 65–80, 2000
Terrestrial Biophysics & Remote Sensing Lab.
The University of Arizona
no data
water
-0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

VI Comparisons (MODIS & AVHRR)



Grassland - Forest transition with MODIS data



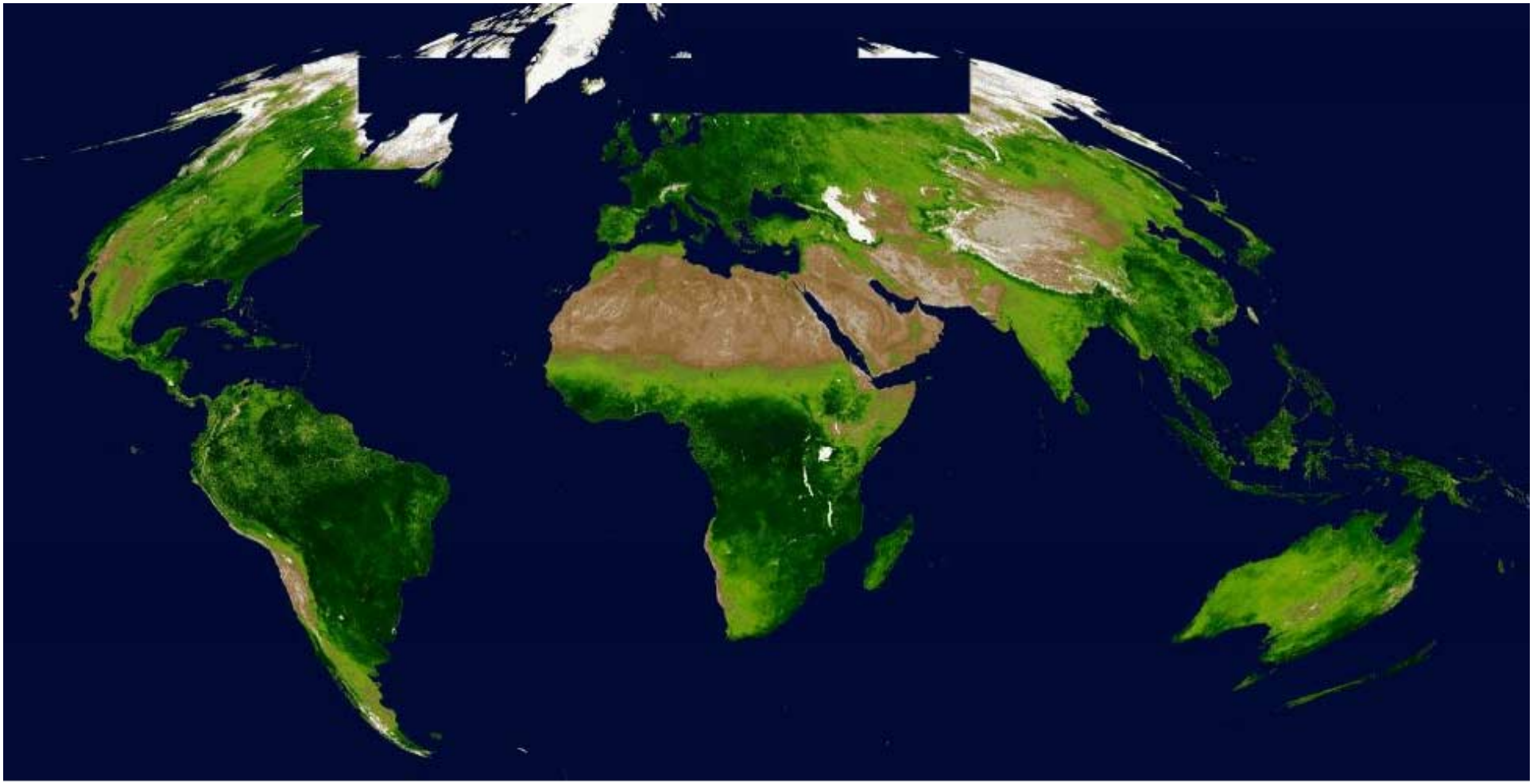


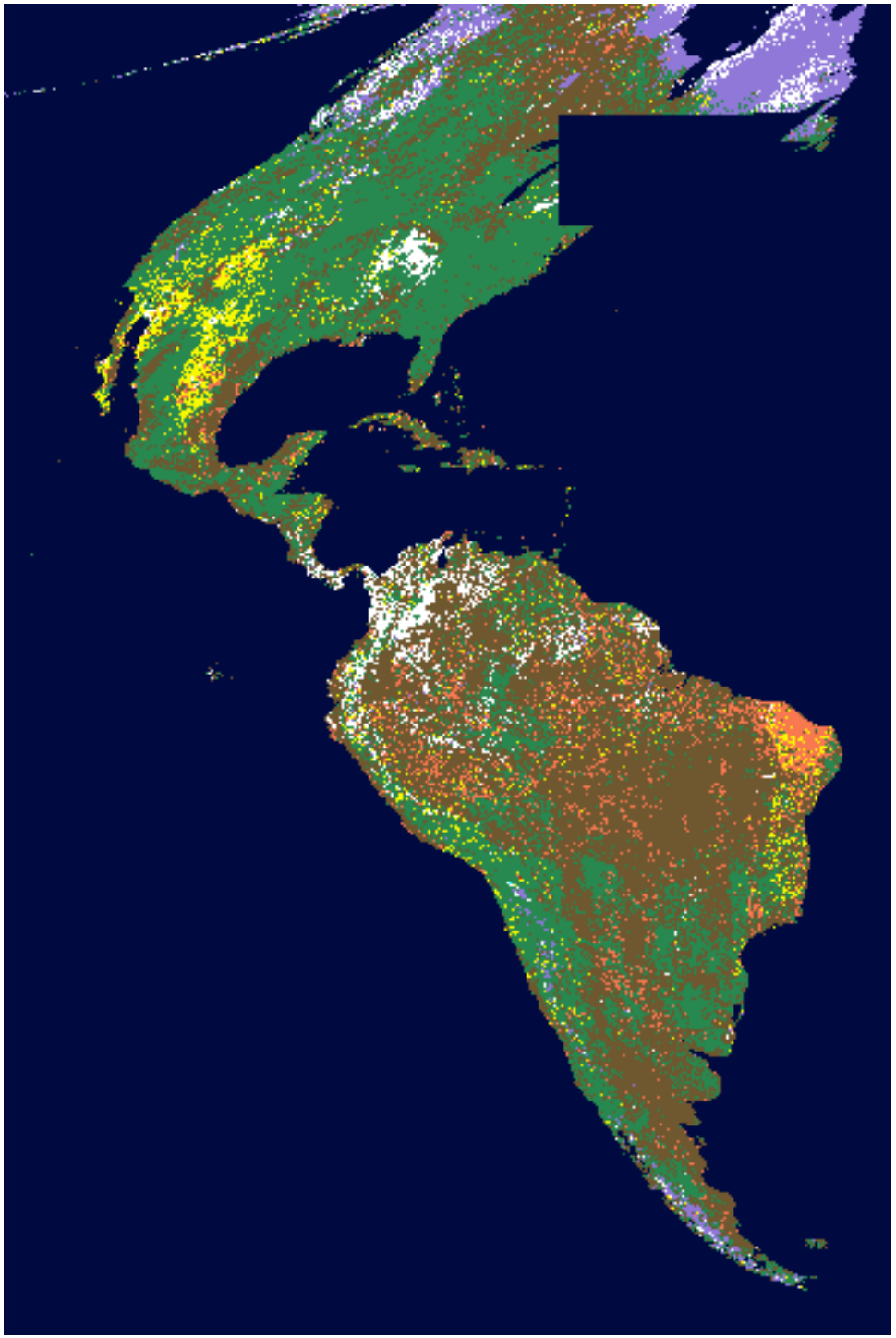
MODIS Standard VI Products
MOD 13A1
500 m and 16-day

- Normalized Difference Vegetation Index (NDVI)
- Enhanced Vegetation Index (EVI)
- Quality Analysis (QA) Image

Global NDVI at 500 m

DOY 113-128





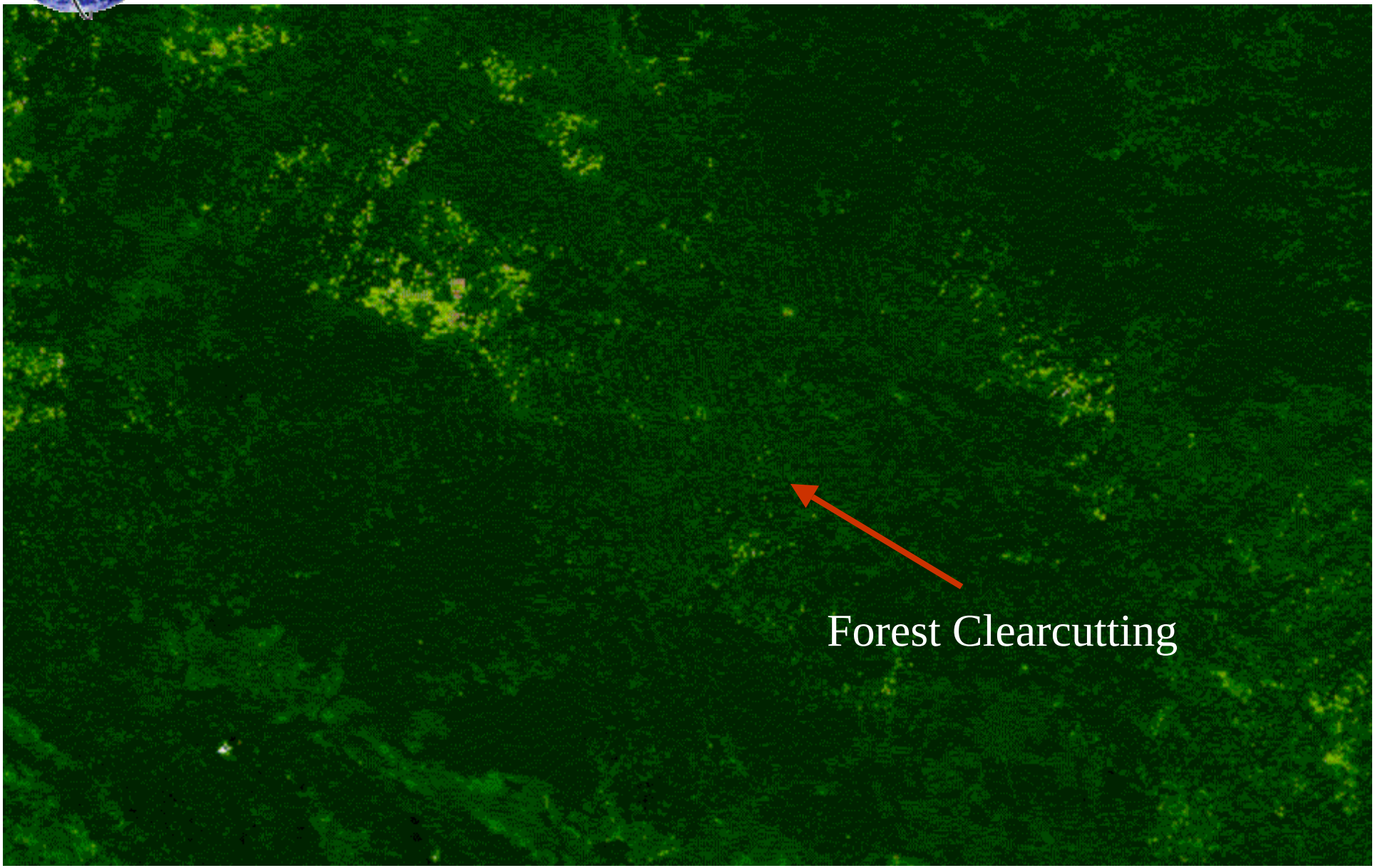
MOD13A1 QA

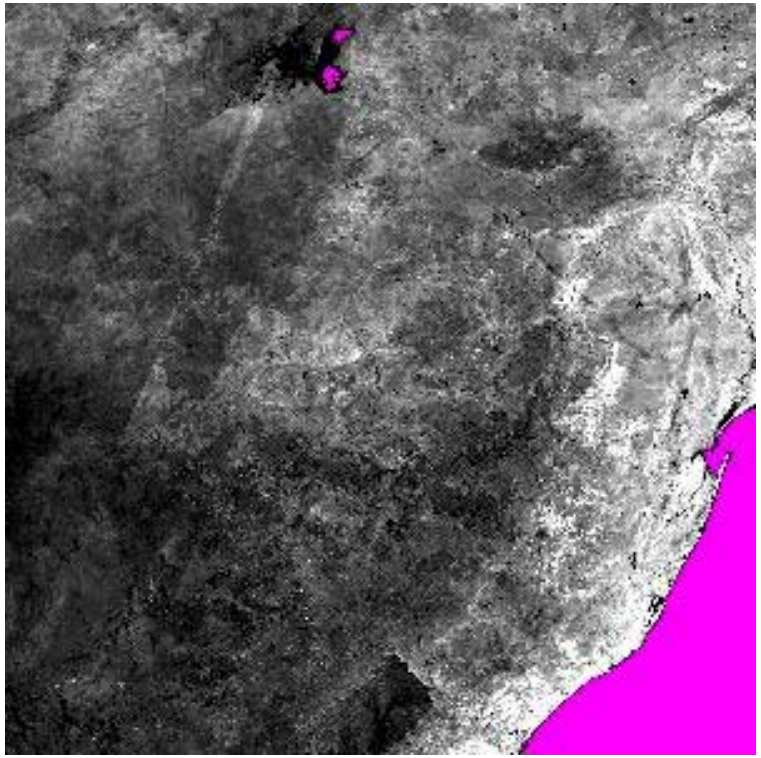
500m

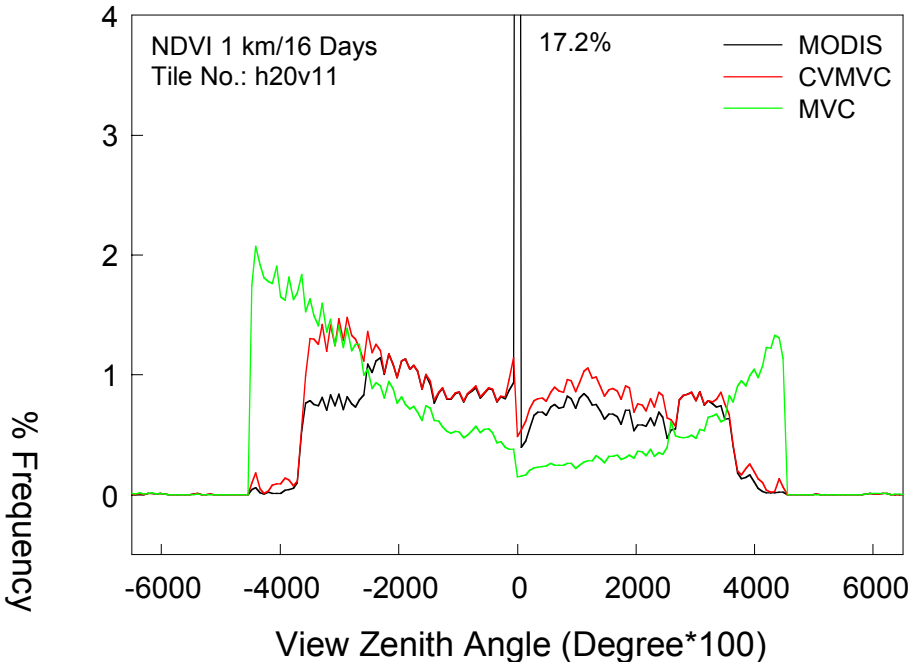
- Fill Value
- Ocean/Inland Water
- Faulty Pixel
- Mixed Cloud / Shadow / Snow/Ice
- Cloud
- Mixed Cloud / Aerosol High
- Mixed Cloud / Aerosol Medium
- Mixed Cloud / Aerosol Low
- Mixed Cloud / Aerosol Climatology
- Shadow / Aerosol Climatology
- Snow/Ice / Aerosol Climatology
- Aerosol High
- Aerosol Medium
- Aerosol Low
- Aerosol Climatology
- Good Quality

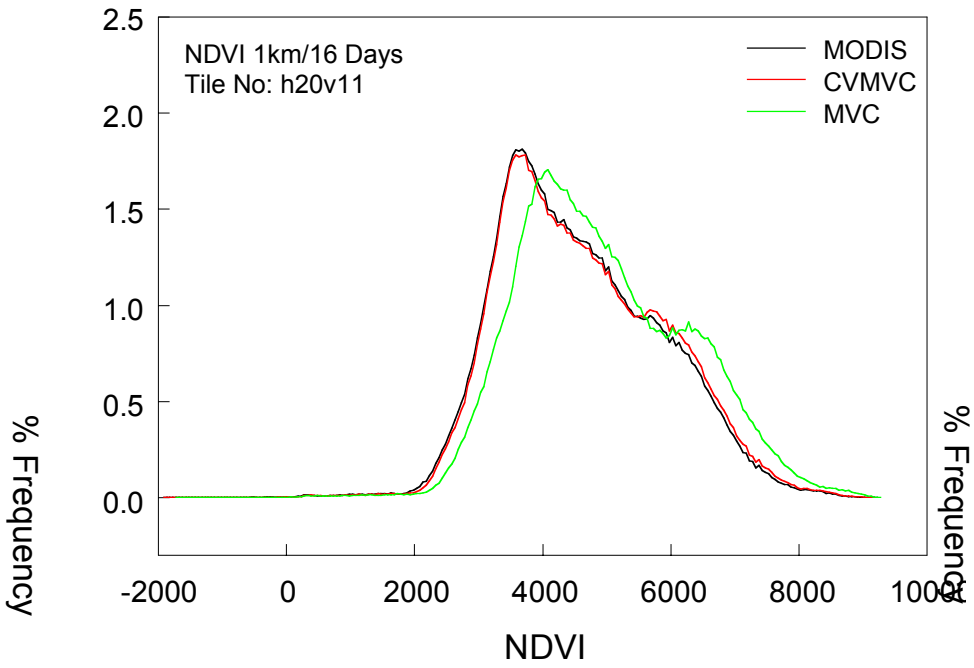

NDVI
DOY 113–128
Terrestrial Biophysics & Remote Sensing Lab.
The University of Arizona

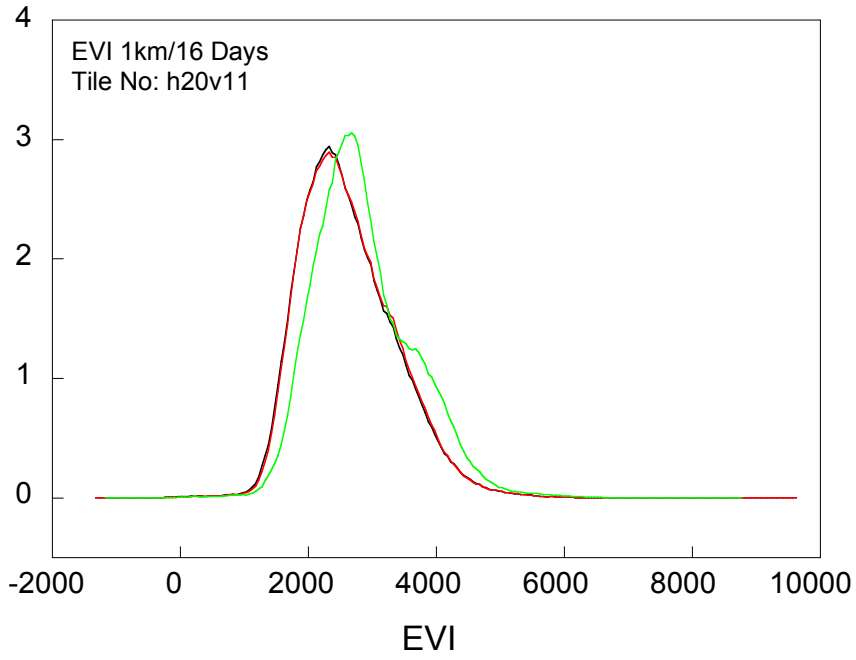
500 m South America

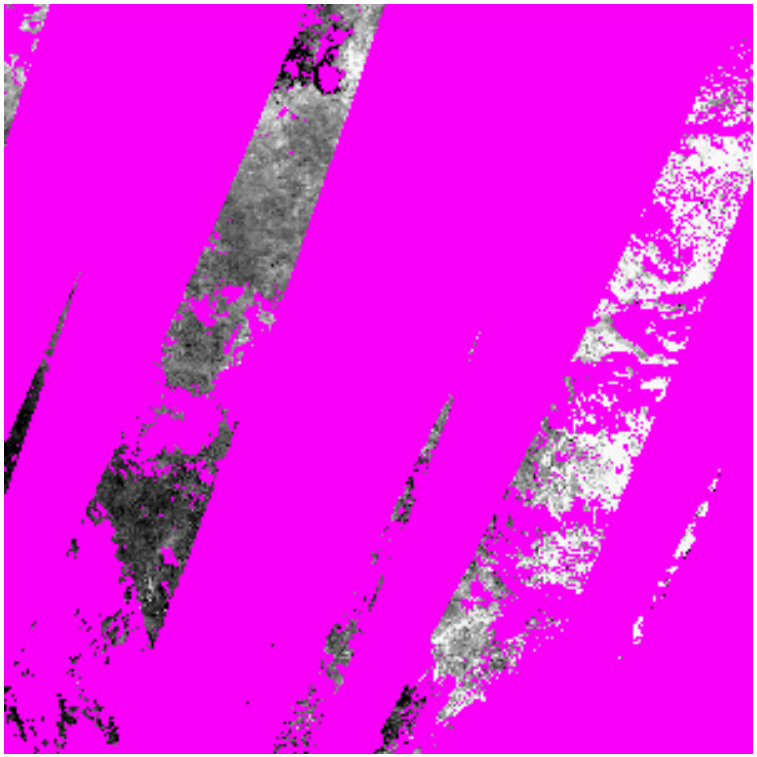


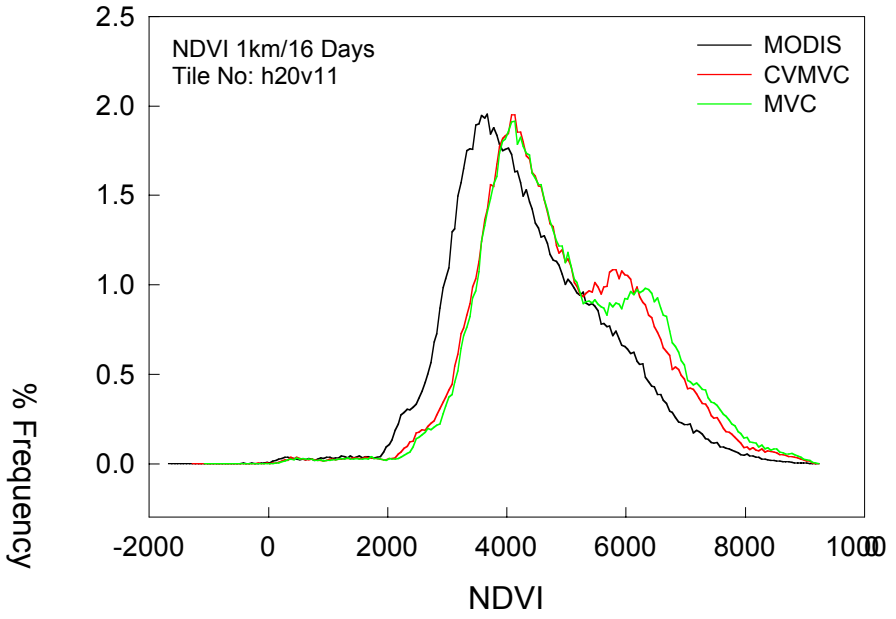


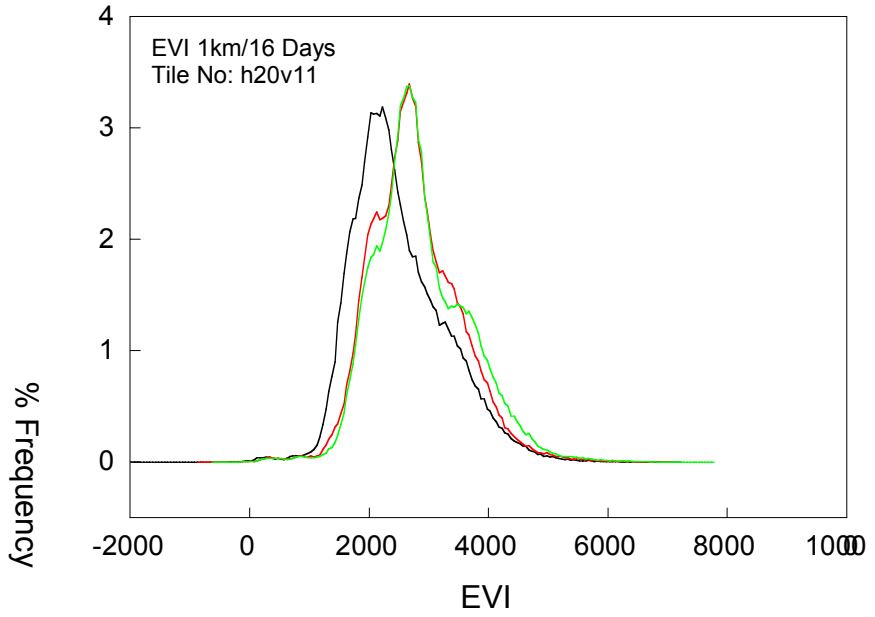

NDVI 1 km/16 Days
Tile No.: h20v11
17.2%
MODIS
CVMVC
MVC
% Frequency
0
1
2
3
4
-6000
-4000
-2000
0
2000
4000
6000
View Zenith Angle (Degree*100)

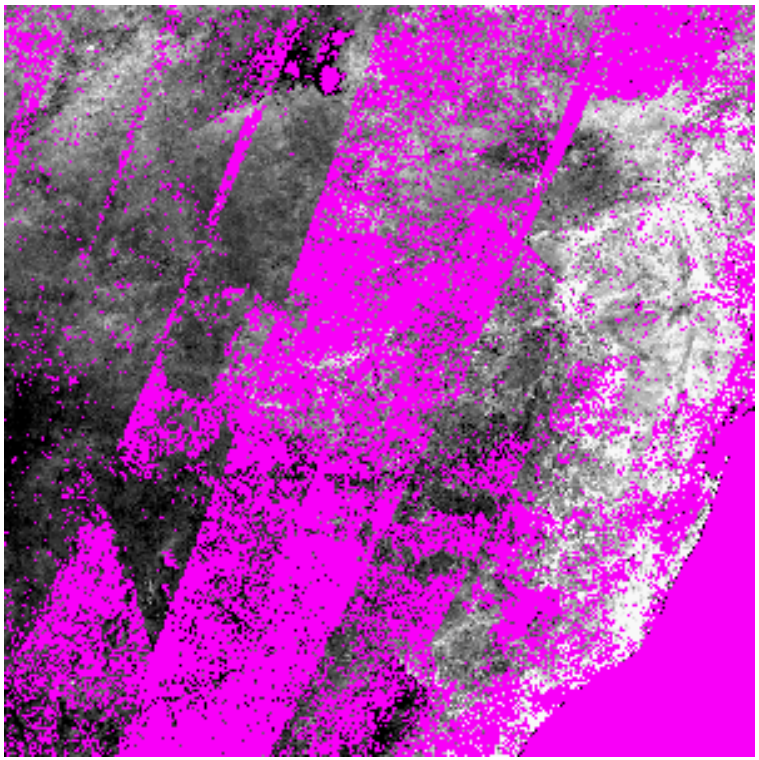

NDVI 1km/16 Days
Tile No: h20v11
MODIS
CVMVC
MVC
% Frequency
NDVI
2.5
2.0
1.5
1.0
0.5
0.0
-2000
0
2000
4000
6000
8000
10000

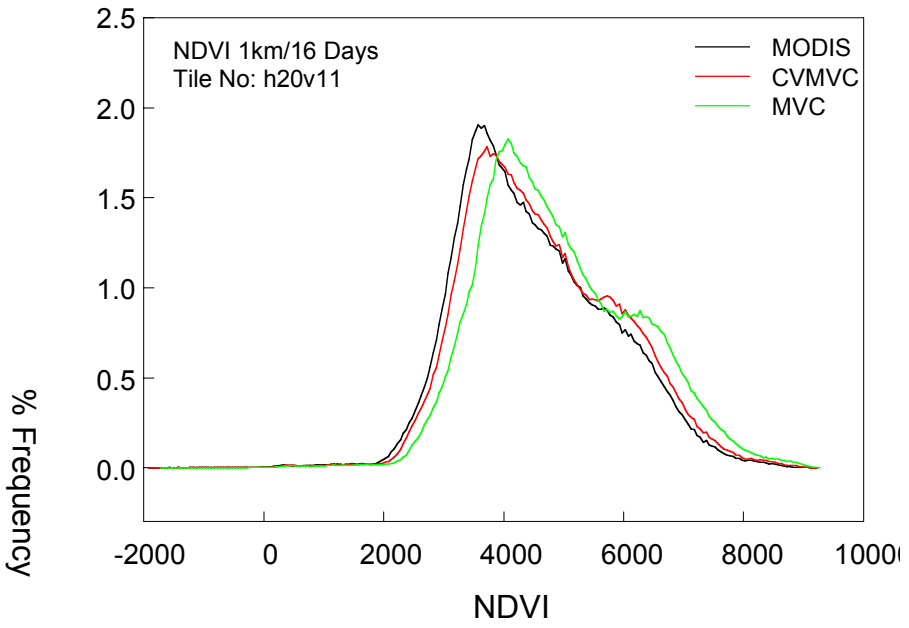

EVI 1km/16 Days
Tile No: h20v11
% Frequency
EVI
4
3
2
1
0
-2000
0
2000
4000
6000
8000
10000

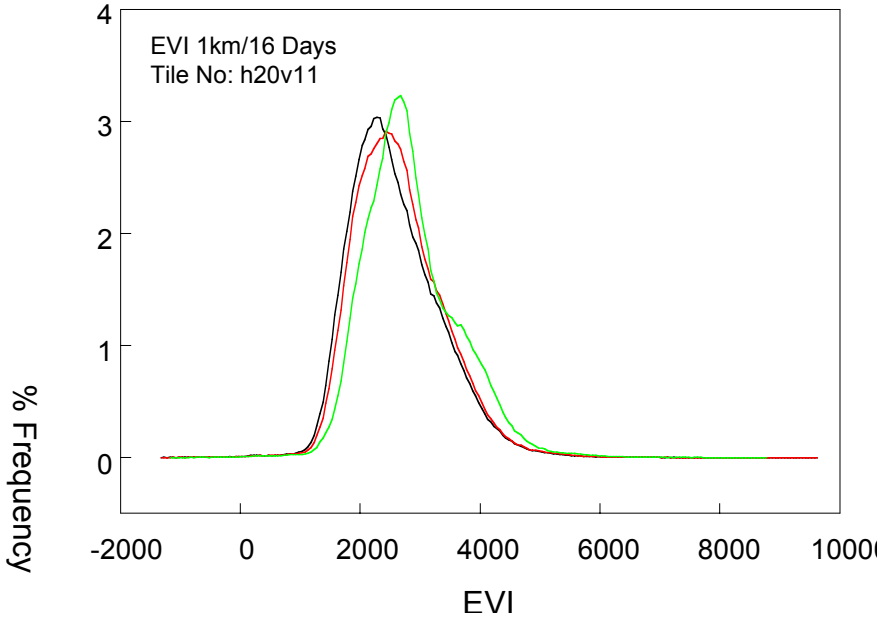



NDVI 1km/16 Days
Tile No: h20v11
MODIS
CVMVC
MVC
2.5
2.0
1.5
1.0
0.5
0.0
% Frequency
-2000
0
2000
4000
6000
8000
10000
NDVI


EVI 1km/16 Days
Tile No: h20v11
4
3
2
1
0
% Frequency
-2000
0
2000
4000
6000
8000
10000
EVI

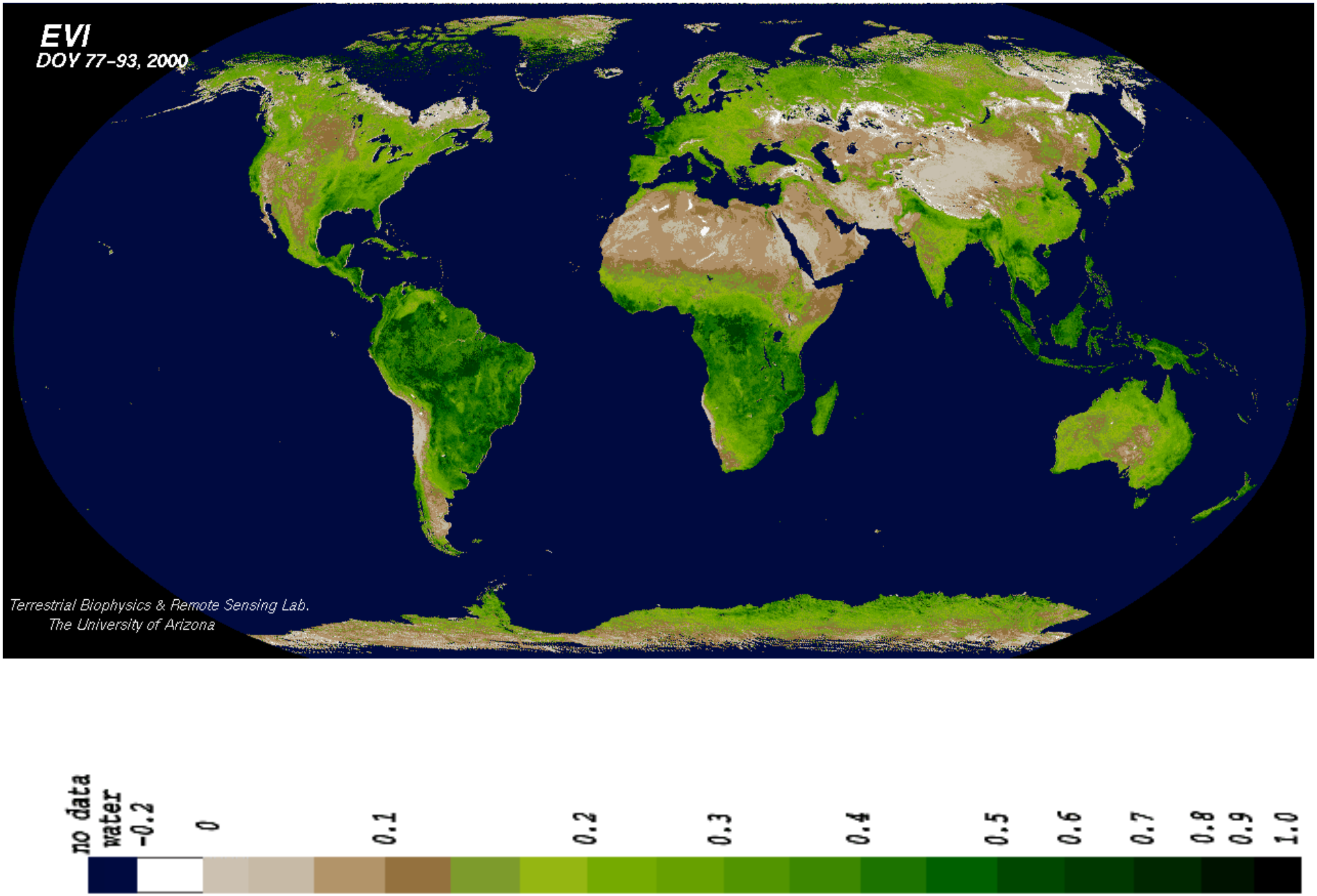


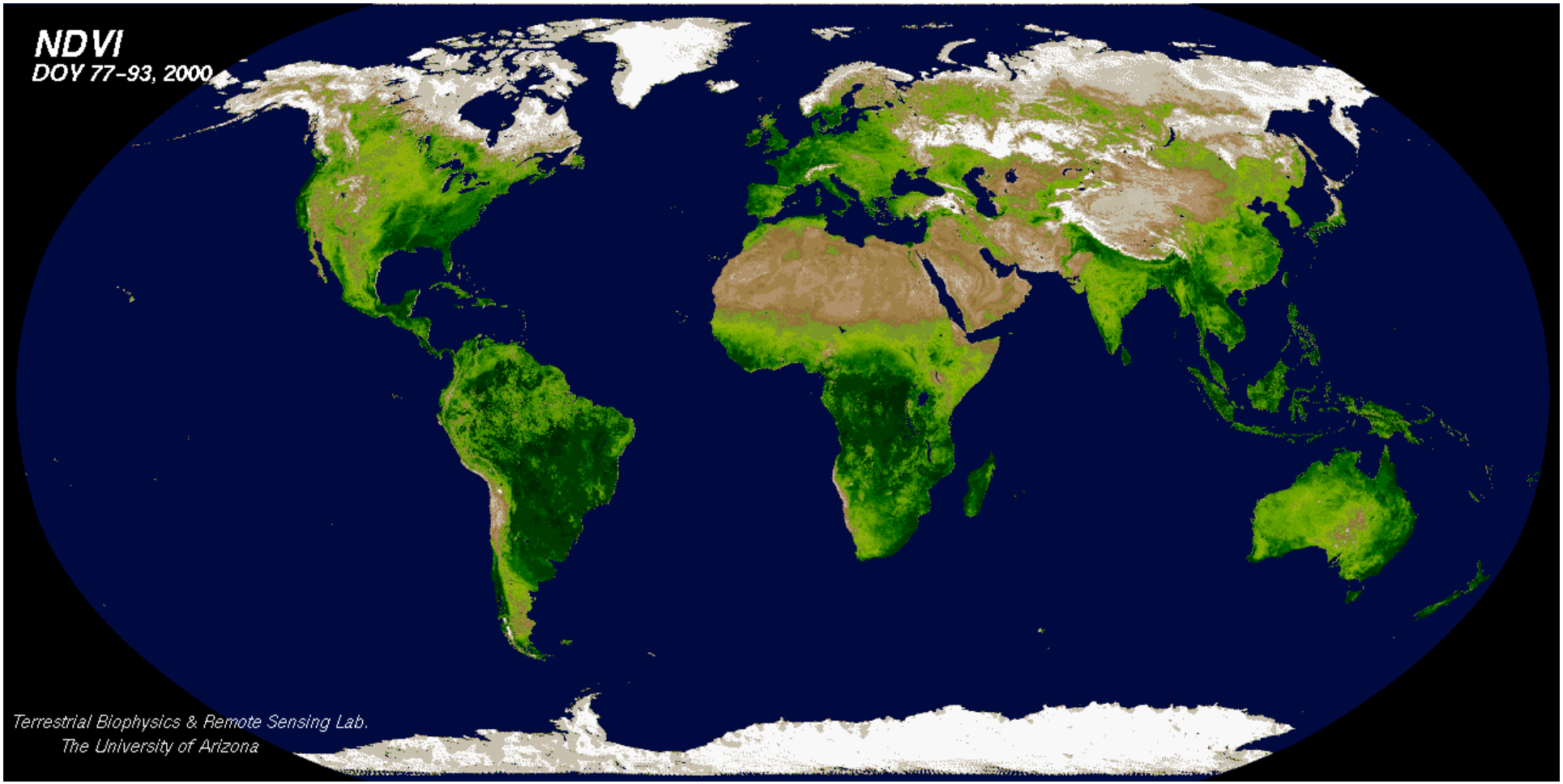

NDVI 1km/16 Days
Tile No: h20v11
MODIS
CVMVC
MVC
2.5
2.0
1.5
1.0
0.5
0.0
% Frequency
-2000
0
2000
4000
6000
8000
1000
NDVI


EVI 1km/16 Days
Tile No: h20v11
4
3
2
1
0
% Frequency
-2000
0
2000
4000
6000
8000
1000
EVI

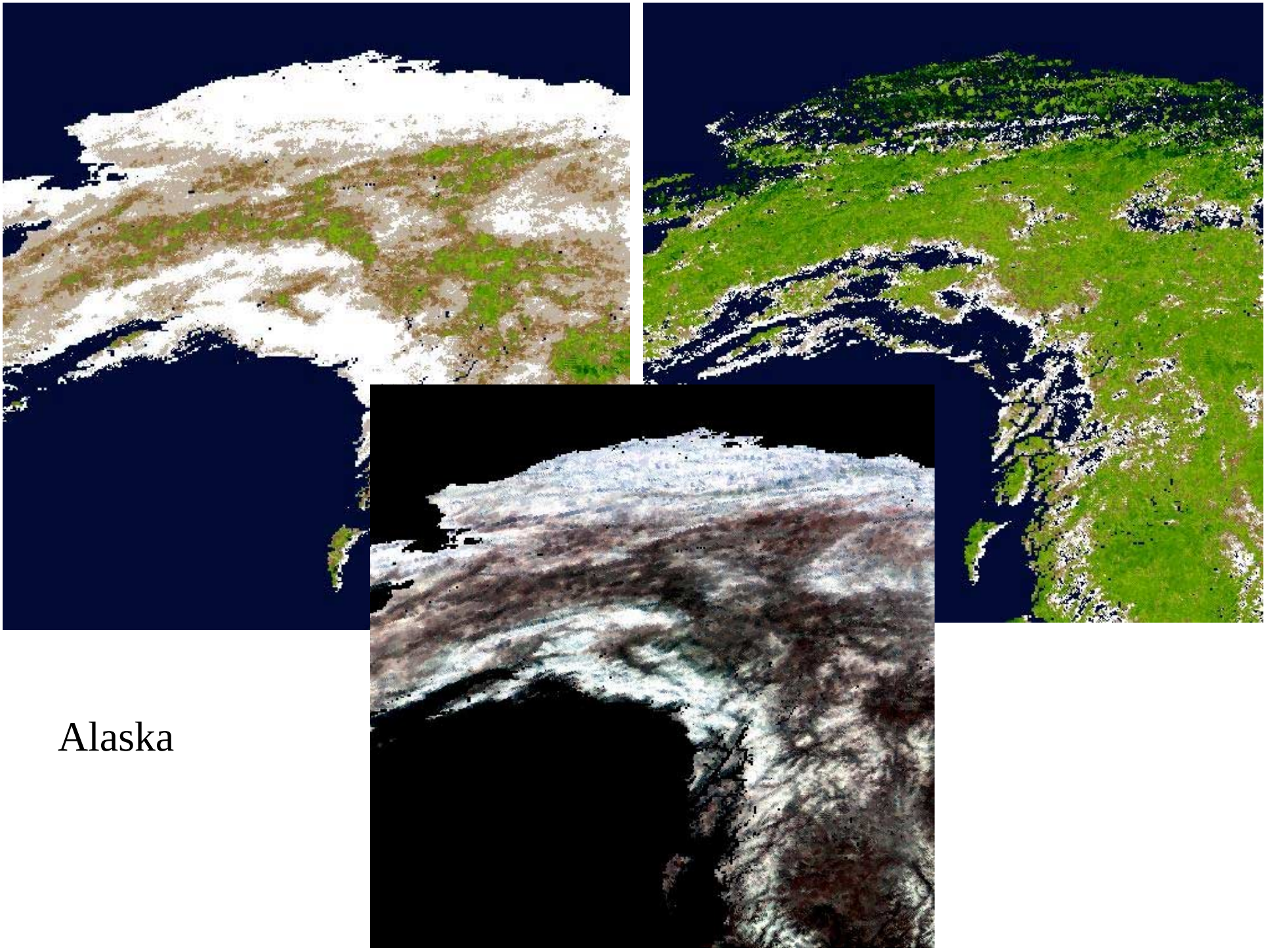
Conclusions

- VI performance coming along well
- Most problems are diminishing
- More work needed on compositing algorithm and merging with cloud mask
- Need to investigate snow problem in EVI
- Aerosol resistance and VI saturation have yet to be determined

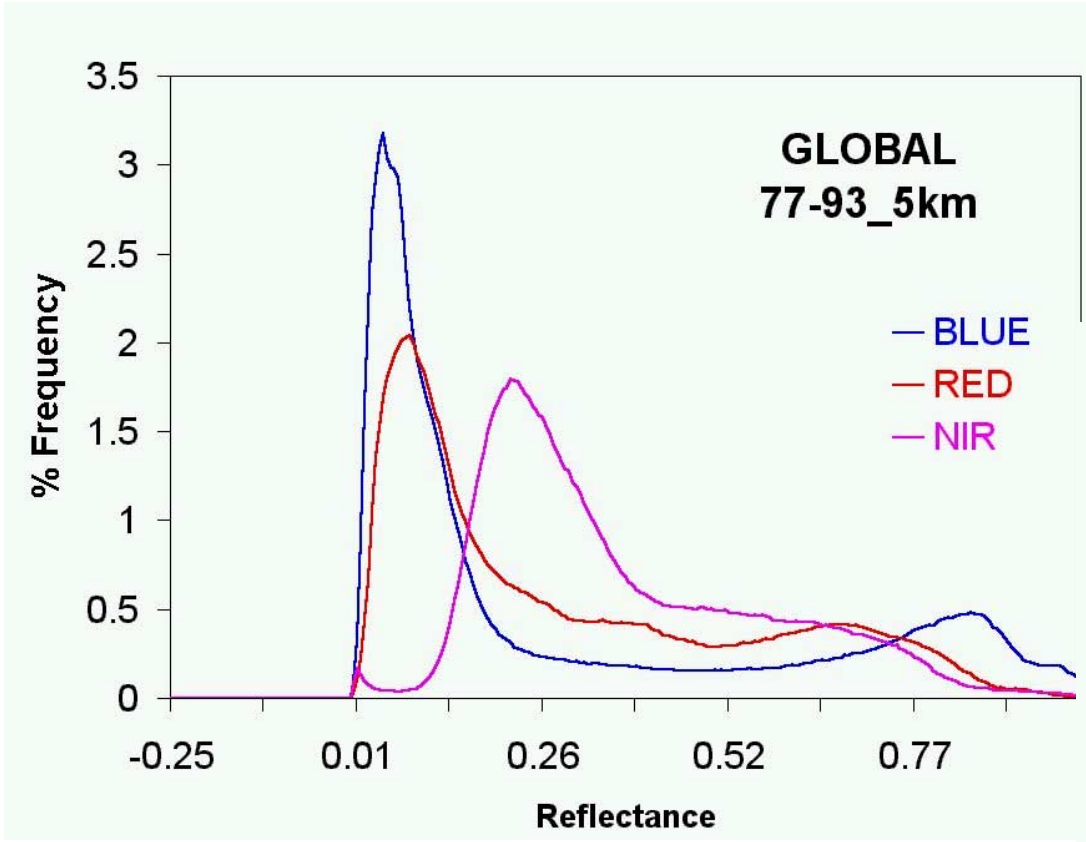

EVI
DOY 77-93, 2000
Terrestrial Biophysics & Remote Sensing Lab.
The University of Arizona
no data
water
-0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

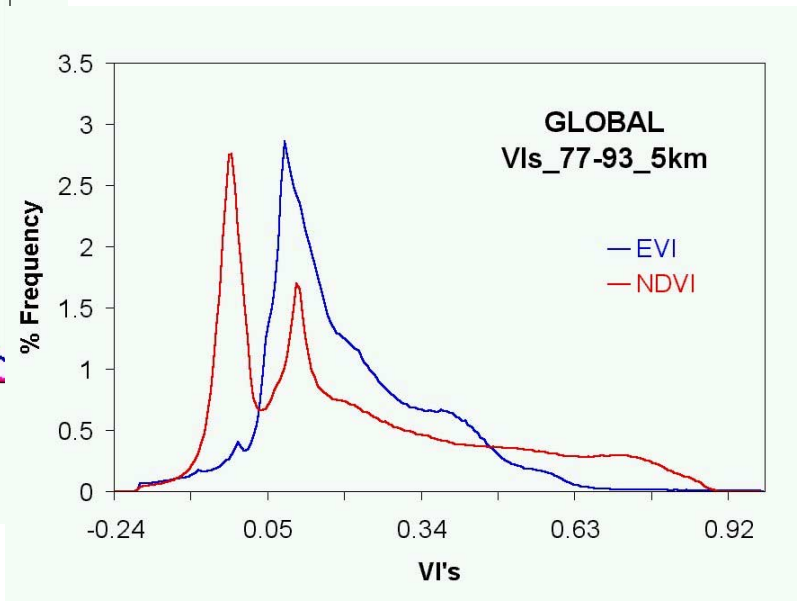

NDVI
DOY 77-93, 2000
Terrestrial Biophysics & Remote Sensing Lab.
The University of Arizona

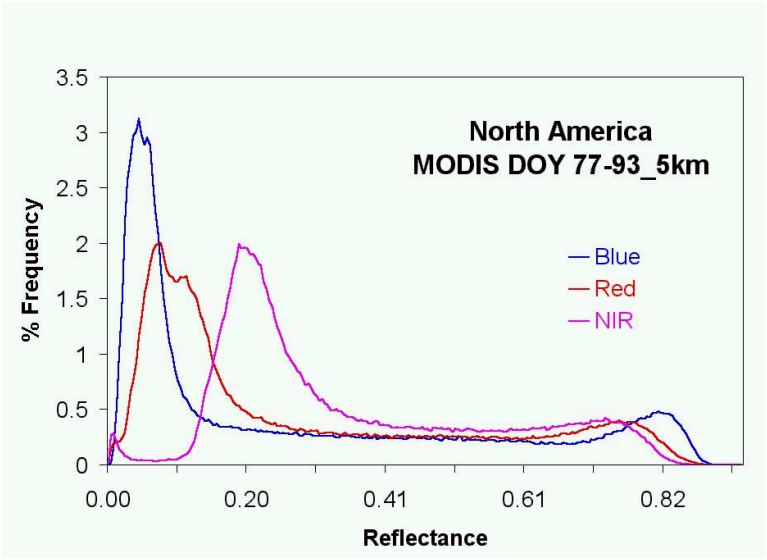

no data
water
-0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

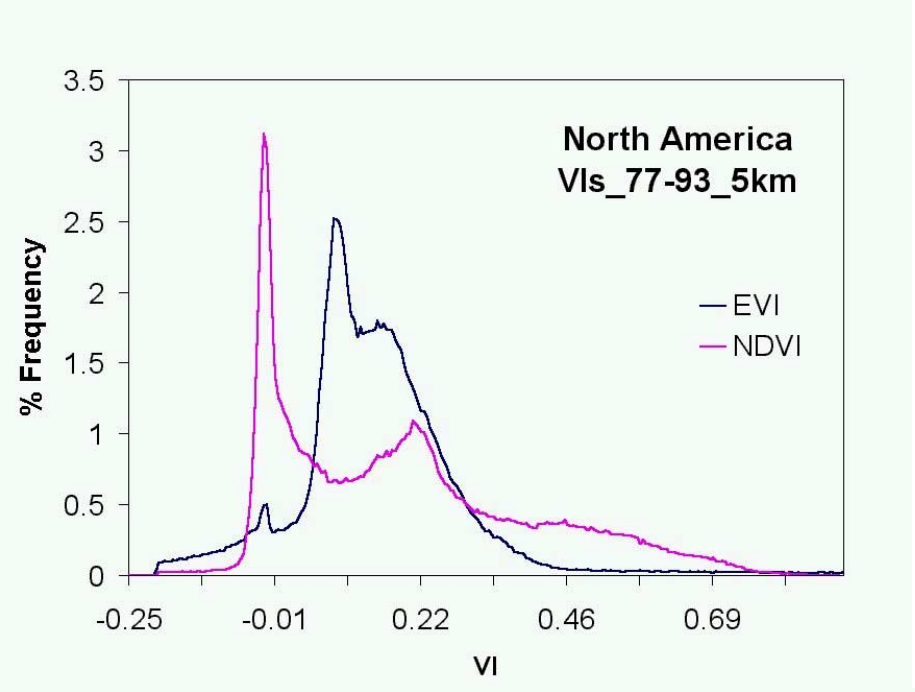


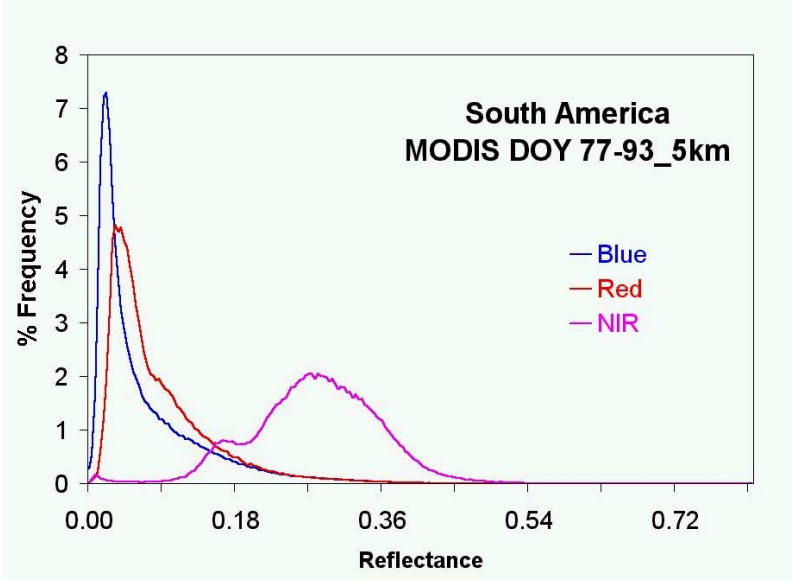
Alaska

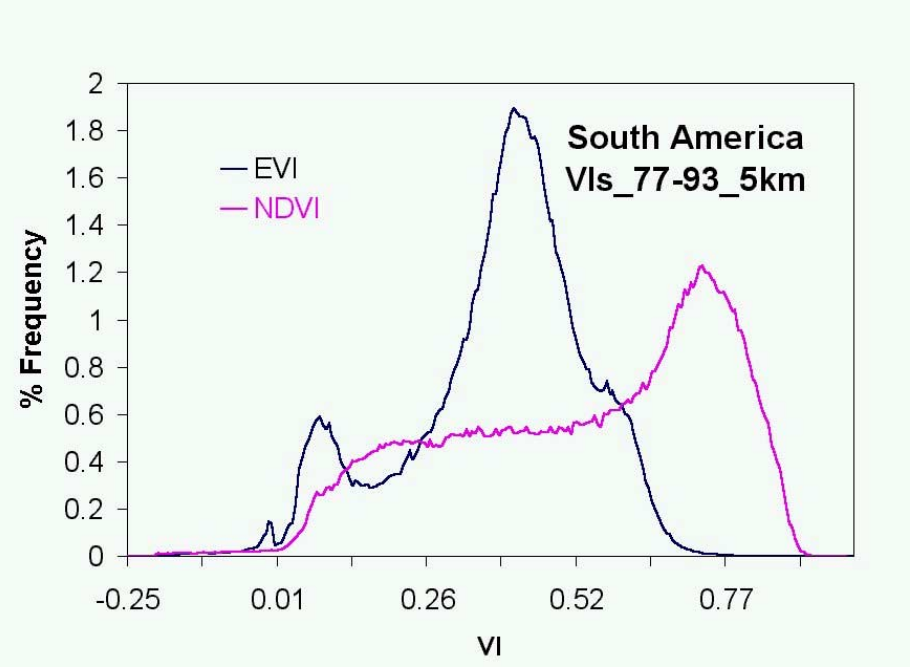

GLOBAL
77-93_5km
BLUE
RED
NIR
% Frequency
Reflectance
3.5
3
2.5
2
1.5
1
0.5
0
-0.25
0.01
0.26
0.52
0.77


GLOBAL
VIs_77-93_5km
EVI
NDVI
% Frequency
VI's
3.5
3
2.5
2
1.5
1
0.5
0
-0.24
0.05
0.34
0.63
0.92


North America
MODIS DOY 77-93_5km
% Frequency
Reflectance
Blue
Red
NIR
0
0.5
1
1.5
2
2.5
3
3.5
0.00
0.20
0.41
0.61
0.82


North America
VIs_77-93_5km
% Frequency
VI
EVI
NDVI
0
0.5
1
1.5
2
2.5
3
3.5
-0.25
-0.01
0.22
0.46
0.69


South America
MODIS DOY 77-93_5km
% Frequency
Reflectance
Blue
Red
NIR
0
1
2
3
4
5
6
7
8
0.00
0.18
0.36
0.54
0.72


South America
VIs_77-93_5km
% Frequency
VI
EVI
NDVI
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
-0.25
0.01
0.26
0.52
0.77