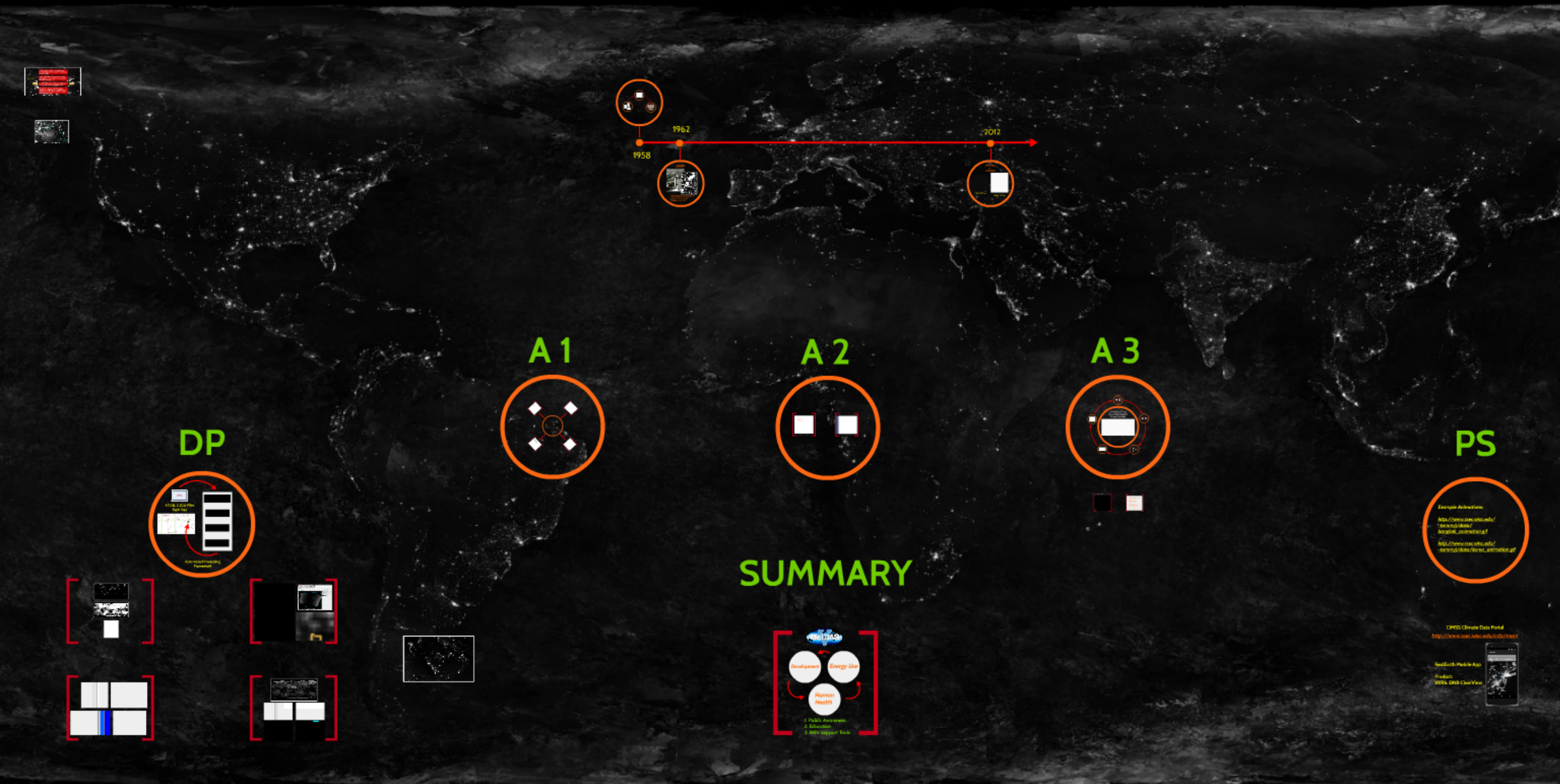
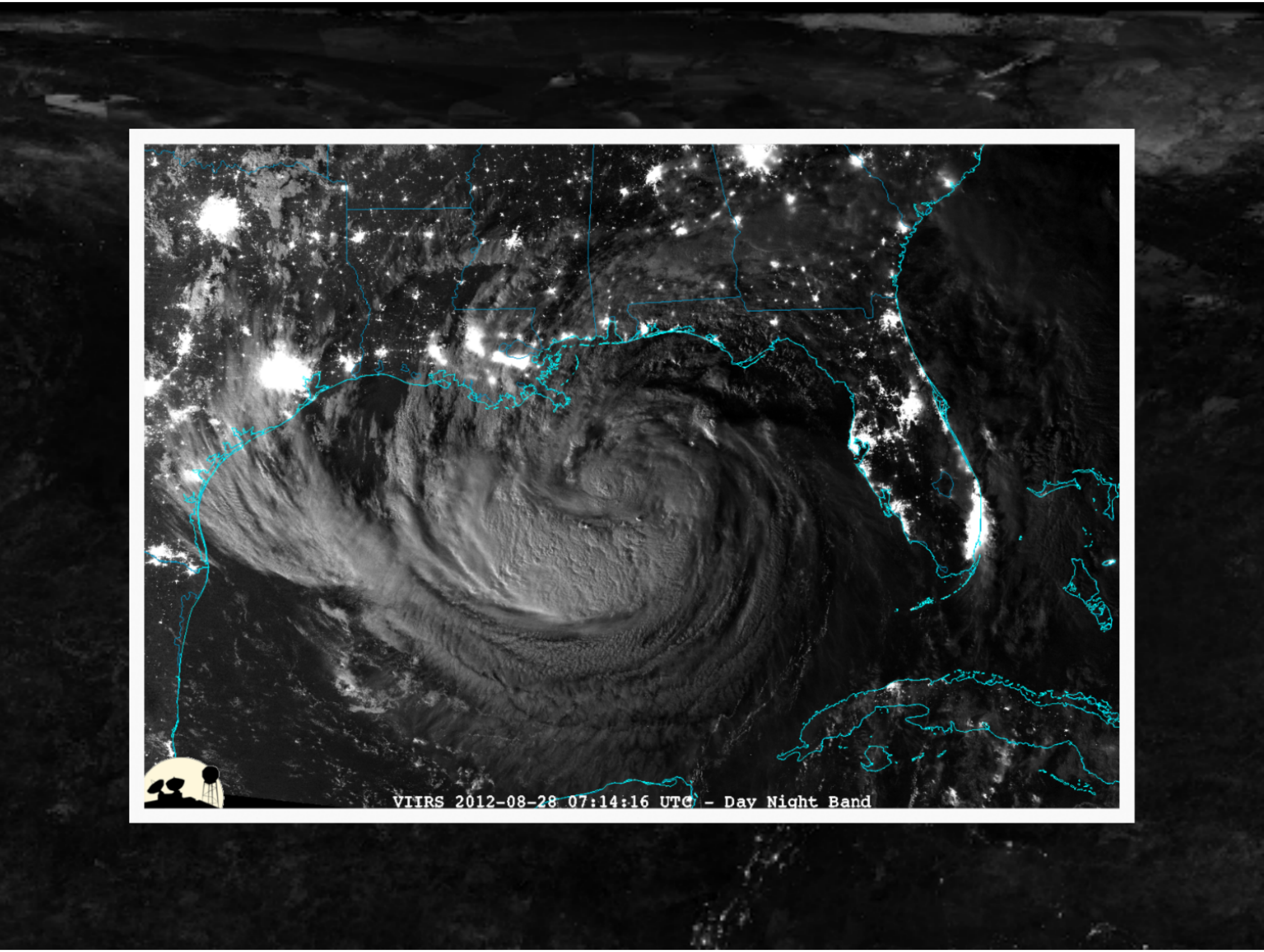
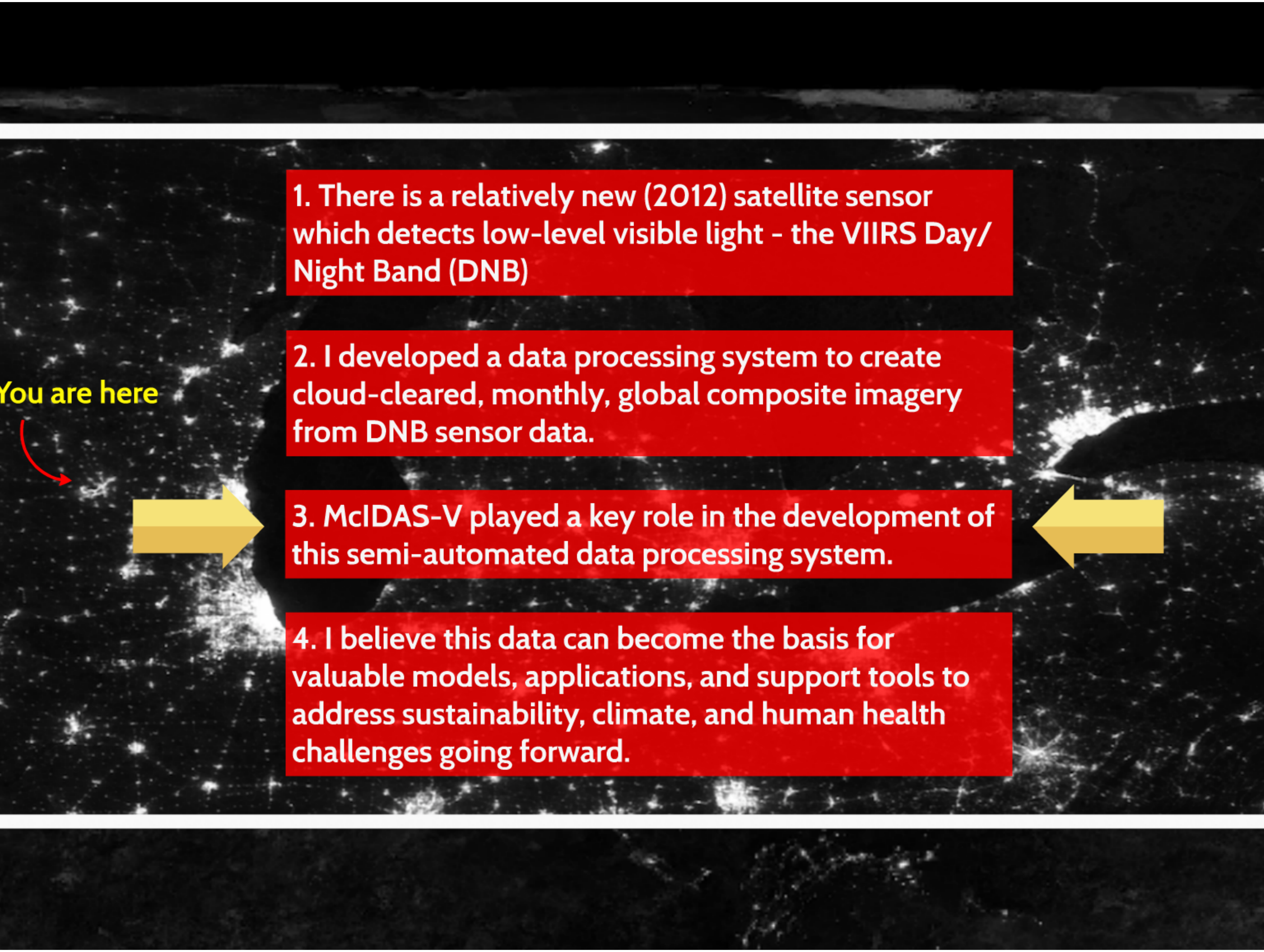
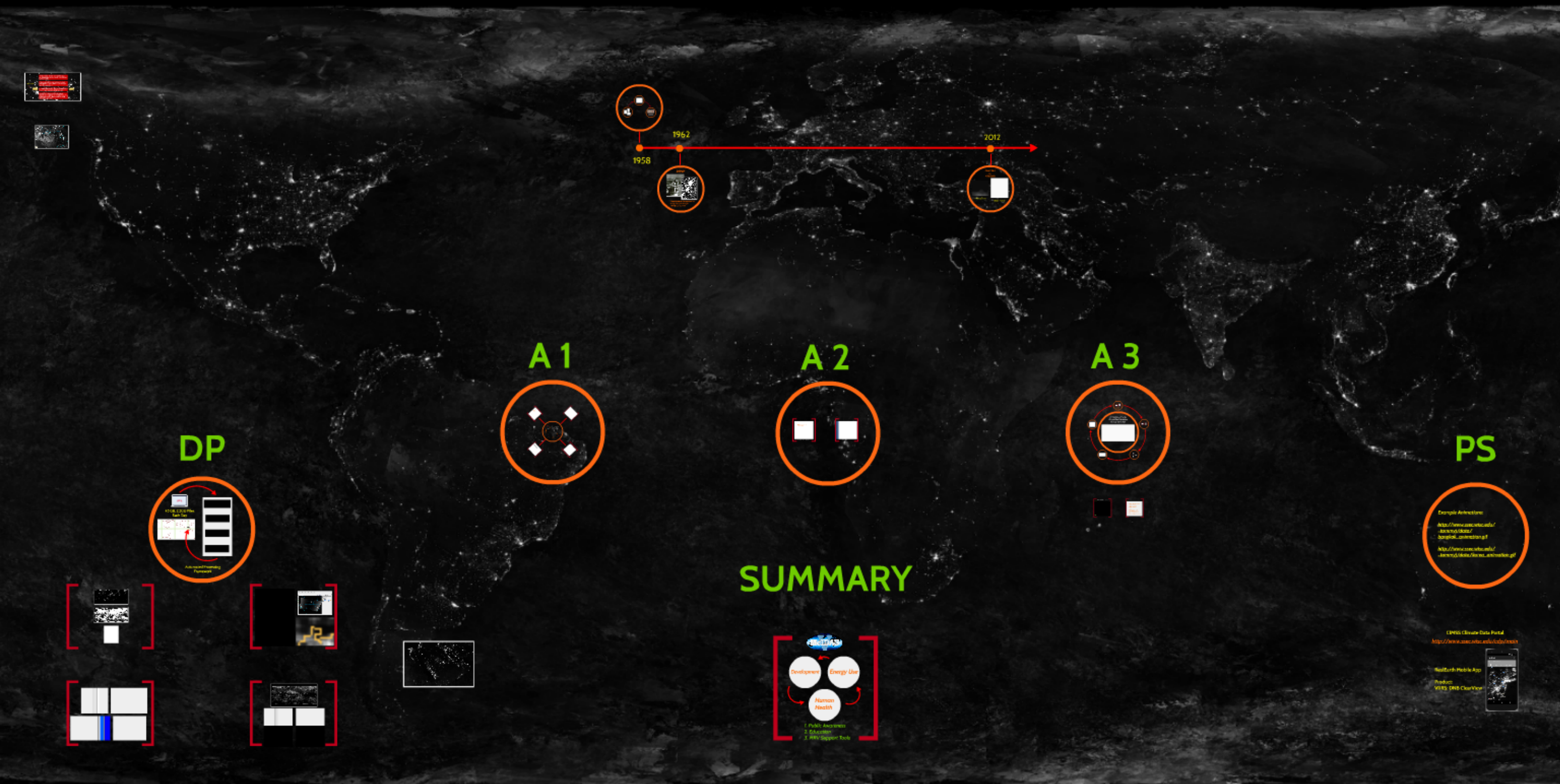


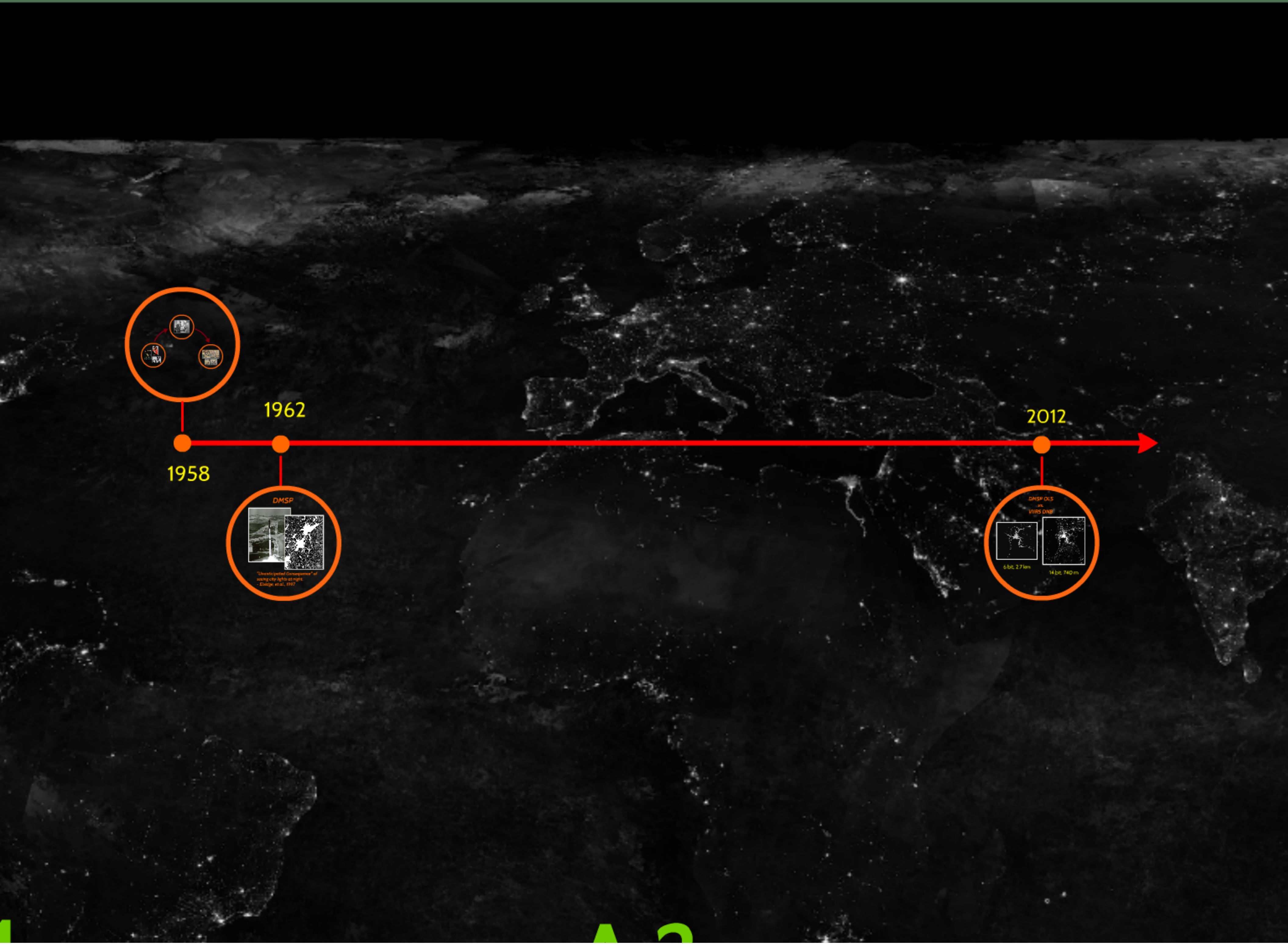
1958
1962
2012
A 1
A 2
A 3
DP
PS
Example Animations
CIMSS Climate Data Portal
RealEarth Mobile App
Product:
VIIRS DNB ClearView
SUMMARY
Development
Energy Use
Human Health
1. Public Awareness
2. Education
3. MRV Support Tools

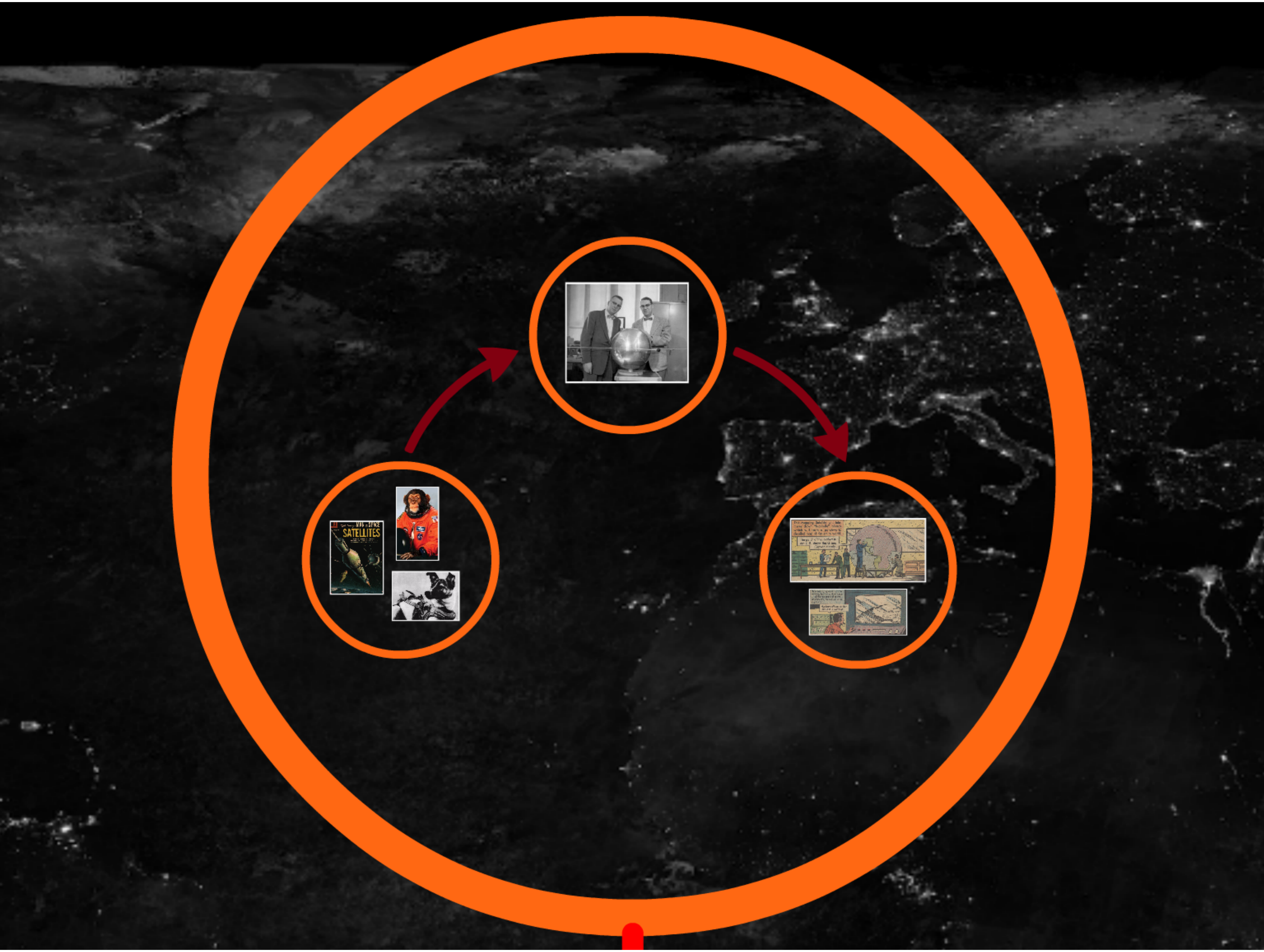

VIIRS 2012-08-28 07:14:16 UTC - Day Night Band


1. There is a relatively new (2012) satellite sensor which detects low-level visible light - the VIIRS Day/Night Band (DNB)
2. I developed a data processing system to create cloud-cleared, monthly, global composite imagery from DNB sensor data.
3. McIDAS-V played a key role in the development of this semi-automated data processing system.
4. I believe this data can become the basis for valuable models, applications, and support tools to address sustainability, climate, and human health challenges going forward.
You are here



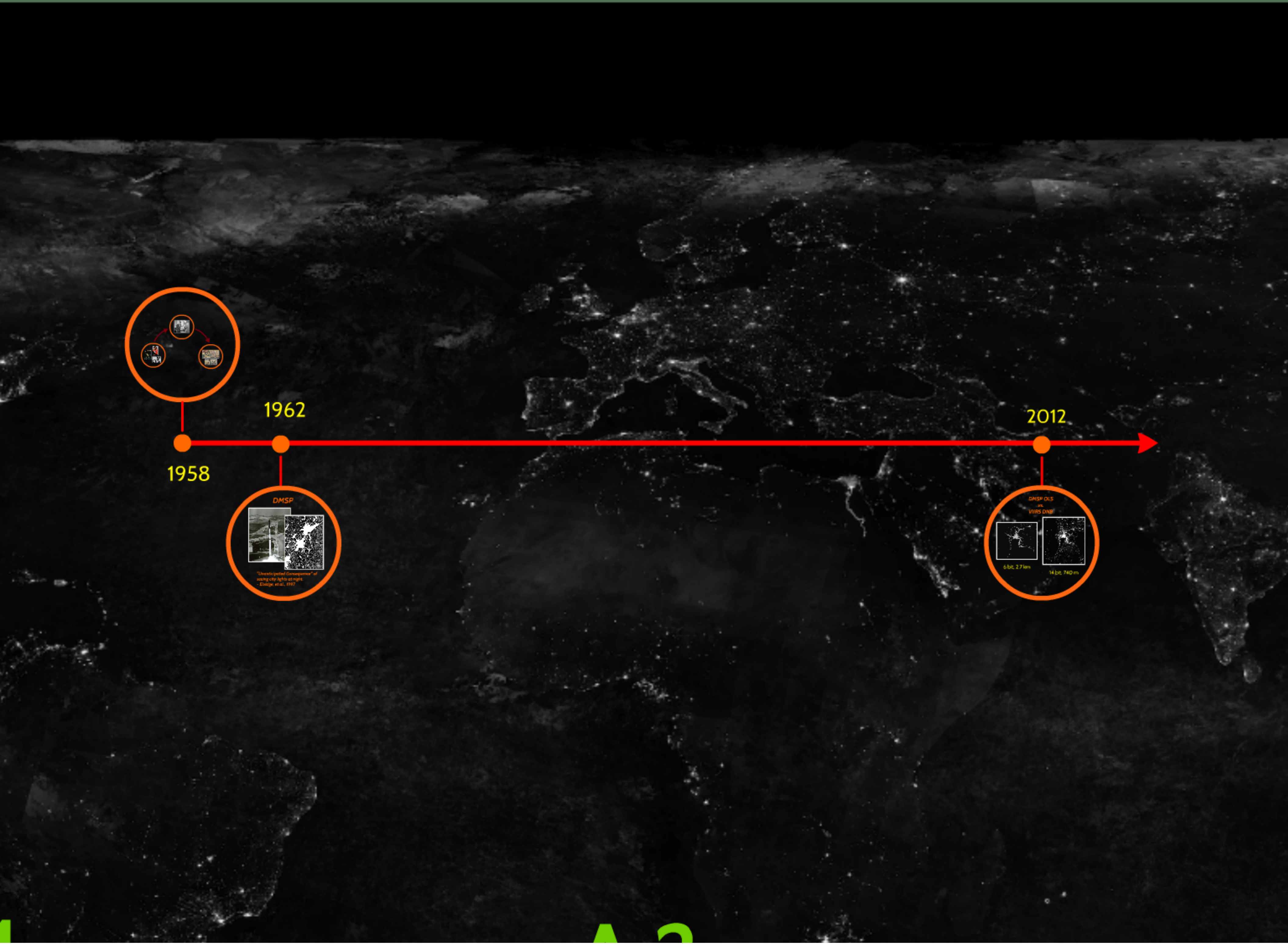
1958
1962
2012
DP
A 1
A 2
A 3
PS
Example Animations:
SUMMARY
Development
Energy Use
Human Health
1. Public Awareness
2. Education
CIMSS Climate Data Portal
RealEarth Mobile App
Product:
VIIRS: DNB-ClearView


1962
2012
1958
DMSP
DMSP OLS
vs.
VIIRS DNB
6 bit, 2.7 km
14 bit, 740 m

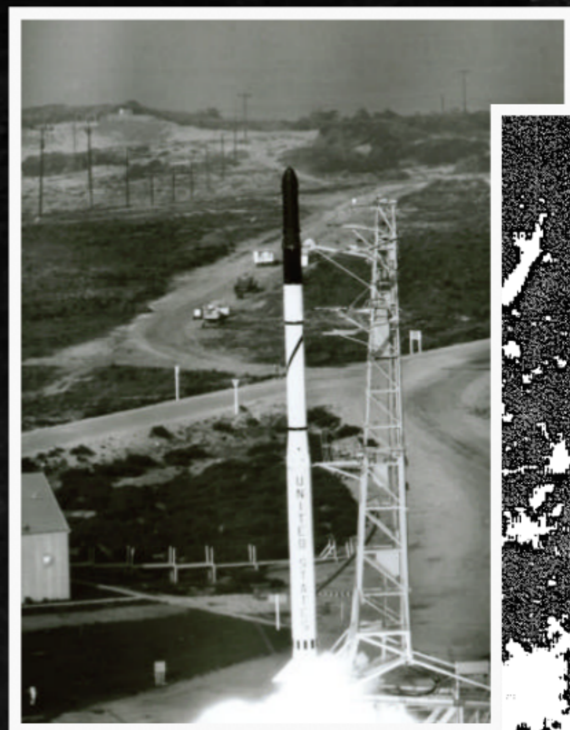

SATELLITES

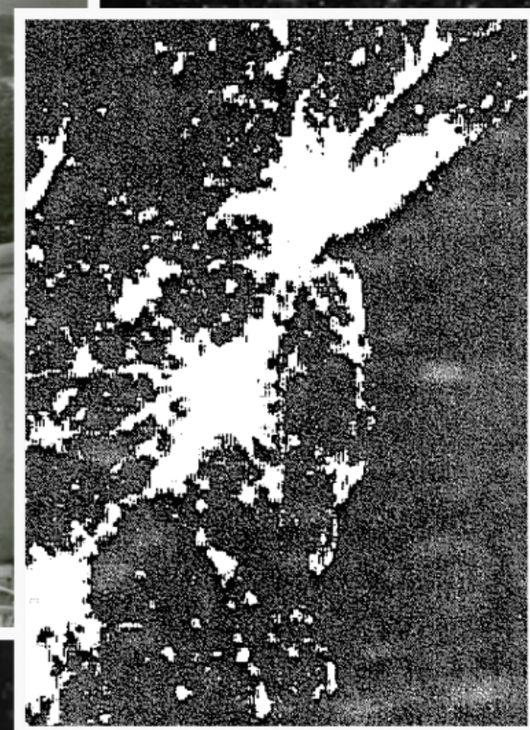

DELL
Walt Disney's MAN IN SPACE
Still 10¢
SATELLITES
Explorer! Vanguard! Sputnik!
What are they – and WHY have they been rocketed into space? This is their story...
NASA


This Mapping Satellite will telemeter down "facsimile" photos which will form a patchwork, detailed map of the entire world.
This patch of the southwestern U.S. shows the Grand Canyon clearly!
Its all-seeing eyes will spot tornadoes, typhoons, tidal waves ...all the rampages of nature... and become an Earliest Warning System!
Hurricane off coast of Florida! Send a warning!

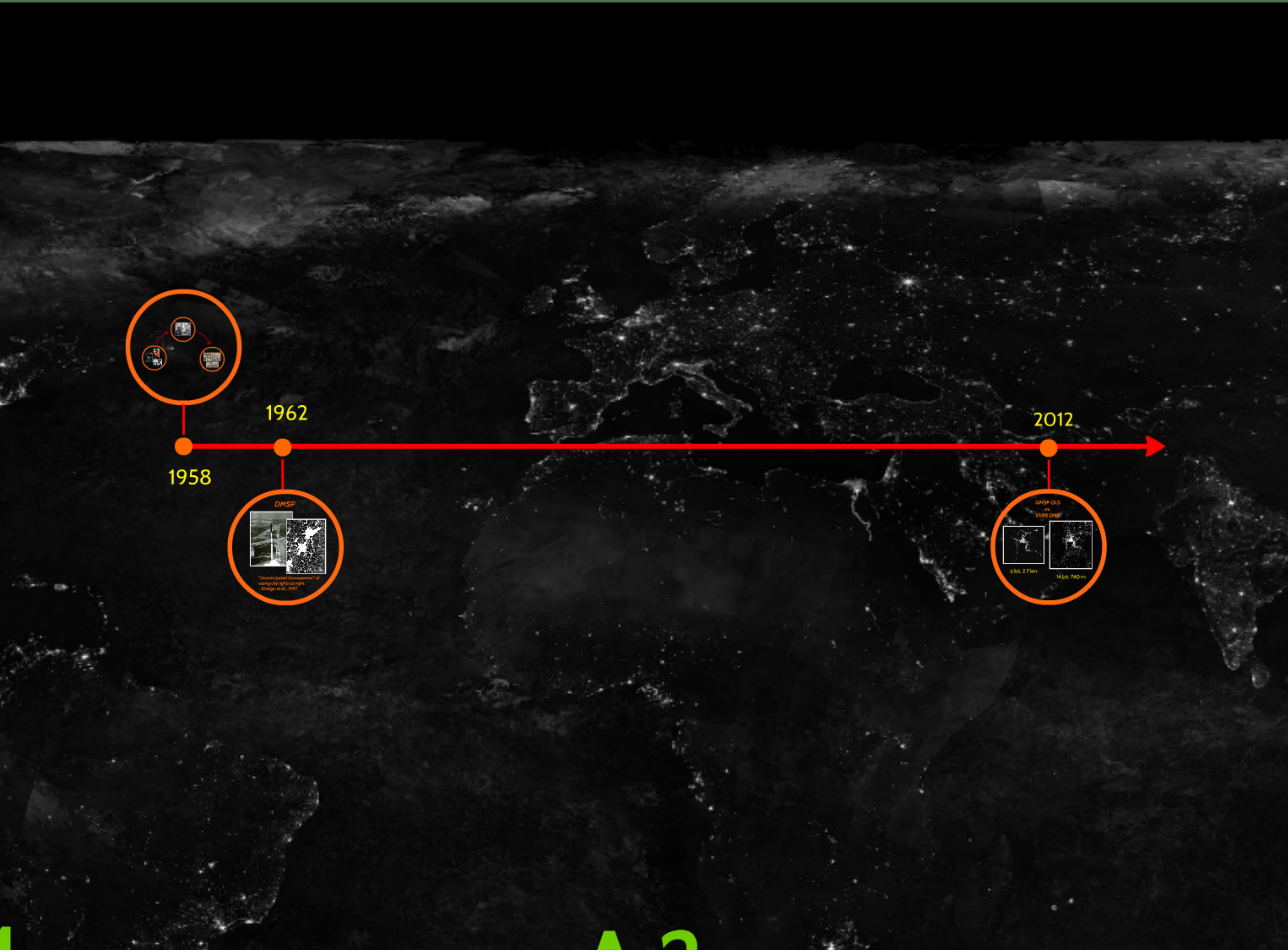

1958
1962
2012
DMSP
"Unanticipated Consequence" of
seeing city lights at night.
- Elvidge, et al., 1997
DMSP OLS
vs.
VIIRS DNB
6 bit, 2.7 km
14 bit, 740 m

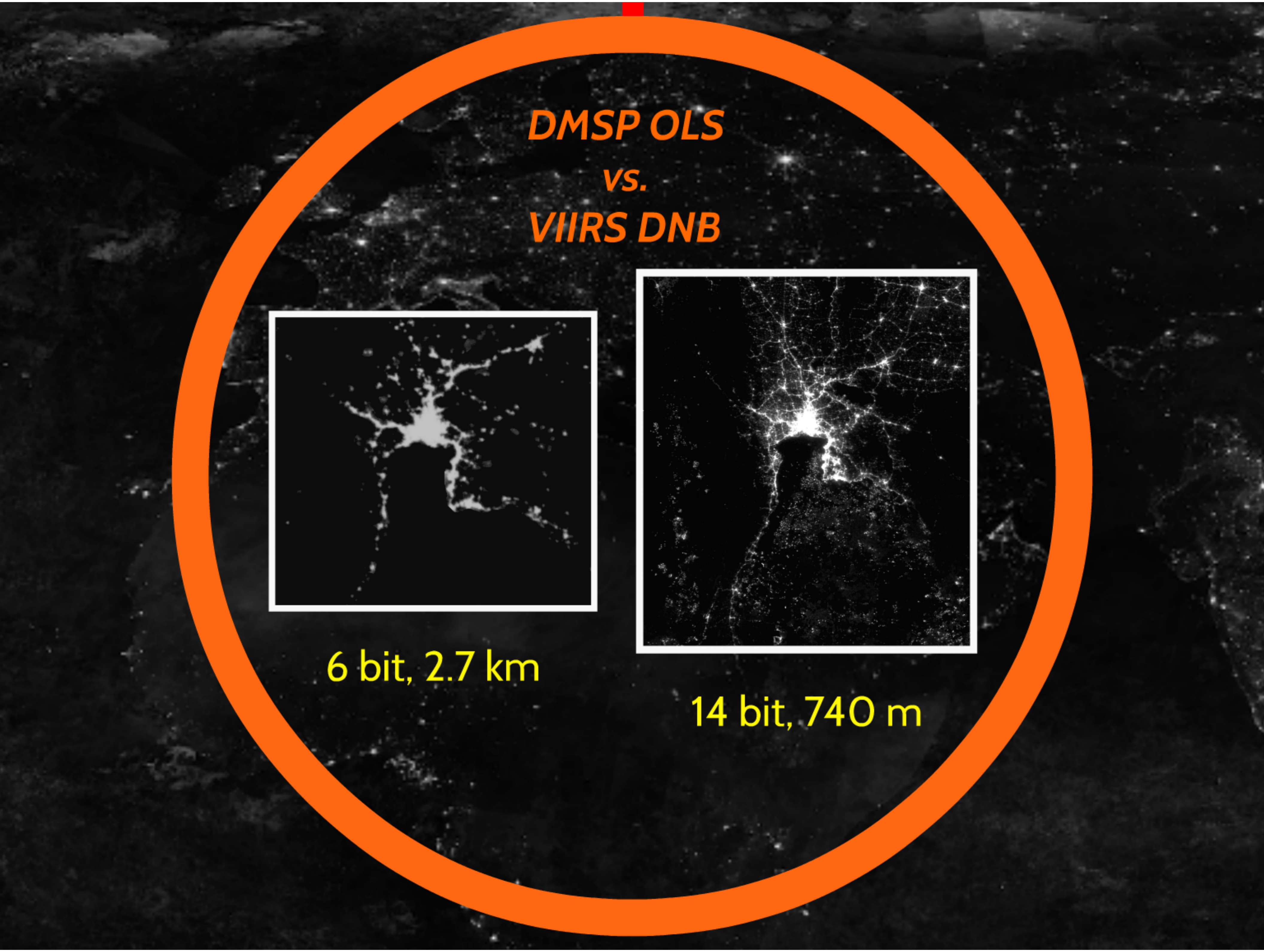
DMSP



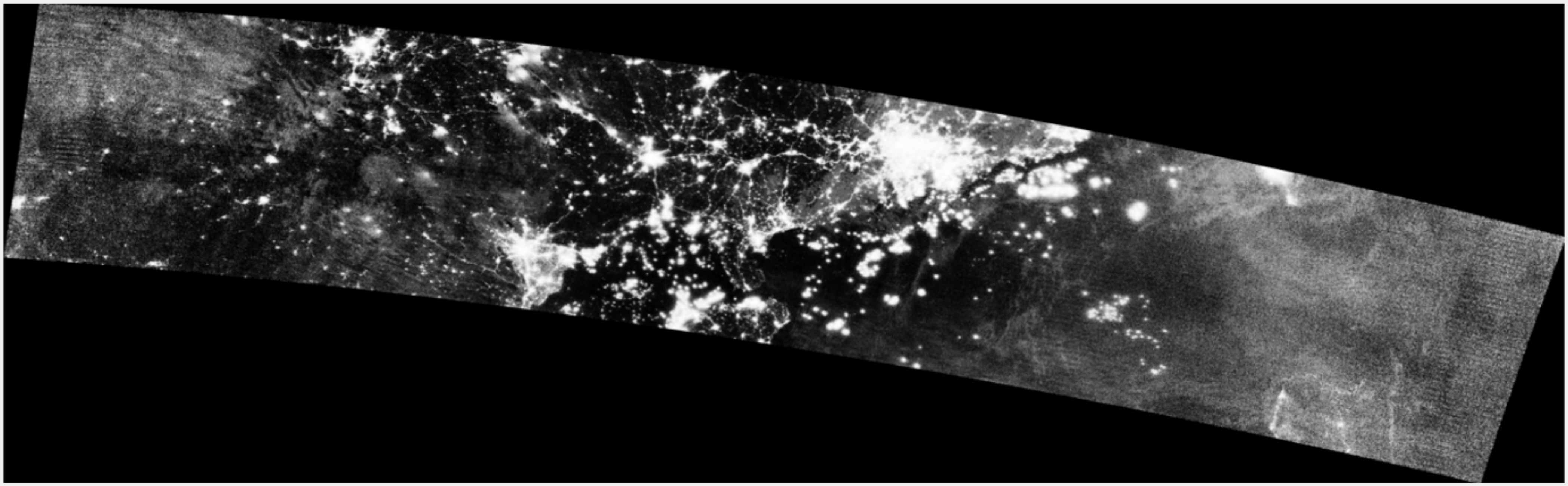


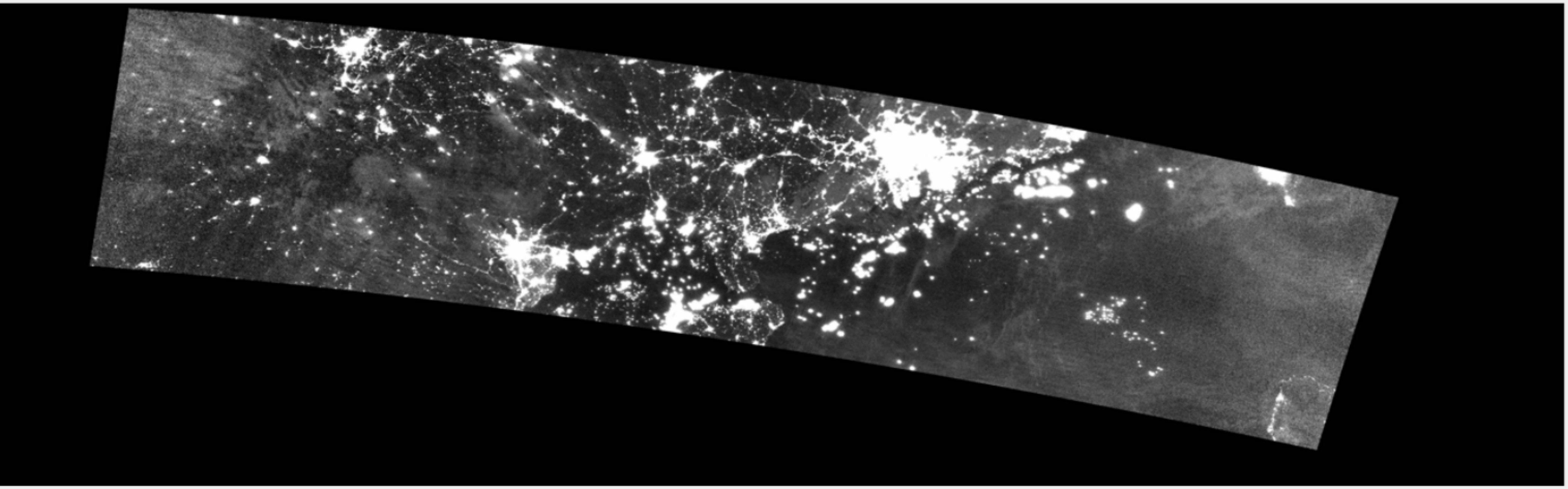
"Unanticipated Consequence" of seeing city lights at night.
- Elvidge, et al., 1997

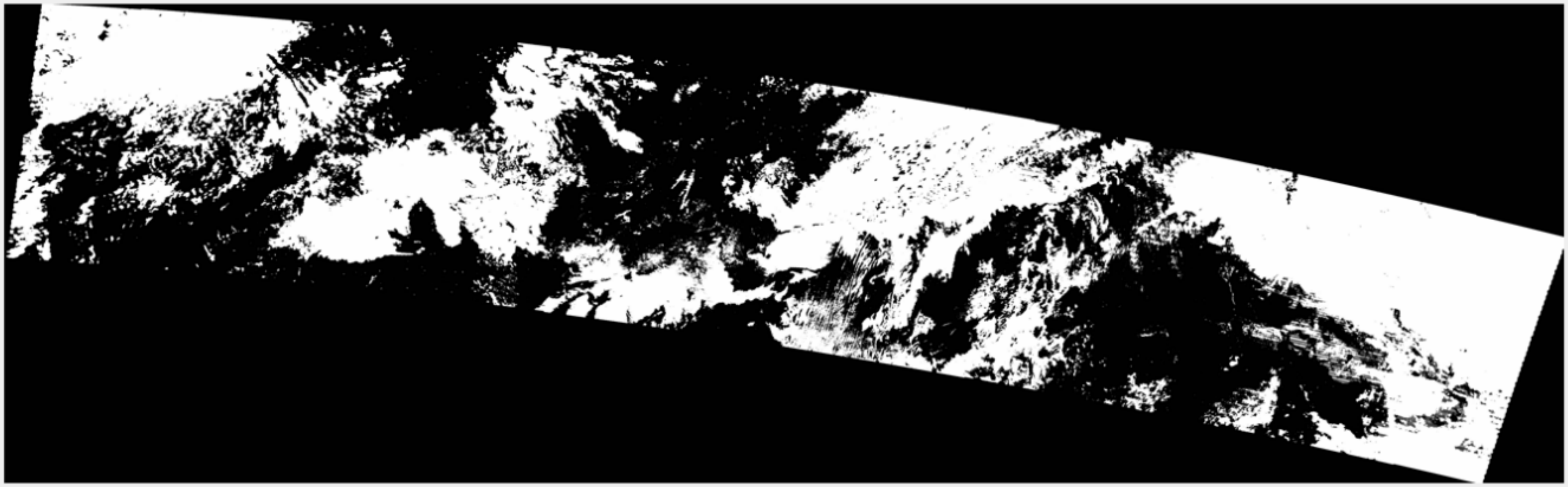

1958
1962
DMSP
2012
DMSP OLS
vs.
VIIRS DNB
6 bit, 2.7 km
14 bit, 740 m

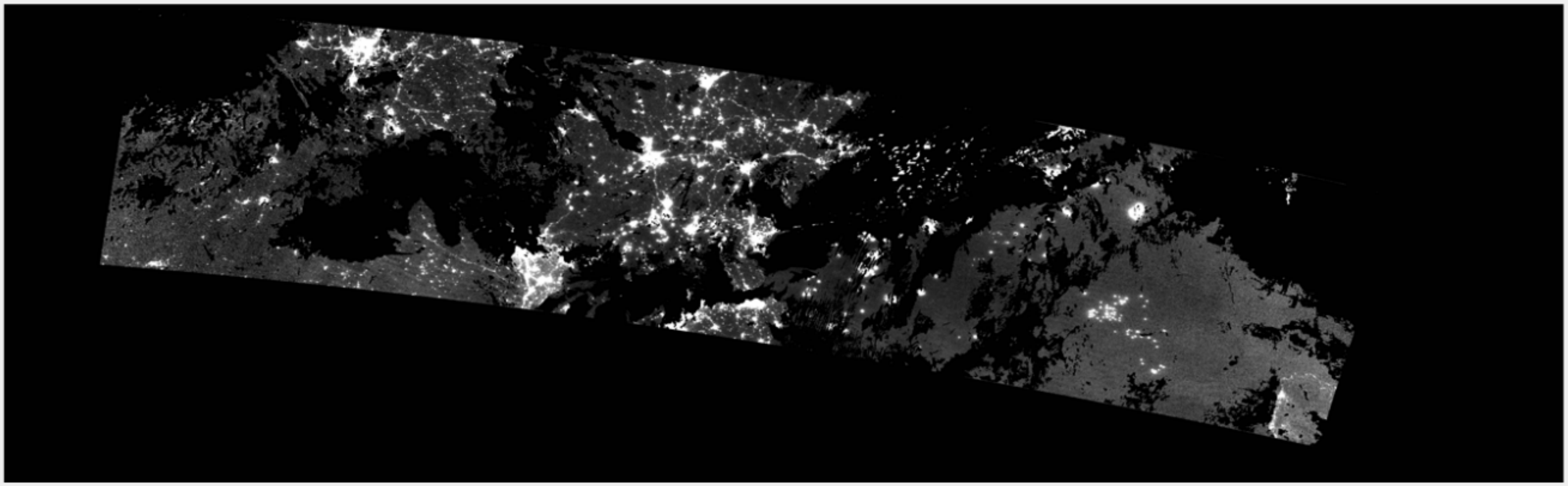

DMSP OLS
vs.
VIIRS DNB
6 bit, 2.7 km
14 bit, 740 m


DP
SIPS
45 GB, 2,200 Files
Each Day
Automated Processing
Framework

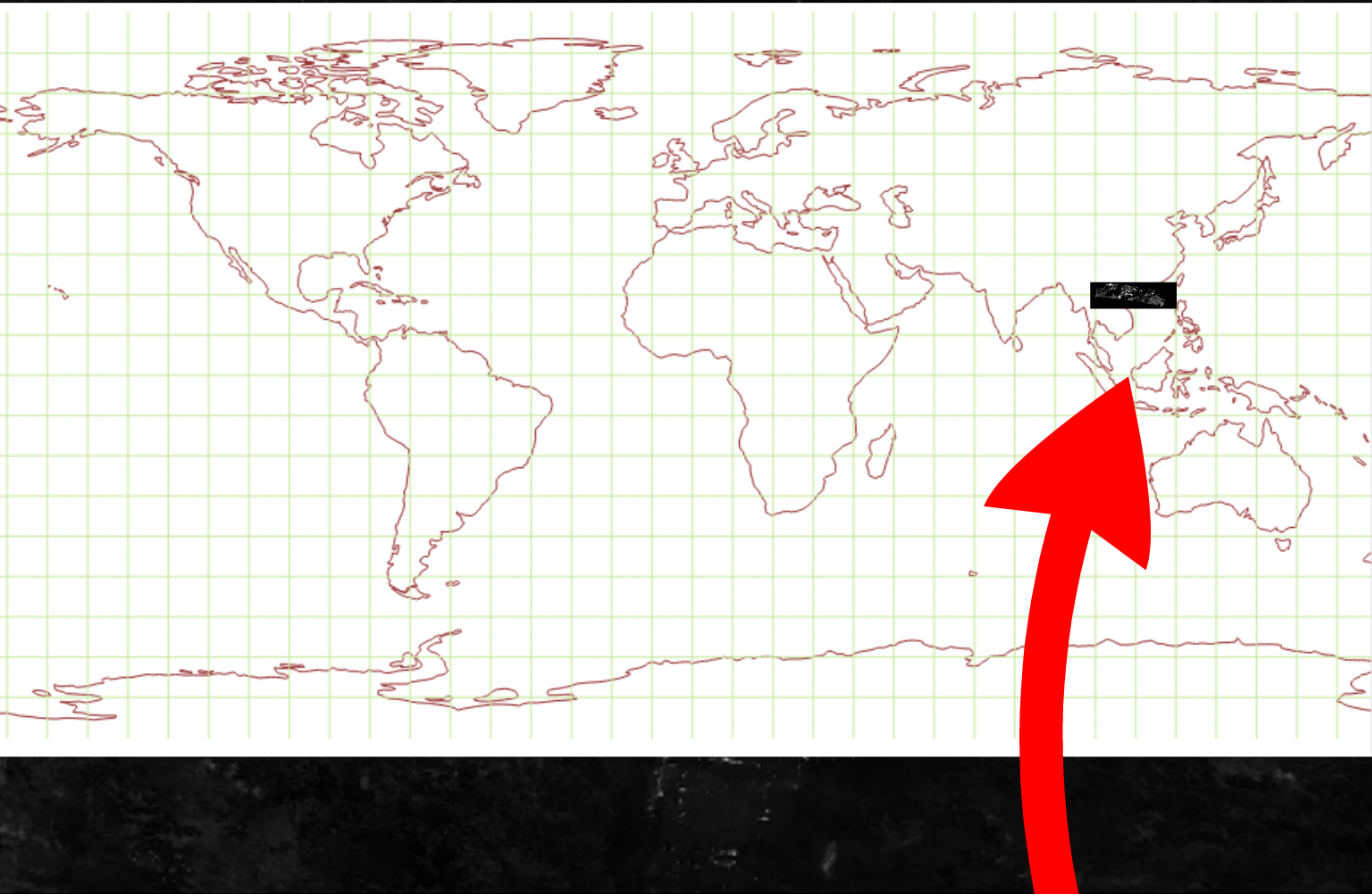




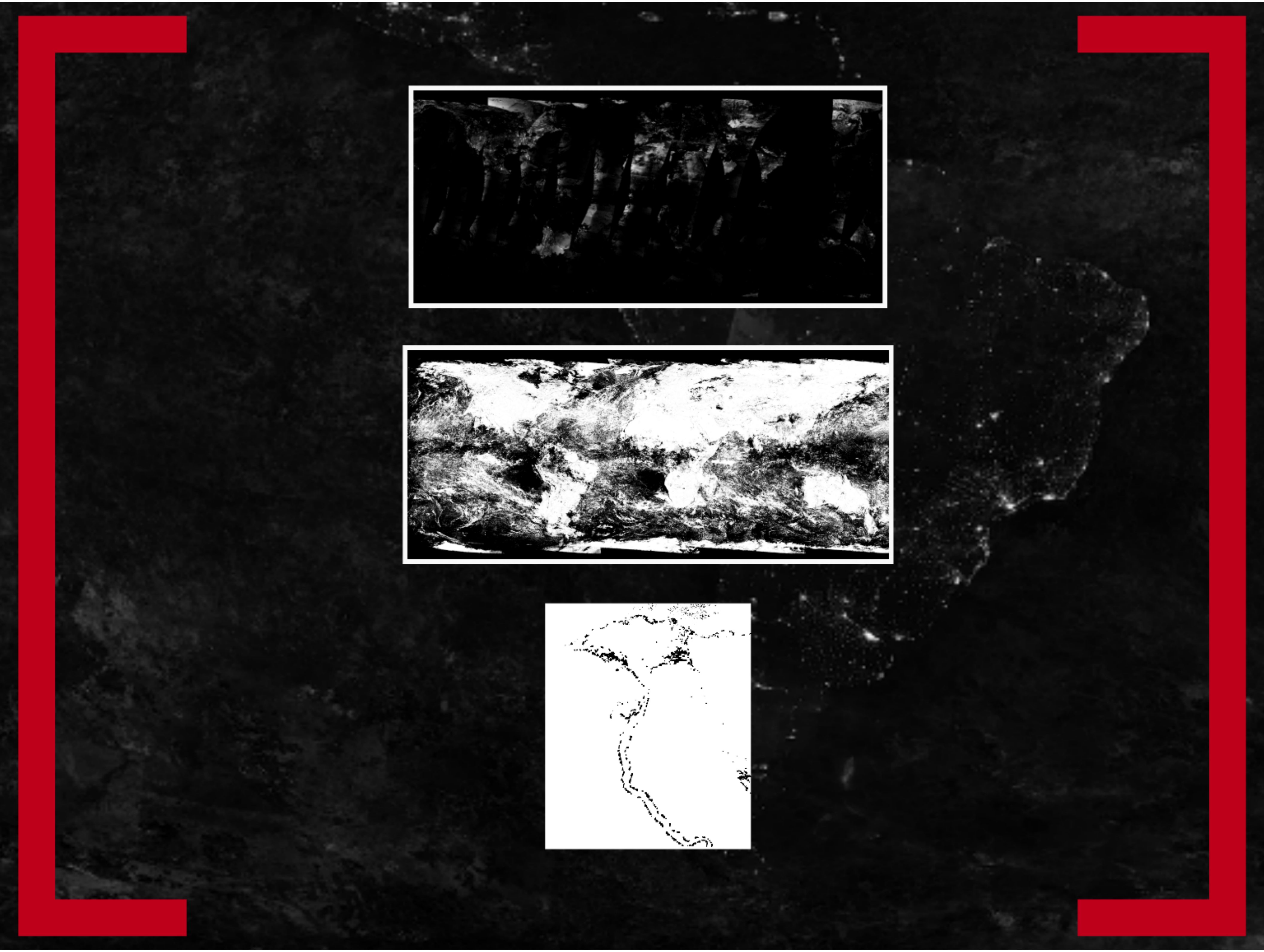


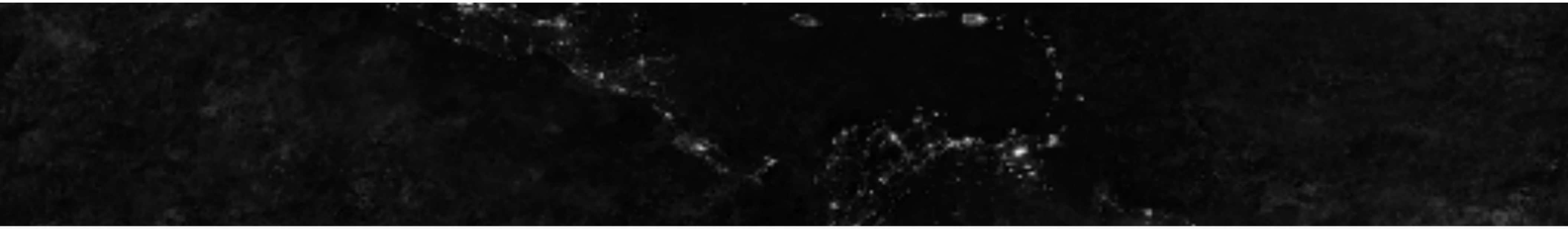


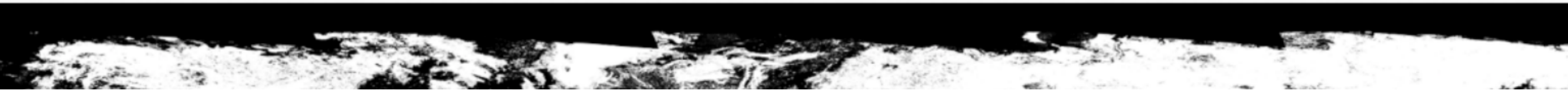
Each Day

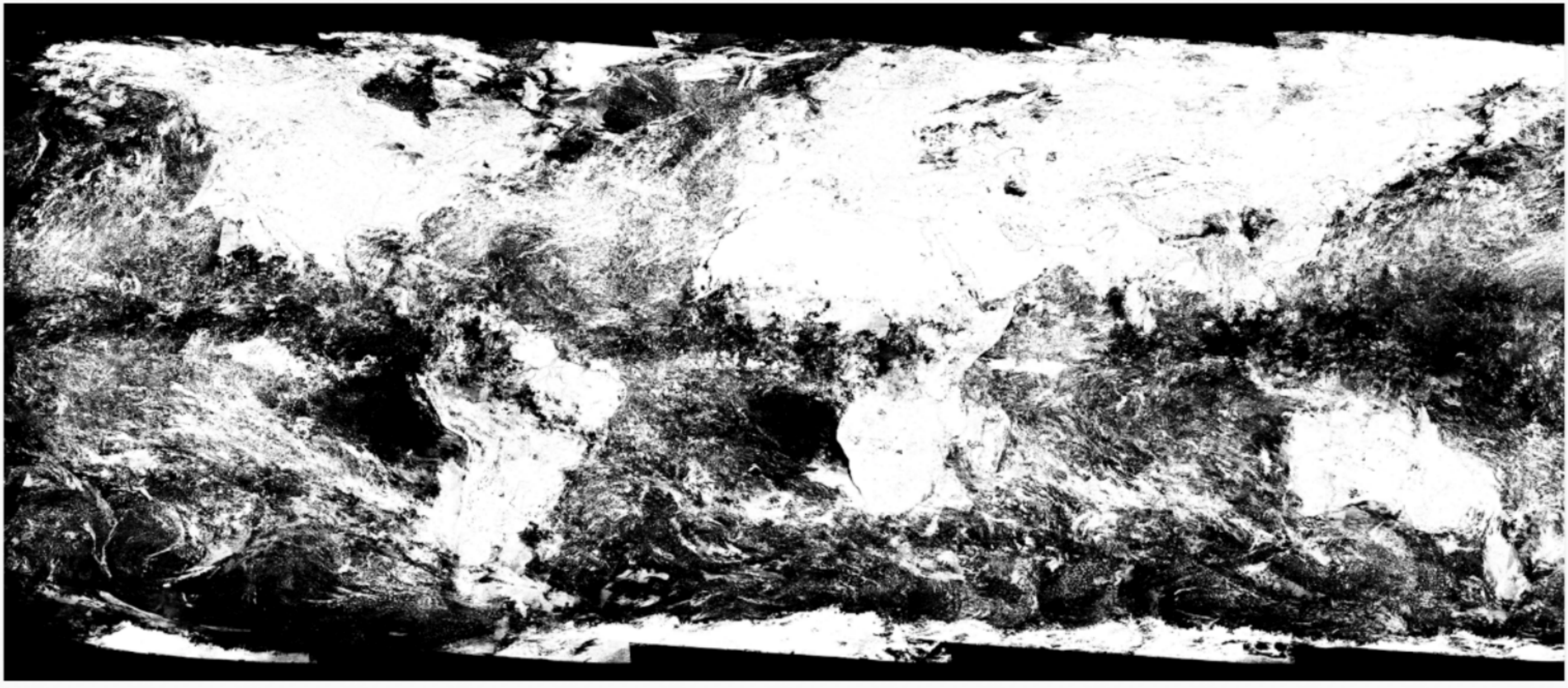


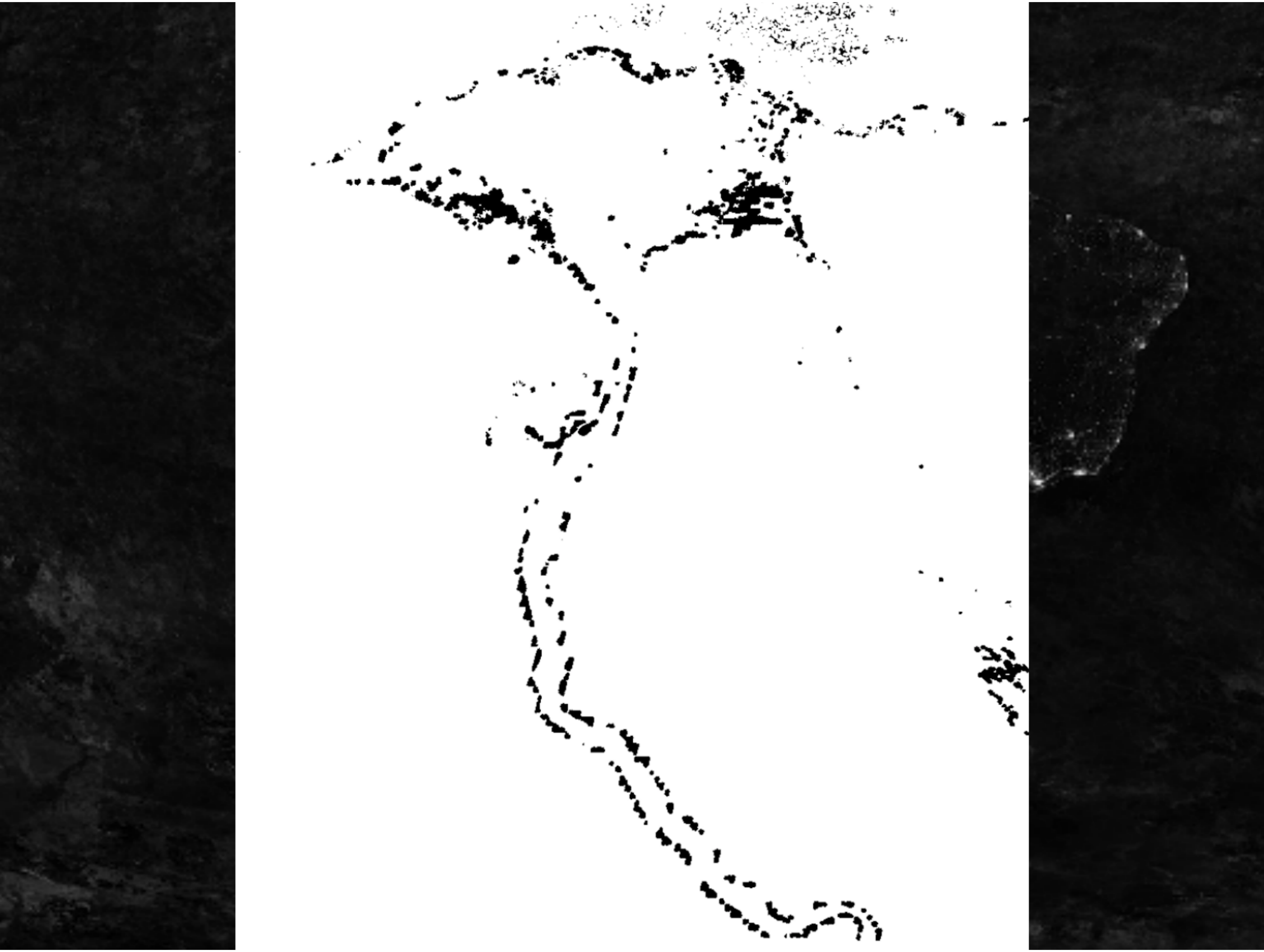

DP
SIPS
45 GB, 2,200 Files
Each Day
Automated Processing
Framework

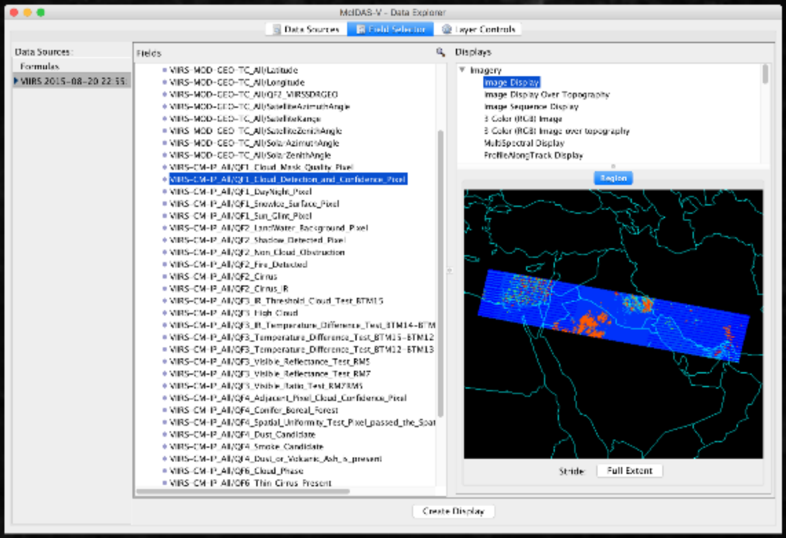




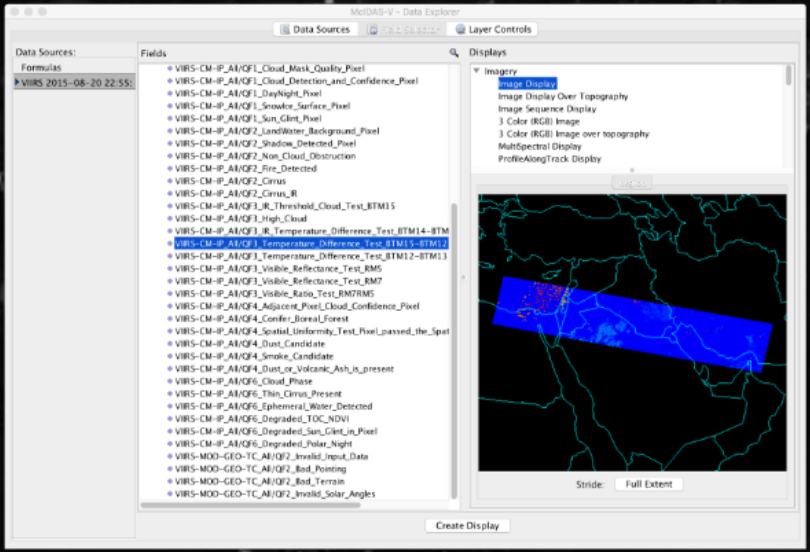




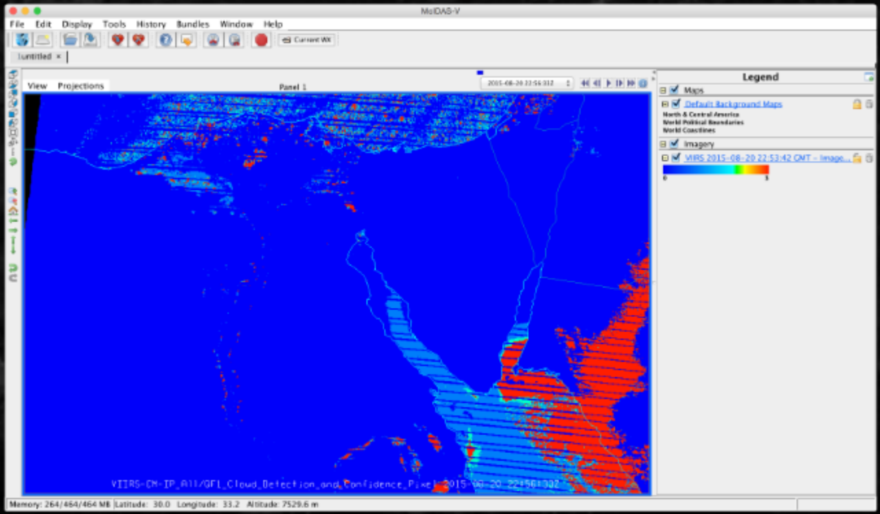




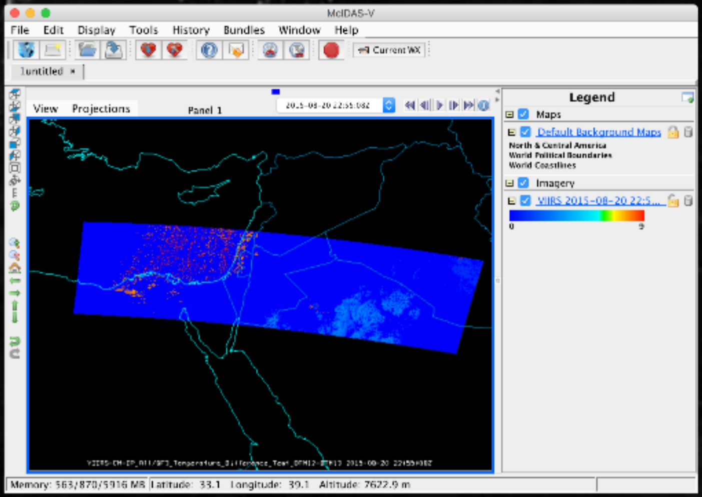
McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
Fields
Displays
Create Display



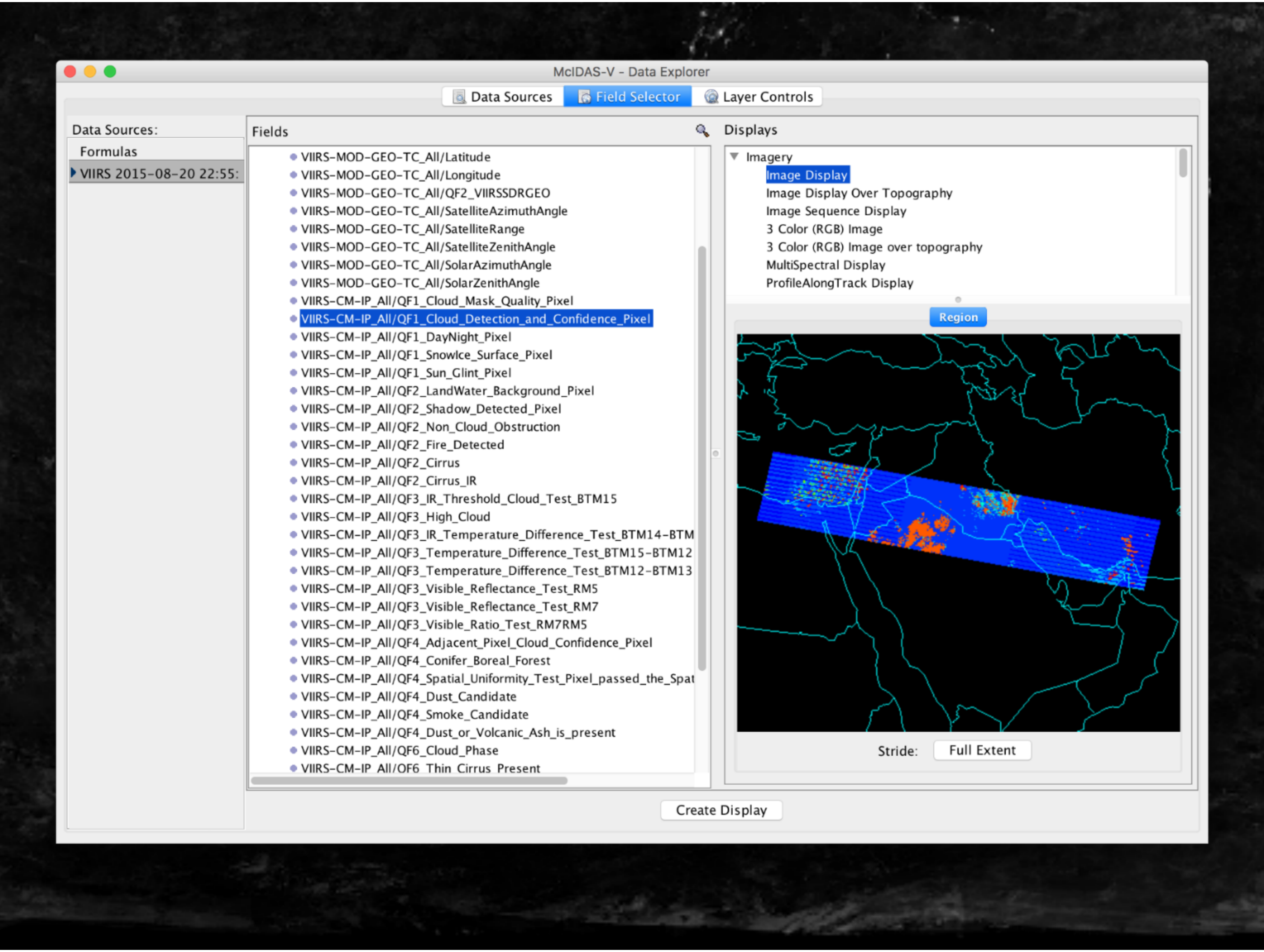
Data Sources
Layer Controls
Fields
Displays
Create Display

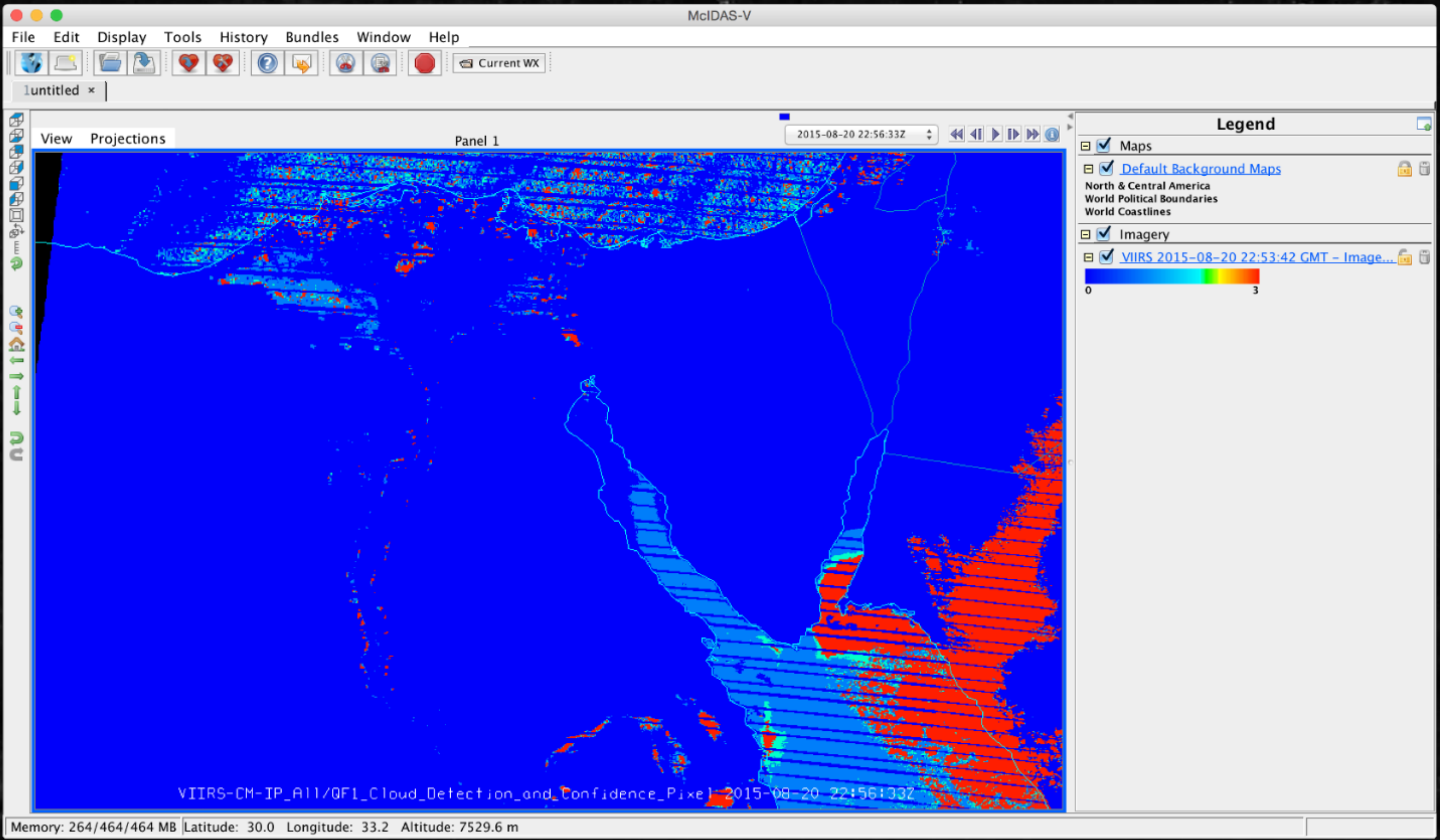


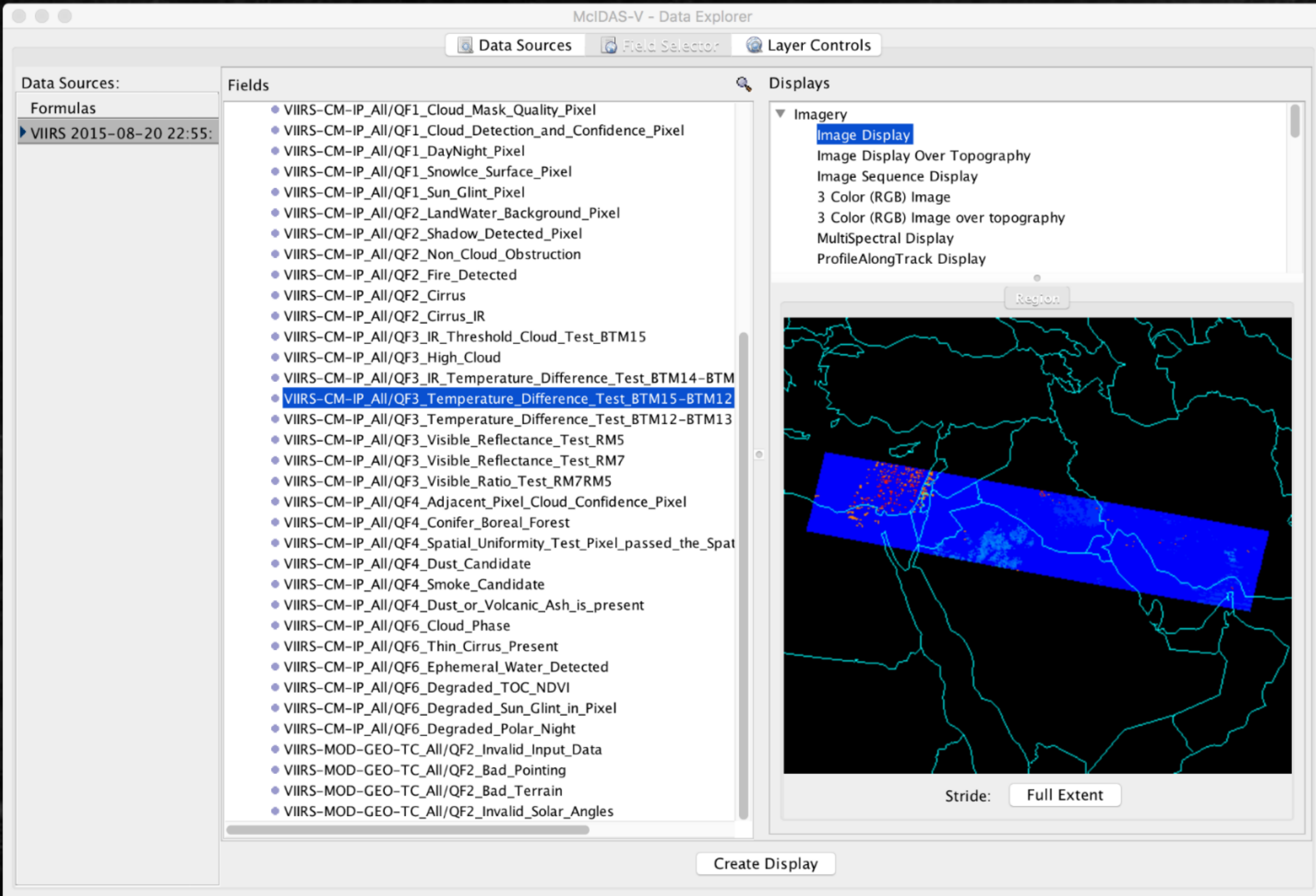
McIDAS-V
File
Edit
Display
Tools
History
Bundles
Window
Help
Legend

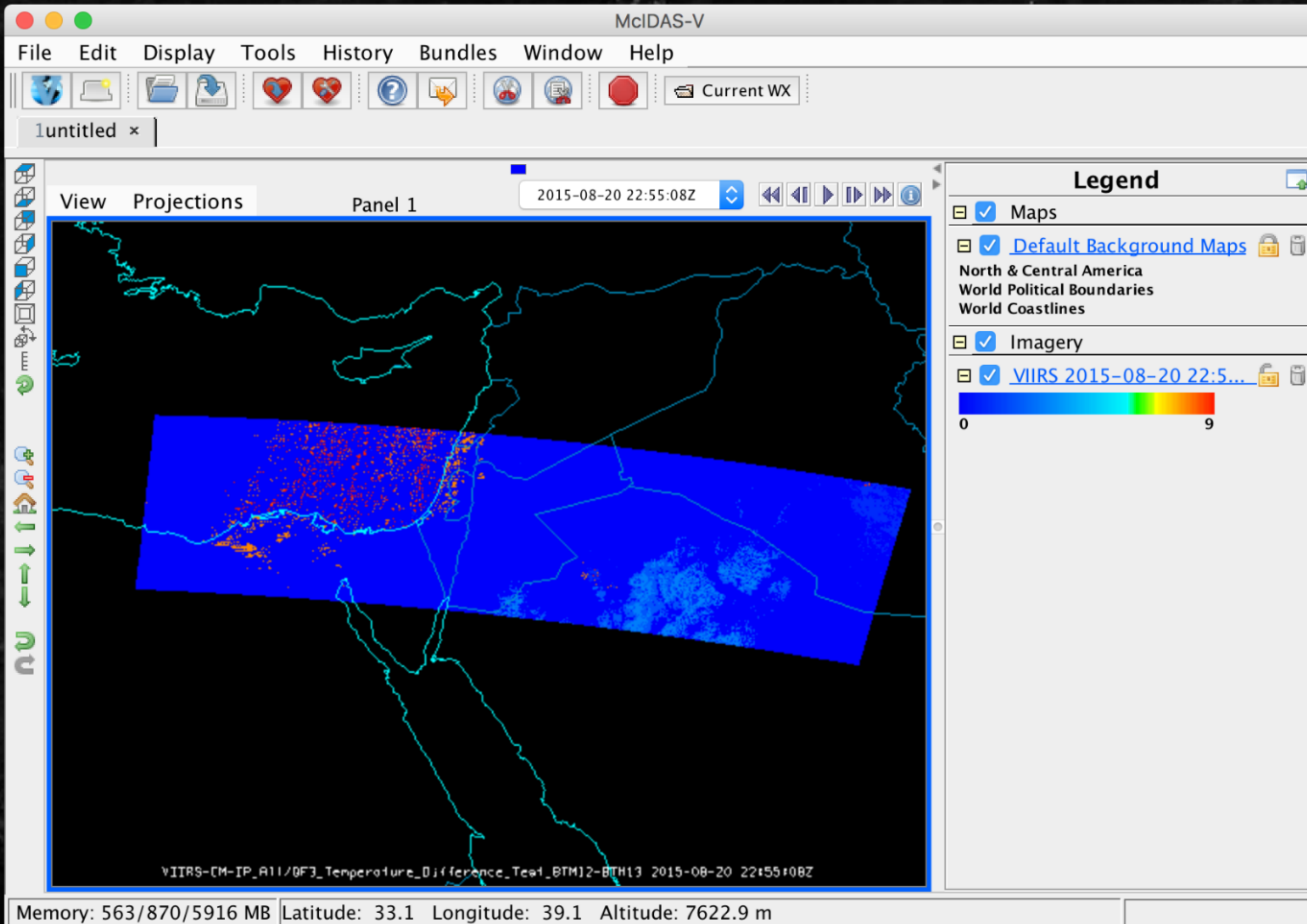


McIDAS-V
File
Edit
Display
Tools
History
Bundles
Window
Help
View
Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery


McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
Data Sources:
Formulas
VIIRS 2015-08-20 22:55:
Fields
VIIRS-MOD-GEO-TC_All/Latitude
VIIRS-MOD-GEO-TC_All/Longitude
VIIRS-MOD-GEO-TC_All/QF2_VIIRSSDRGEO
VIIRS-MOD-GEO-TC_All/SatelliteAzimuthAngle
VIIRS-MOD-GEO-TC_All/SatelliteRange
VIIRS-MOD-GEO-TC_All/SatelliteZenithAngle
VIIRS-MOD-GEO-TC_All/SolarAzimuthAngle
VIIRS-MOD-GEO-TC_All/SolarZenithAngle
VIIRS-CM-IP_All/QF1_Cloud_Mask_Quality_Pixel
VIIRS-CM-IP_All/QF1_Cloud_Detection_and_Confidence_Pixel
VIIRS-CM-IP_All/QF1_DayNight_Pixel
VIIRS-CM-IP_All/QF1_SnowIce_Surface_Pixel
VIIRS-CM-IP_All/QF1_Sun_Glint_Pixel
VIIRS-CM-IP_All/QF2_LandWater_Background_Pixel
VIIRS-CM-IP_All/QF2_Shadow_Detected_Pixel
VIIRS-CM-IP_All/QF2_Non_Cloud_Obstruction
VIIRS-CM-IP_All/QF2_Fire_Detected
VIIRS-CM-IP_All/QF2_Cirrus
VIIRS-CM-IP_All/QF2_Cirrus_IR
VIIRS-CM-IP_All/QF3_IR_Threshold_Cloud_Test_BTM15
VIIRS-CM-IP_All/QF3_High_Cloud
VIIRS-CM-IP_All/QF3_IR_Temperature_Difference_Test_BTM14-BTM
VIIRS-CM-IP_All/QF3_Temperature_Difference_Test_BTM15-BTM12
VIIRS-CM-IP_All/QF3_Temperature_Difference_Test_BTM12-BTM13
VIIRS-CM-IP_All/QF3_Visible_Reflectance_Test_RM5
VIIRS-CM-IP_All/QF3_Visible_Reflectance_Test_RM7
VIIRS-CM-IP_All/QF3_Visible_Ratio_Test_RM7RM5
VIIRS-CM-IP_All/QF4_Adjacent_Pixel_Cloud_Confidence_Pixel
VIIRS-CM-IP_All/QF4_Conifer_Boreal_Forest
VIIRS-CM-IP_All/QF4_Spatial_Uniformity_Test_Pixel_passed_the_Spat
VIIRS-CM-IP_All/QF4_Dust_Candidate
VIIRS-CM-IP_All/QF4_Smoke_Candidate
VIIRS-CM-IP_All/QF4_Dust_or_Volcanic_Ash_is_present
VIIRS-CM-IP_All/QF6_Cloud_Phase
VIIRS-CM-IP_All/QF6_Thin_Cirrus_Present
Displays
Imagery
Image Display
Image Display Over Topography
Image Sequence Display
3 Color (RGB) Image
3 Color (RGB) Image over topography
MultiSpectral Display
ProfileAlongTrack Display
Region
Stride:
Full Extent
Create Display


McIDAS-V
File Edit Display Tools History Bundles Window Help
Current WX
untitled
View Projections
Panel 1
2015-08-20 22:56:33Z
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-08-20 22:53:42 GMT - Image...
0
3
VIIRS-CM-IP_All/QF1_Cloud_Detection_and_Confidence_Pixel 2015-08-20 22:56:33Z
Memory: 264/464/464 MB Latitude: 30.0 Longitude: 33.2 Altitude: 7529.6 m


McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
Data Sources:
Formulas
VIIRS 2015-08-20 22:55:
Fields
VIIRS-CM-IP_All/QF1_Cloud_Mask_Quality_Pixel
VIIRS-CM-IP_All/QF1_Cloud_Detection_and_Confidence_Pixel
VIIRS-CM-IP_All/QF1_DayNight_Pixel
VIIRS-CM-IP_All/QF1_SnowIce_Surface_Pixel
VIIRS-CM-IP_All/QF1_Sun_Glint_Pixel
VIIRS-CM-IP_All/QF2_LandWater_Background_Pixel
VIIRS-CM-IP_All/QF2_Shadow_Detected_Pixel
VIIRS-CM-IP_All/QF2_Non_Cloud_Obstruction
VIIRS-CM-IP_All/QF2_Fire_Detected
VIIRS-CM-IP_All/QF2_Cirrus
VIIRS-CM-IP_All/QF2_Cirrus_IR
VIIRS-CM-IP_All/QF3_IR_Threshold_Cloud_Test_BTM15
VIIRS-CM-IP_All/QF3_High_Cloud
VIIRS-CM-IP_All/QF3_IR_Temperature_Difference_Test_BTM14-BTM
VIIRS-CM-IP_All/QF3_Temperature_Difference_Test_BTM15-BTM12
VIIRS-CM-IP_All/QF3_Temperature_Difference_Test_BTM12-BTM13
VIIRS-CM-IP_All/QF3_Visible_Reflectance_Test_RM5
VIIRS-CM-IP_All/QF3_Visible_Reflectance_Test_RM7
VIIRS-CM-IP_All/QF3_Visible_Ratio_Test_RM7RM5
VIIRS-CM-IP_All/QF4_Adjacent_Pixel_Cloud_Confidence_Pixel
VIIRS-CM-IP_All/QF4_Conifer_Boreal_Forest
VIIRS-CM-IP_All/QF4_Spatial_Uniformity_Test_Pixel_passed_the_Spat
VIIRS-CM-IP_All/QF4_Dust_Candidate
VIIRS-CM-IP_All/QF4_Smoke_Candidate
VIIRS-CM-IP_All/QF4_Dust_or_Volcanic_Ash_is_present
VIIRS-CM-IP_All/QF6_Cloud_Phase
VIIRS-CM-IP_All/QF6_Thin_Cirrus_Present
VIIRS-CM-IP_All/QF6_Ephemeral_Water_Detected
VIIRS-CM-IP_All/QF6_Degraded_TOC_NDVI
VIIRS-CM-IP_All/QF6_Degraded_Sun_Glint_in_Pixel
VIIRS-CM-IP_All/QF6_Degraded_Polar_Night
VIIRS-MOD-GEO-TC_All/QF2_Invalid_Input_Data
VIIRS-MOD-GEO-TC_All/QF2_Bad_Pointing
VIIRS-MOD-GEO-TC_All/QF2_Bad_Terrain
VIIRS-MOD-GEO-TC_All/QF2_Invalid_Solar_Angles
Displays
Imagery
Image Display
Image Display Over Topography
Image Sequence Display
3 Color (RGB) Image
3 Color (RGB) Image over topography
MultiSpectral Display
ProfileAlongTrack Display
Region
Stride:
Full Extent
Create Display


McIDAS-V
File Edit Display Tools History Bundles Window Help
Current WX
1untitled
View Projections
Panel 1
2015-08-20 22:55:08Z
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-08-20 22:5...
0
9
VIIRS-CM-IP_All/BF3_Temperature_Difference_Test_BTM12-BTM13 2015-08-20 22:55:08Z
Memory: 563/870/5916 MB
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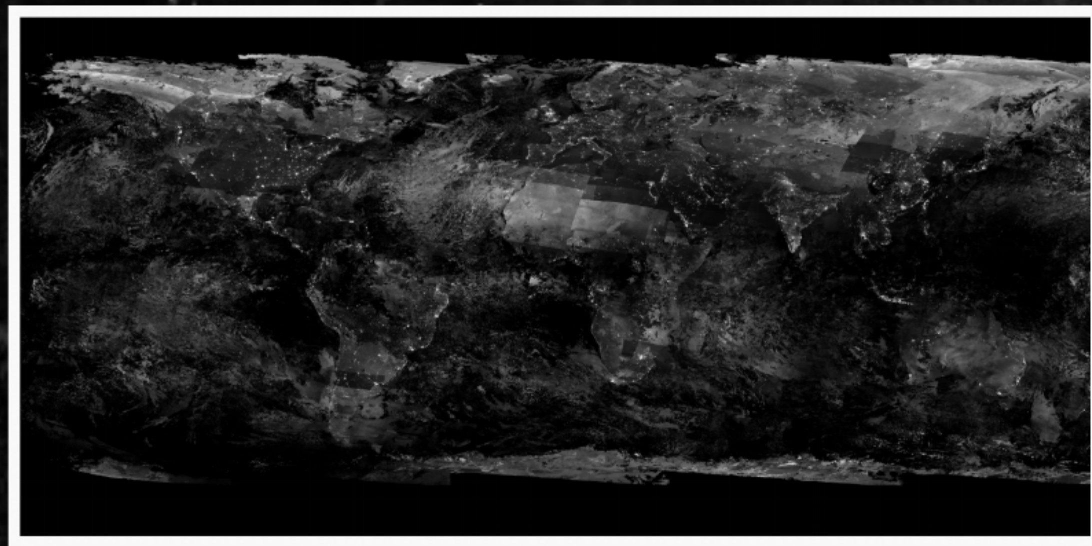
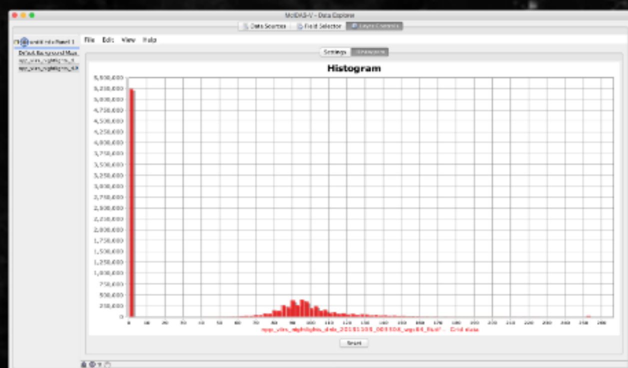
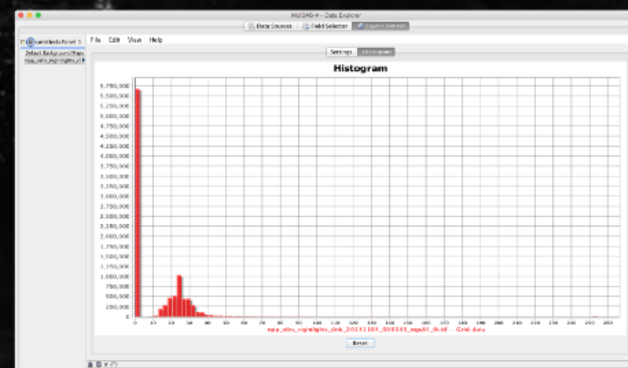
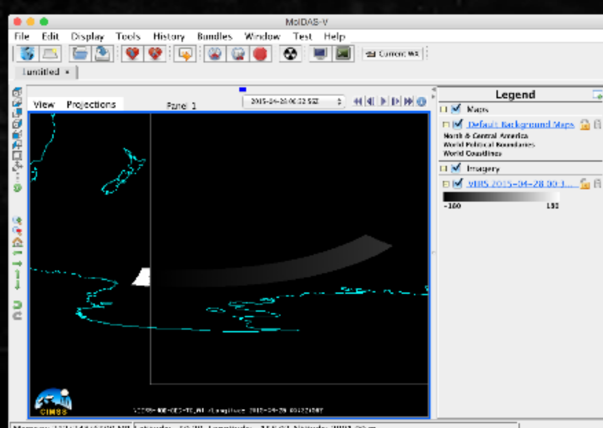
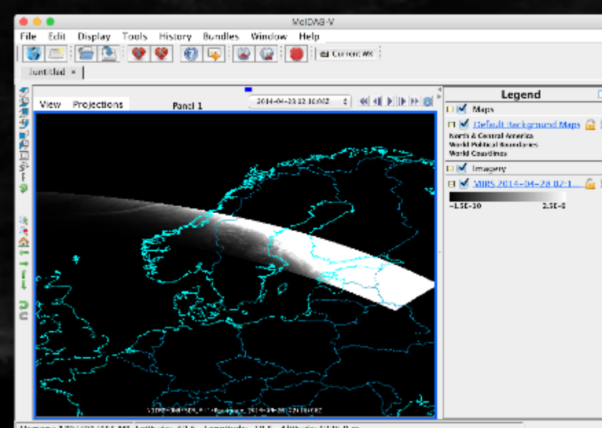
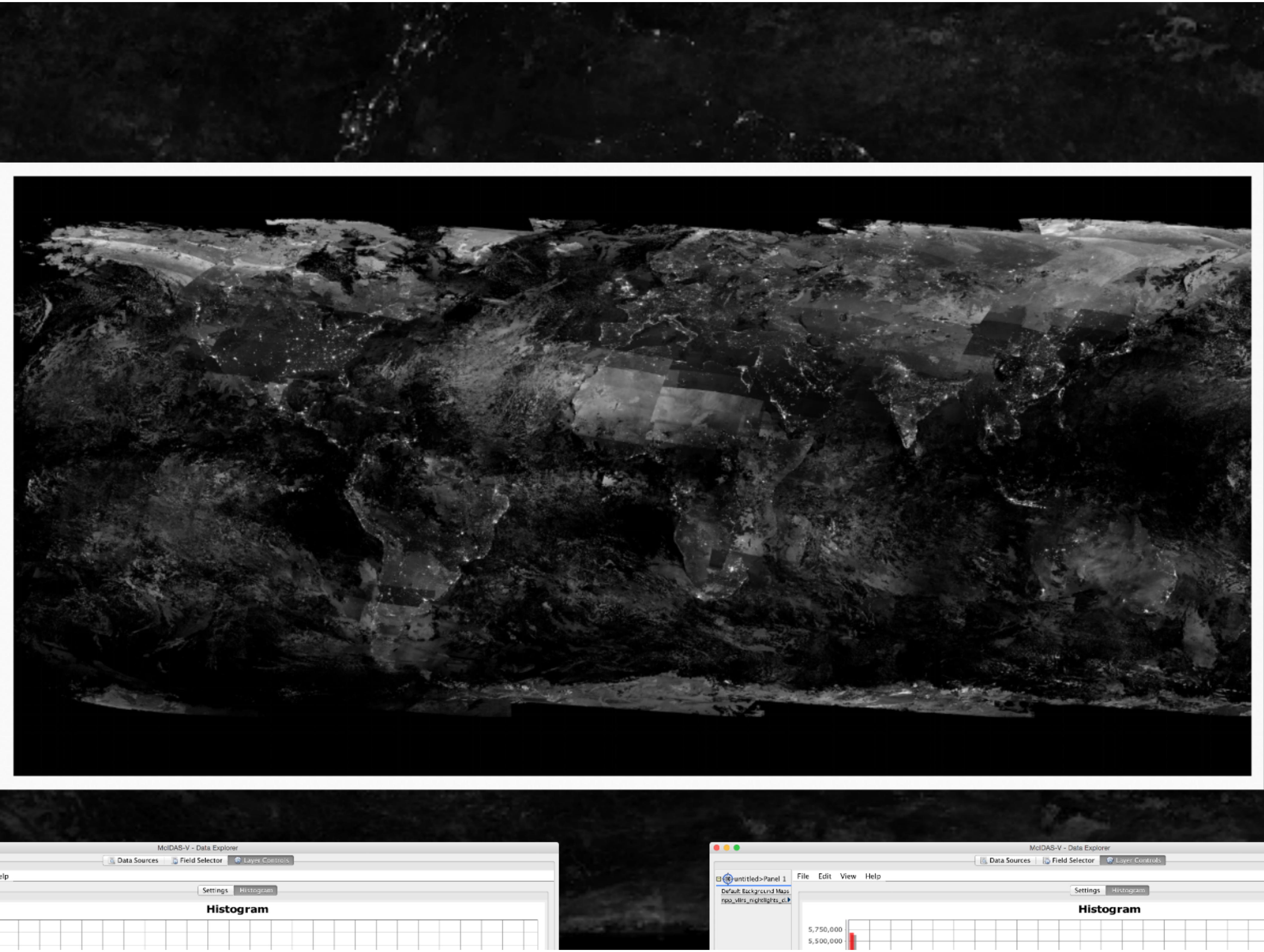


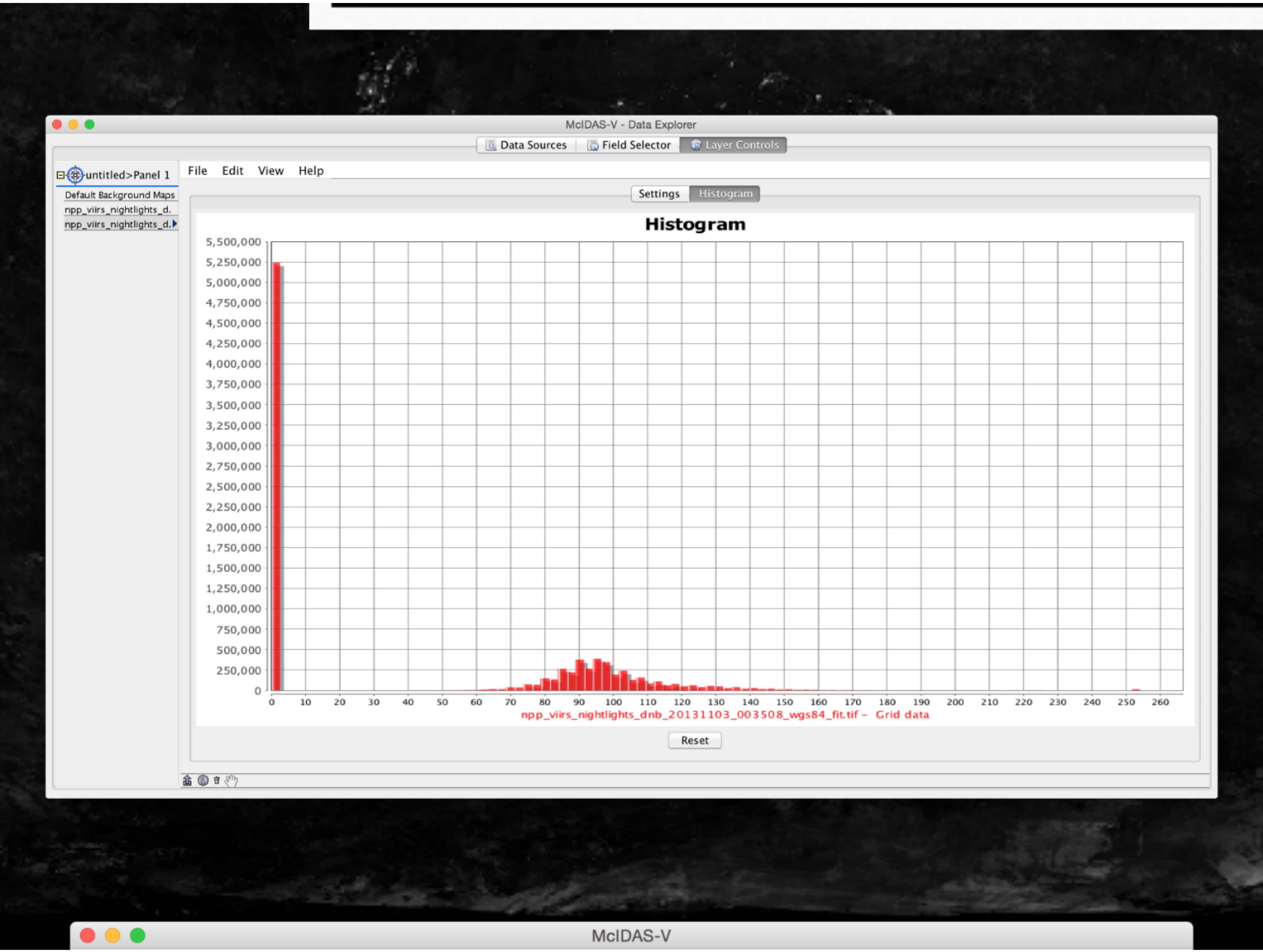

Histogram


Histogram

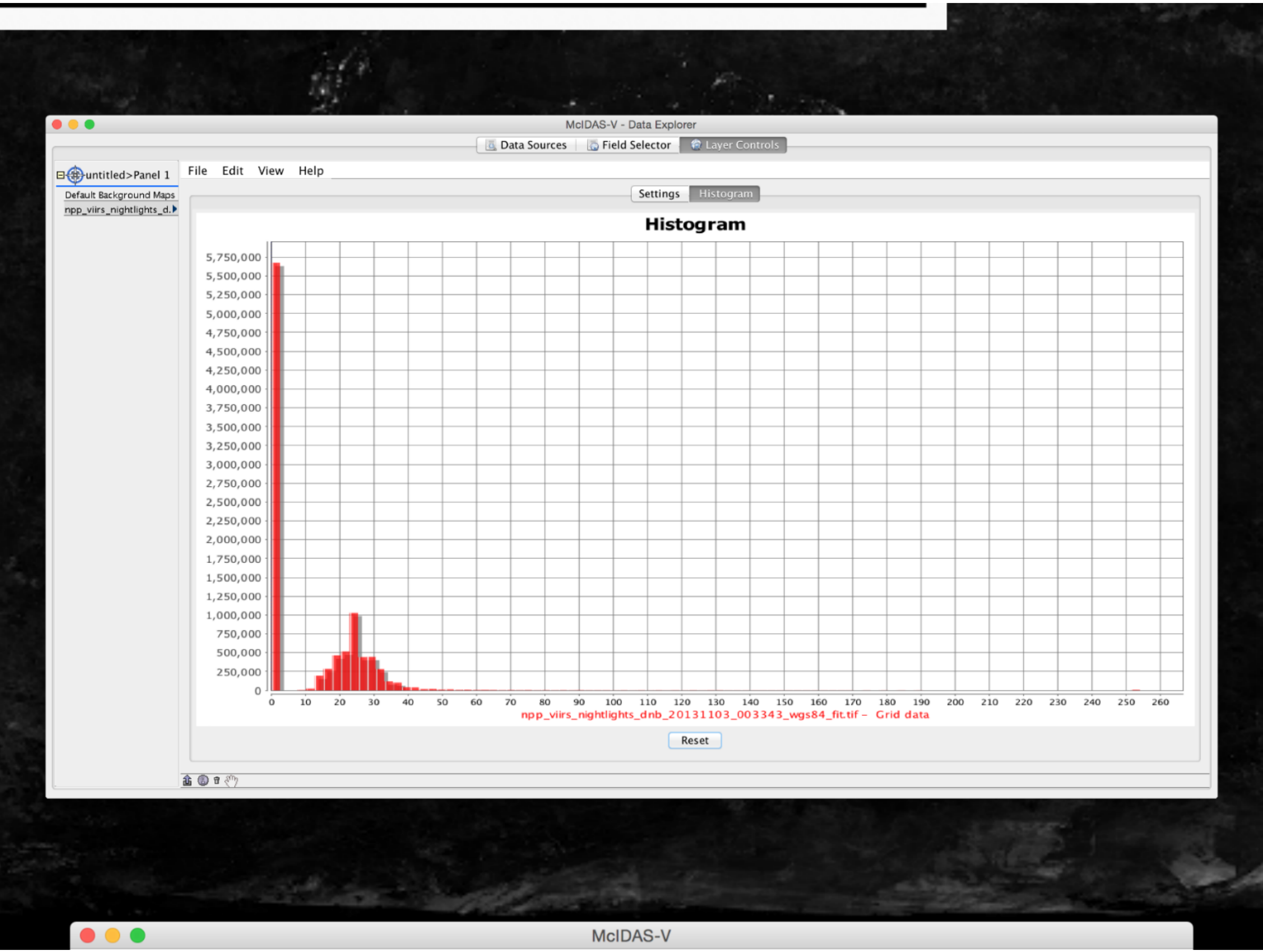

McIDAS-V
File Edit Display Tools History Bundles Window Test Help
View Projections
Legend


McIDAS-V
File Edit Display Tools History Bundles Window Help
View Projections
Legend


McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
elp
Settings
Histogram
Histogram
McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
untitled>Panel 1
Default Background Maps
npp_viirs_nightlights_cl
File
Edit
View
Help
Settings
Histogram
Histogram
5,750,000
5,500,000



McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
untitled>Panel 1
Default Background Maps
npp_viirs_nightlights_d.
npp_viirs_nightlights_d.
File
Edit
View
Help
Settings
Histogram
Histogram
5,500,000
5,250,000
5,000,000
4,750,000
4,500,000
4,250,000
4,000,000
3,750,000
3,500,000
3,250,000
3,000,000
2,750,000
2,500,000
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260
npp_viirs_nightlights_dnb_20131103_003508_wgs84_fit.tif - Grid data
Reset
McIDAS-V


McIDAS-V - Data Explorer
Data Sources
Field Selector
Layer Controls
untitled>Panel 1
Default Background Maps
npp_viirs_nightlights_d.
File
Edit
View
Help
Settings
Histogram
Histogram
5,750,000
5,500,000
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5,000,000
4,750,000
4,500,000
4,250,000
4,000,000
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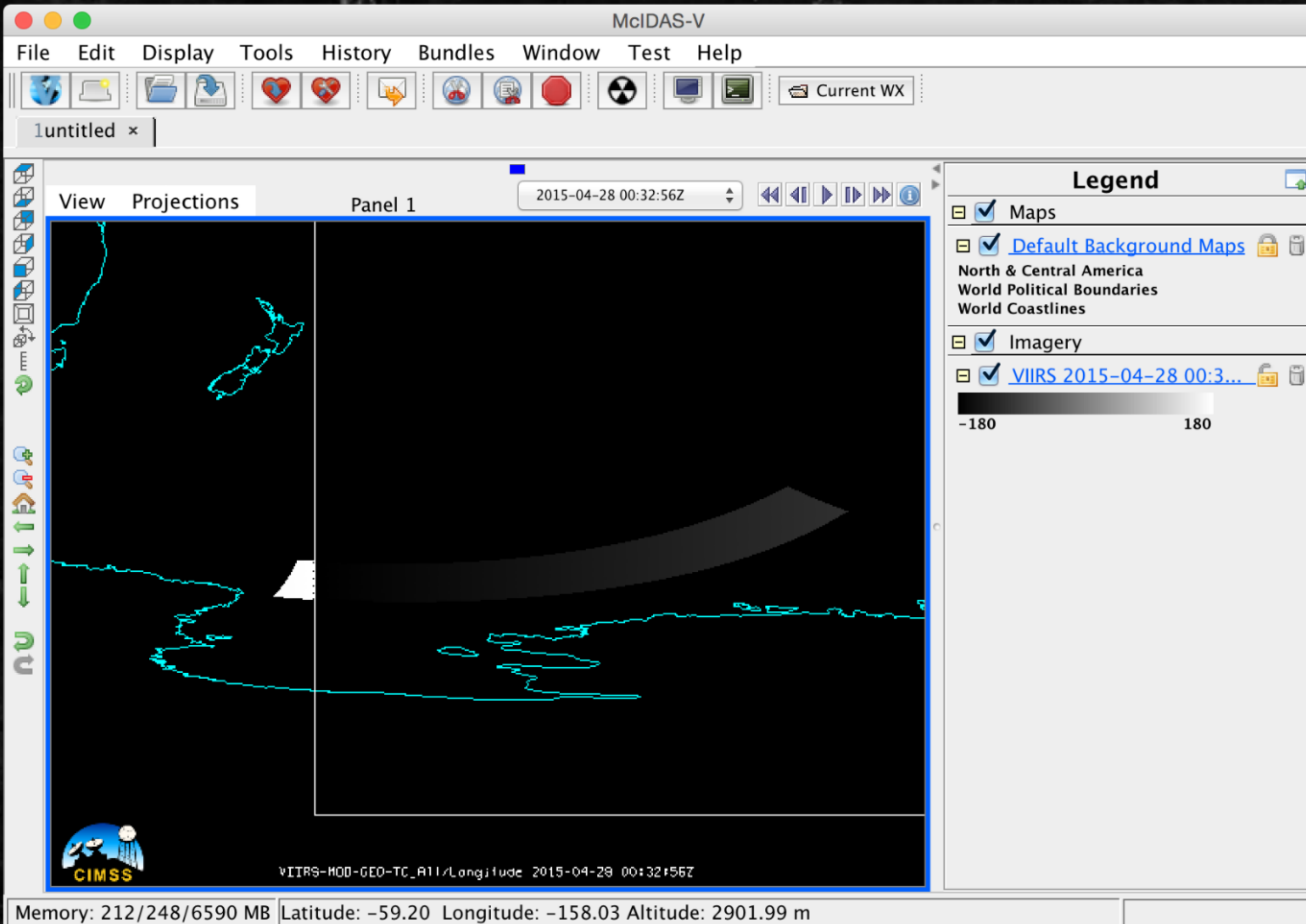
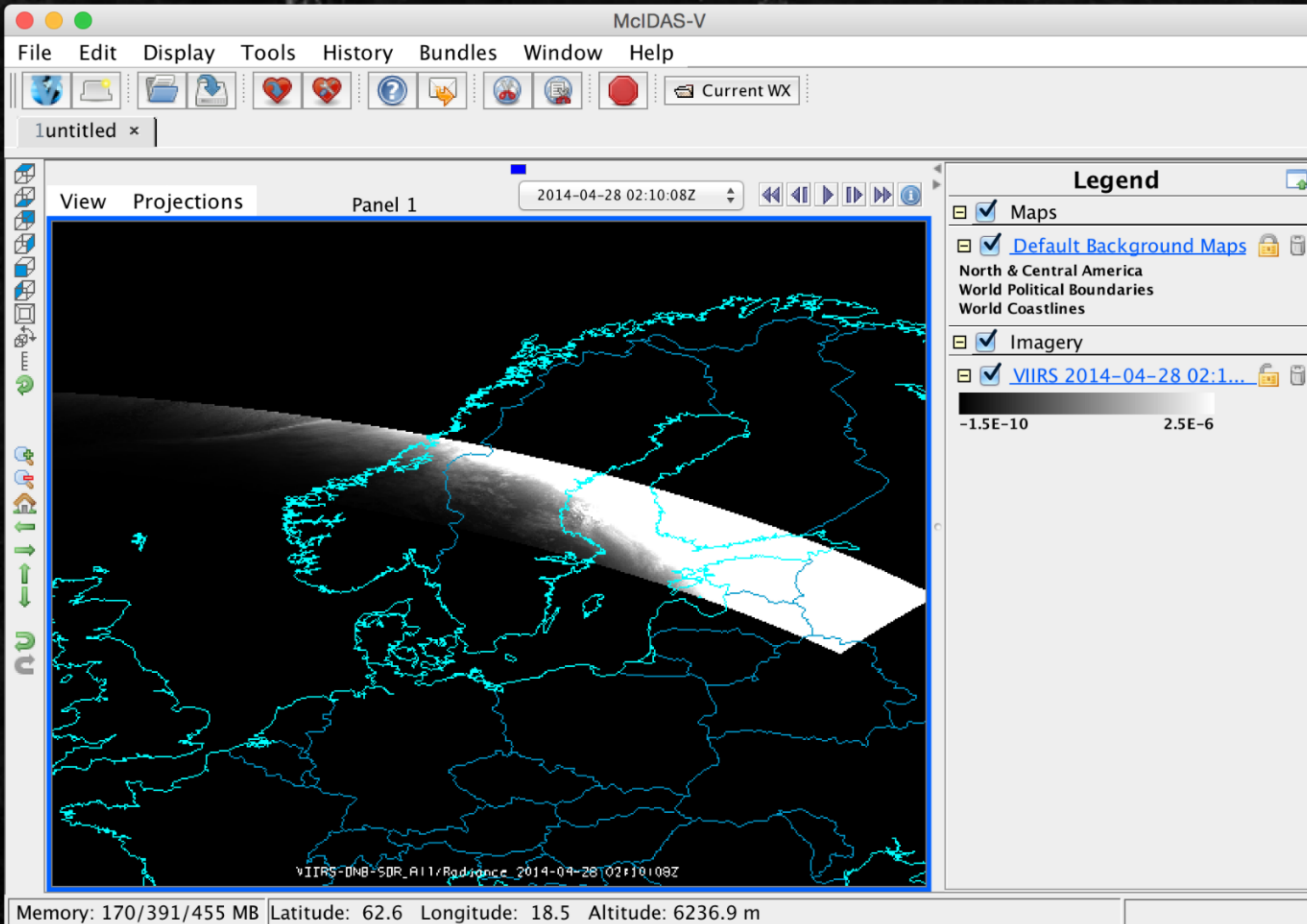
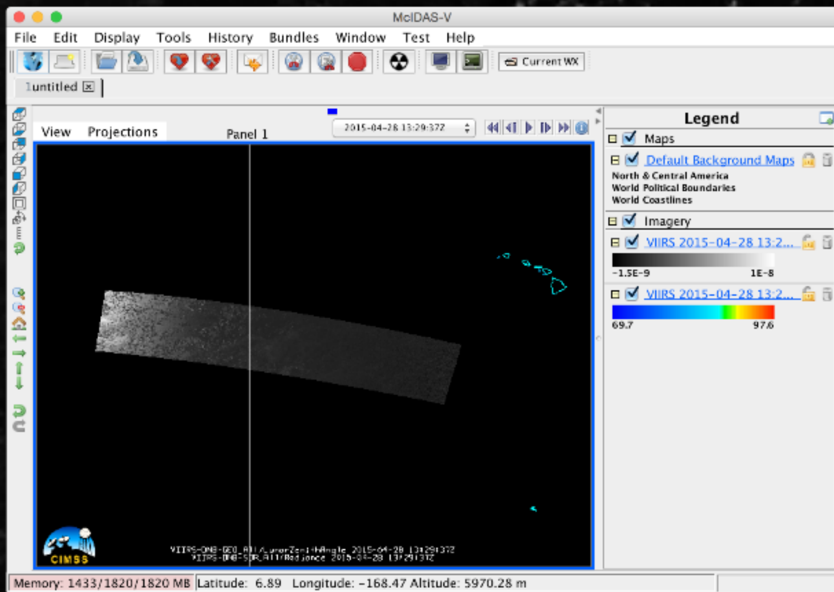
2,500,000
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260
npp_viirs_nightlights_dnb_20131103_003343_wgs84_fit.tif - Grid data
Reset
McIDAS-V


McIDAS-V
File
Edit
Display
Tools
History
Bundles
Window
Test
Help
Current WX
1untitled
View
Projections
Panel 1
2015-04-28 00:32:56Z
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-04-28 00:3...
-180
180
CIMSS
VIIRS-MOD-GEO-TC_All/Longitude 2015-04-28 00:32:56Z
Memory: 212/248/6590 MB
Latitude: -59.20 Longitude: -158.03 Altitude: 2901.99 m


McIDAS-V
File
Edit
Display
Tools
History
Bundles
Window
Help
Current WX
1untitled
View
Projections
Panel 1
2014-04-28 02:10:08Z
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2014-04-28 02:1...
-1.5E-10
2.5E-6
VIIRS-DNB-SDR_All/Radiance 2014-04-28 02:10:08Z
Memory: 170/391/455 MB
Latitude: 62.6
Longitude: 18.5
Altitude: 6236.9 m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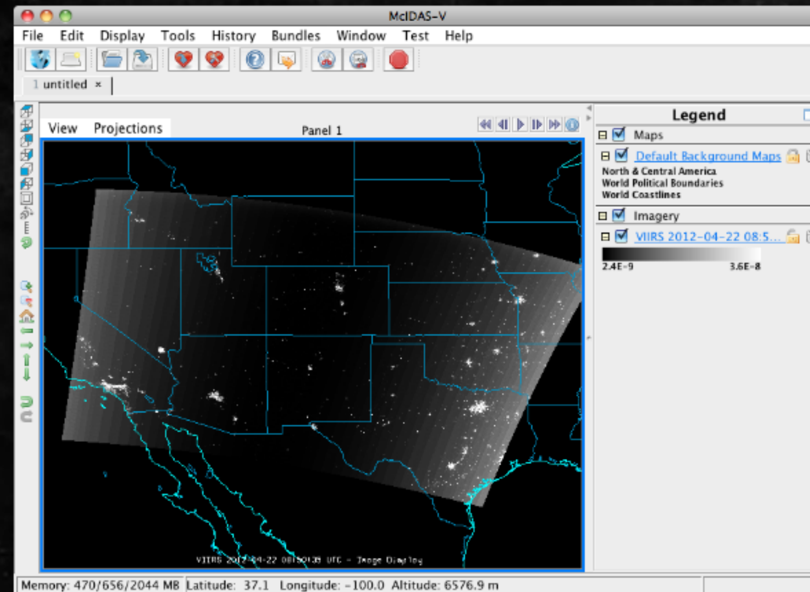
Current WX
untitled
View Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-04-28 13:2...
-1.5E-9
1E-8
VIIRS 2015-04-28 13:2...
69.7
97.6
Memory: 1433/1820/1820 MB
Latitude: 6.89 Longitude: -168.47 Altitude: 5970.28 m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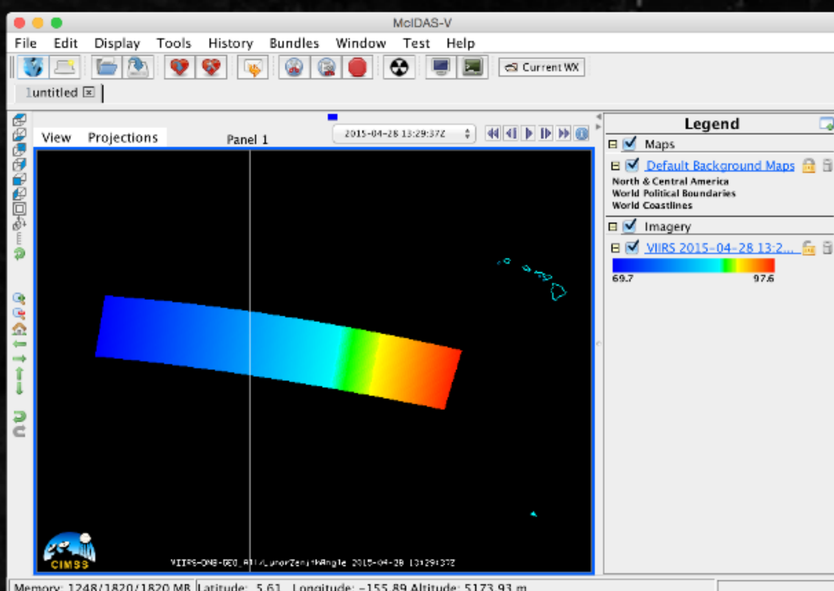
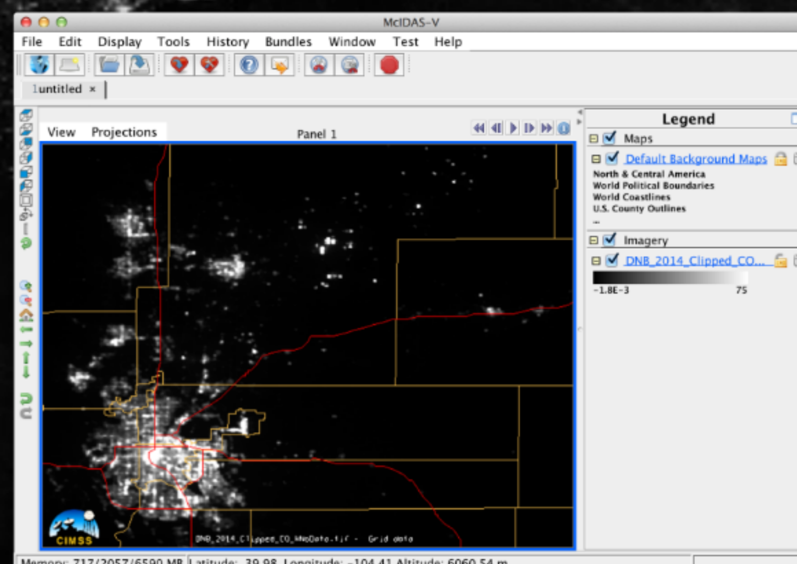
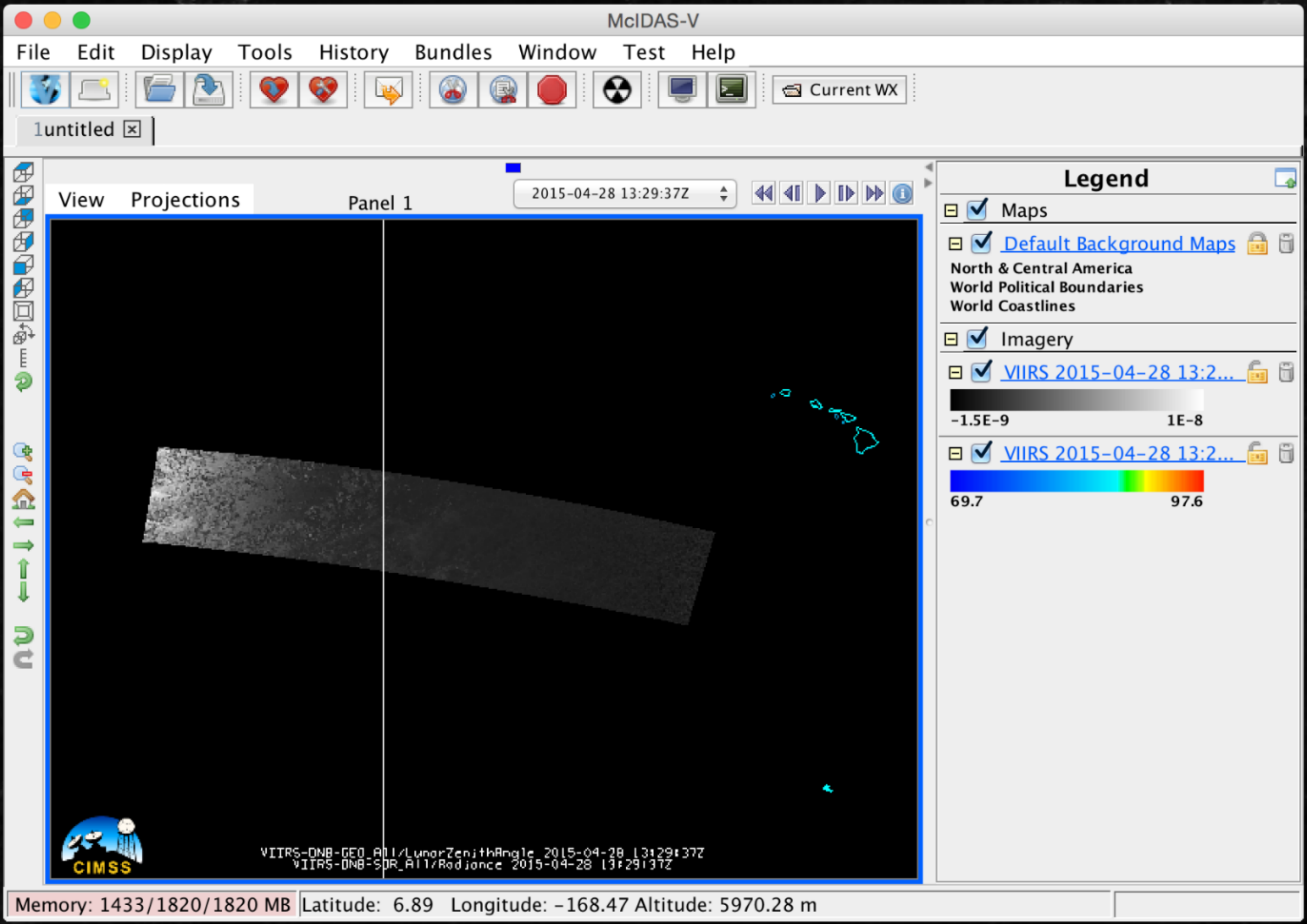
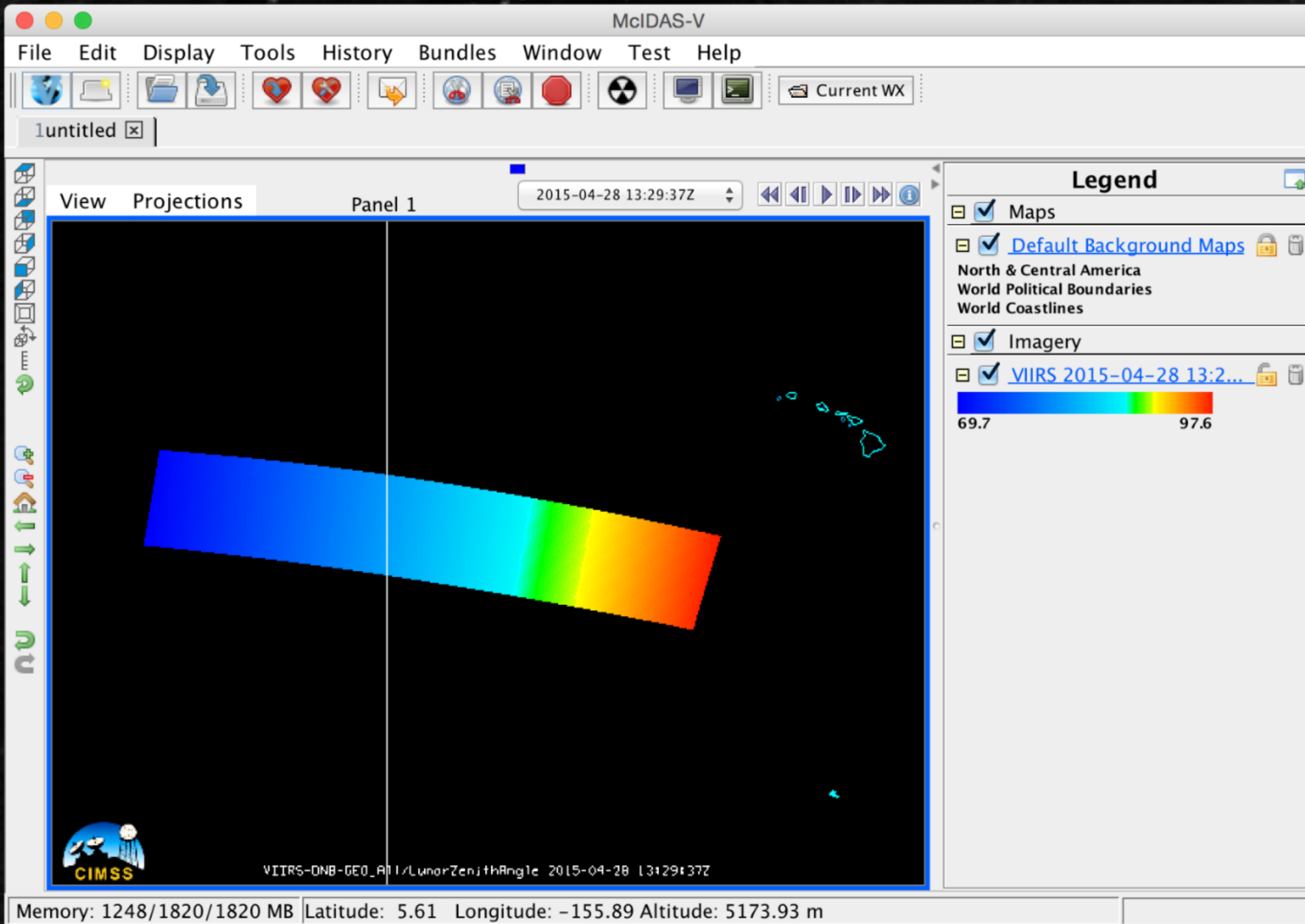
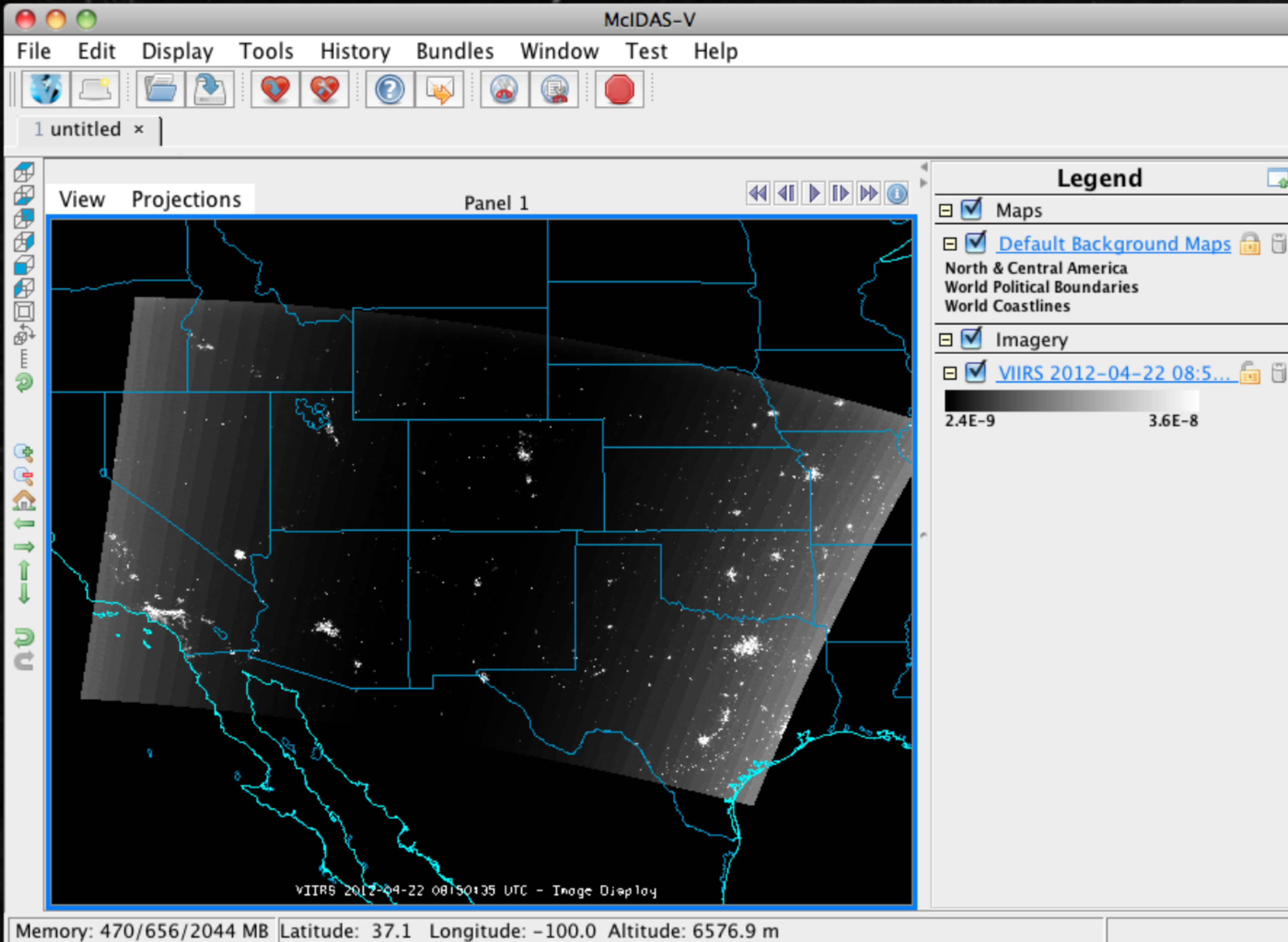
File Edit Display Tools History Bundles Window Test Help
untitled
View Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2012-04-22 08:5...
2.4E-9
3.6E-8
Memory: 470/656/2044 MB
Latitude: 37.1 Longitude: -100.0 Altitude: 6576.9 m

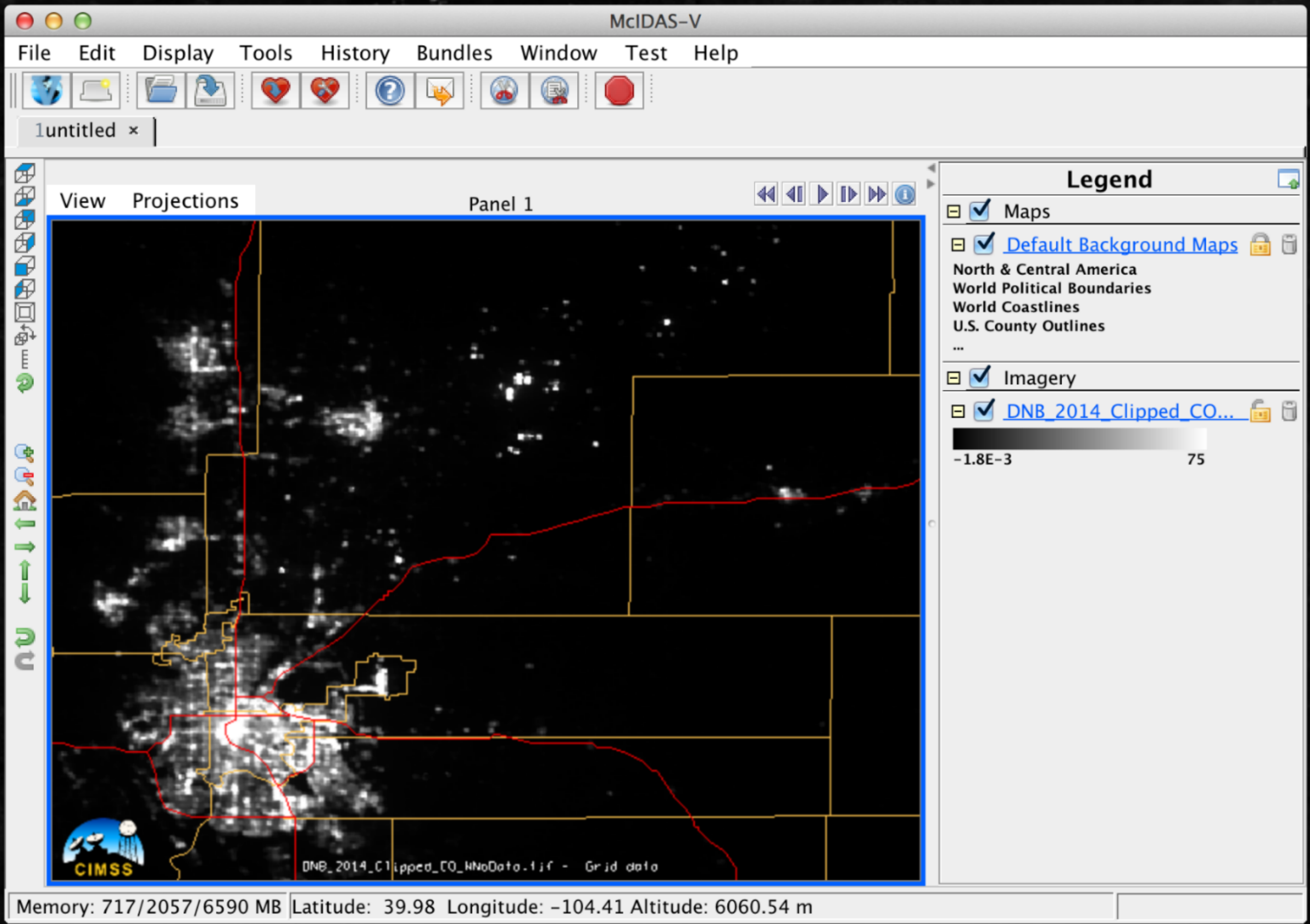

McIDAS-V
File Edit Display Tools History Bundles Window Test Help
Current WX
untitled
View Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-04-28 13:2...
69.7
97.6
Memory: 1248/1820/1820 MB
Latitude: 5.61 Longitude: -155.89 Altitude: 5173.93 m

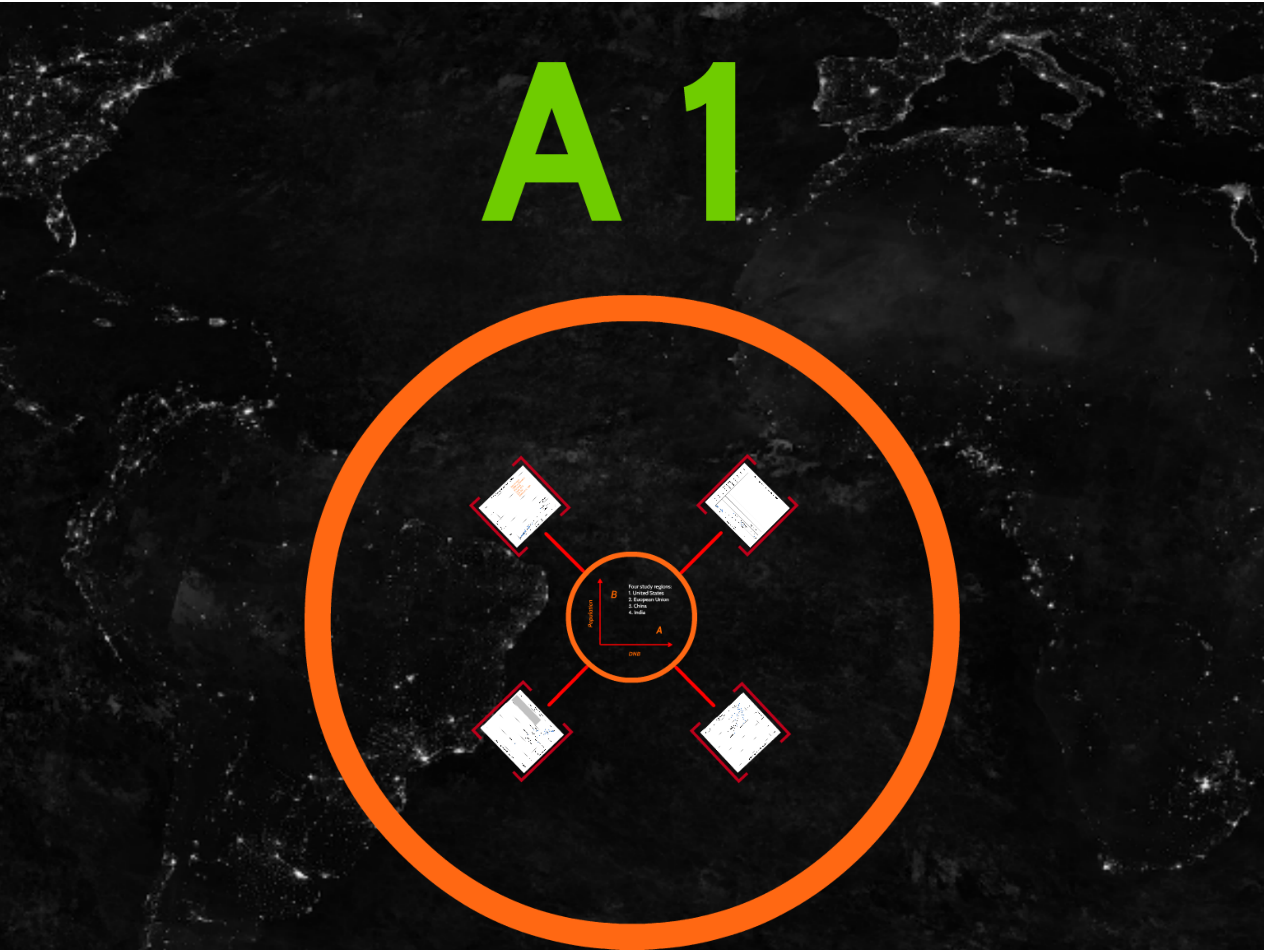

McIDAS-V
File Edit Display Tools History Bundles Window Test Help
untitled
View Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
U.S. County Outlines
Imagery
DNB_2014_Clipped_CO...
-1.8E-3
75
Memory: 717/2057/6590 MB
Latitude: 39.98 Longitude: -104.41 Altitude: 6060.54 m

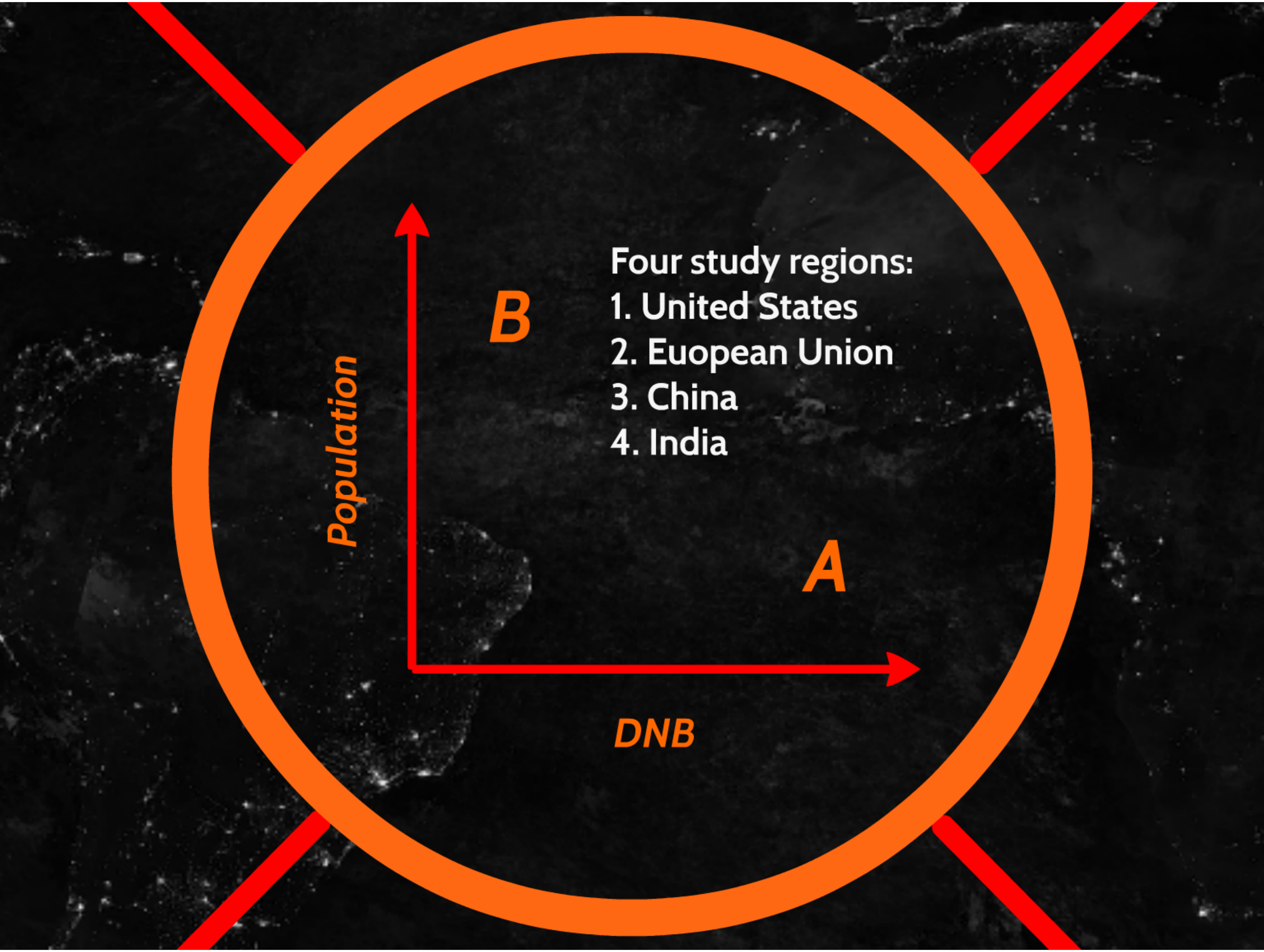

McIDAS-V
File Edit Display Tools History Bundles Window Test Help
Current WX
1untitled
View Projections
Panel 1
2015-04-28 13:29:37Z
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-04-28 13:2...
-1.5E-9
1E-8
VIIRS 2015-04-28 13:2...
69.7
97.6
VIIRS-DNB-GEO_All/LunarZenithAngle 2015-04-28 13:29:37Z
VIIRS-DNB-SDR_All/Radiance 2015-04-28 13:29:37Z
CIMSS
Memory: 1433/1820/1820 MB
Latitude: 6.89 Longitude: -168.47 Altitude: 5970.28 m


McIDAS-V
File Edit Display Tools History Bundles Window Test Help
Current WX
1untitled
View Projections
Panel 1
2015-04-28 13:29:37Z
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2015-04-28 13:2...
69.7
97.6
CIMSS
VIIRS-DNB-GEO_All/LunarZenithAngle 2015-04-28 13:29:37Z
Memory: 1248/1820/1820 MB
Latitude: 5.61 Longitude: -155.89 Altitude: 5173.93 m

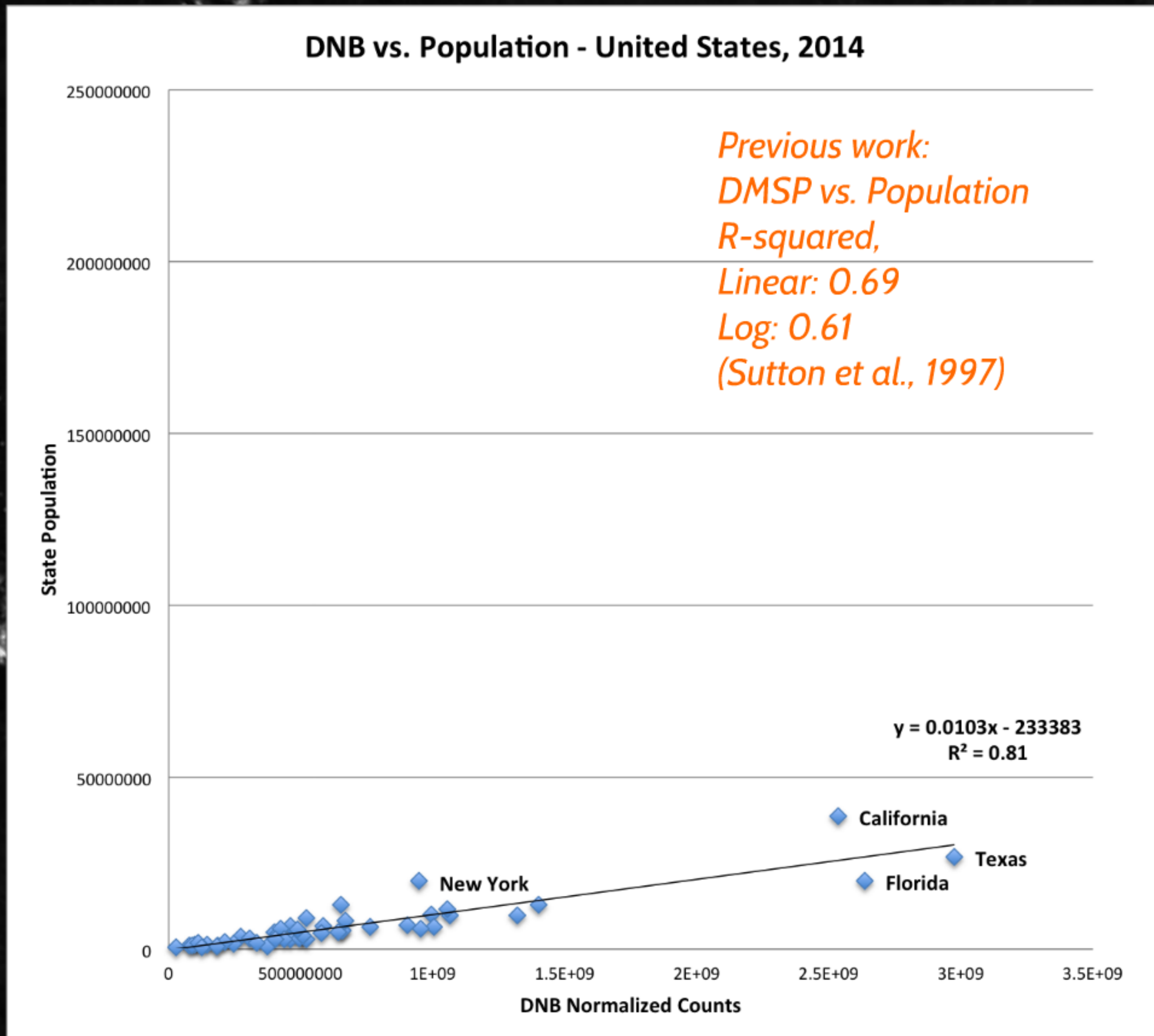

McIDAS-V
File Edit Display Tools History Bundles Window Test Help
1 untitled ×
View Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
Imagery
VIIRS 2012-04-22 08:5...
2.4E-9
3.6E-8
VIIRS 2012-04-22 08:50:35 UTC - Image Display
Memory: 470/656/2044 MB
Latitude: 37.1 Longitude: -100.0 Altitude: 6576.9 m

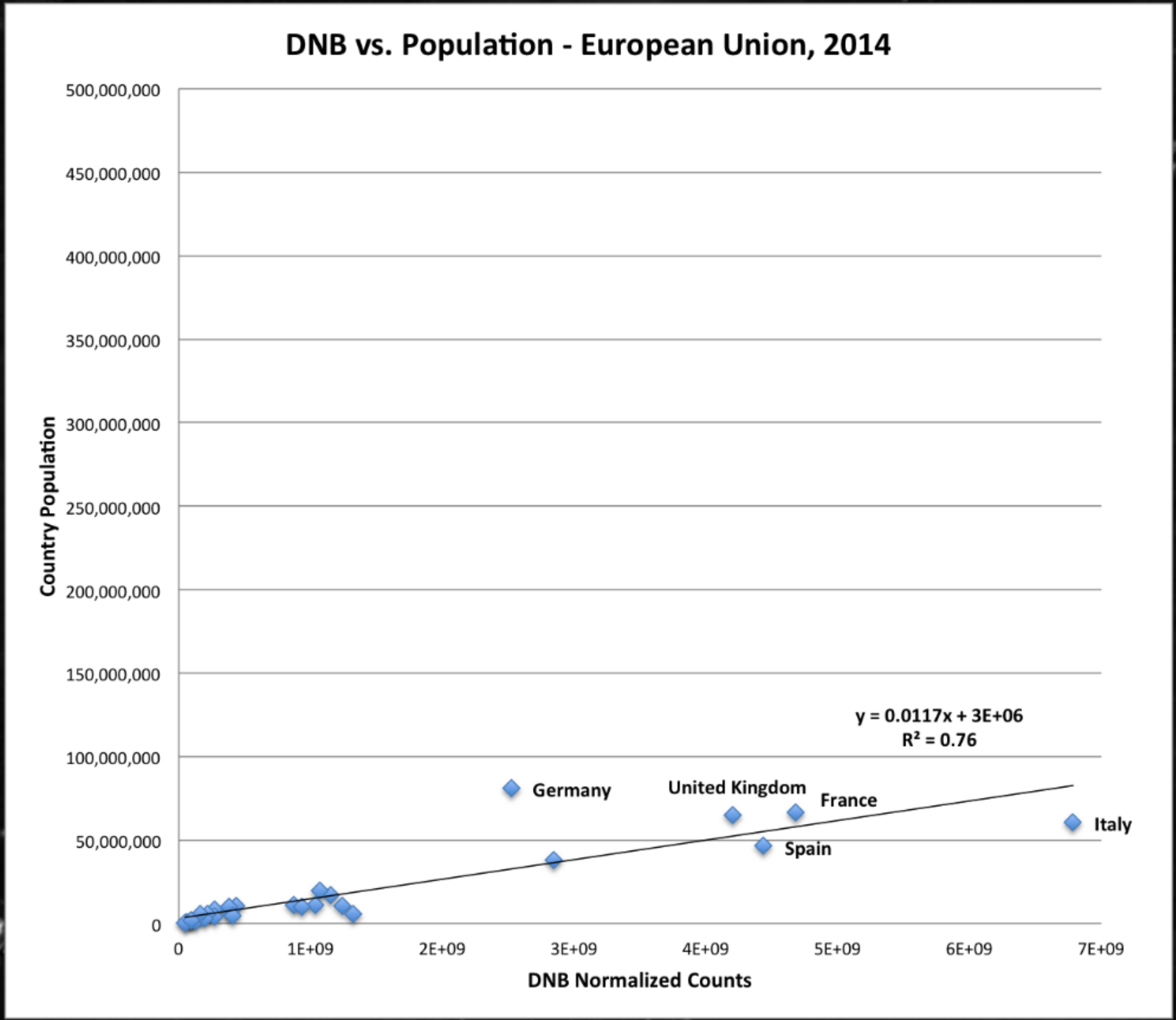

McIDAS-V
File Edit Display Tools History Bundles Window Test Help
1untitled
View Projections
Panel 1
Legend
Maps
Default Background Maps
North & Central America
World Political Boundaries
World Coastlines
U.S. County Outlines
...
Imagery
DNB_2014_Clipped_CO...
-1.8E-3
75
DNB_2014_Clipped_CO_WNoData.tif - Grid data
CIMSS
Memory: 717/2057/6590 MB
Latitude: 39.98 Longitude: -104.41 Altitude: 6060.54 m


A 1
Four study regions:
1. United States
2. European Union
3. China
4. India
B
A
Population
DNB

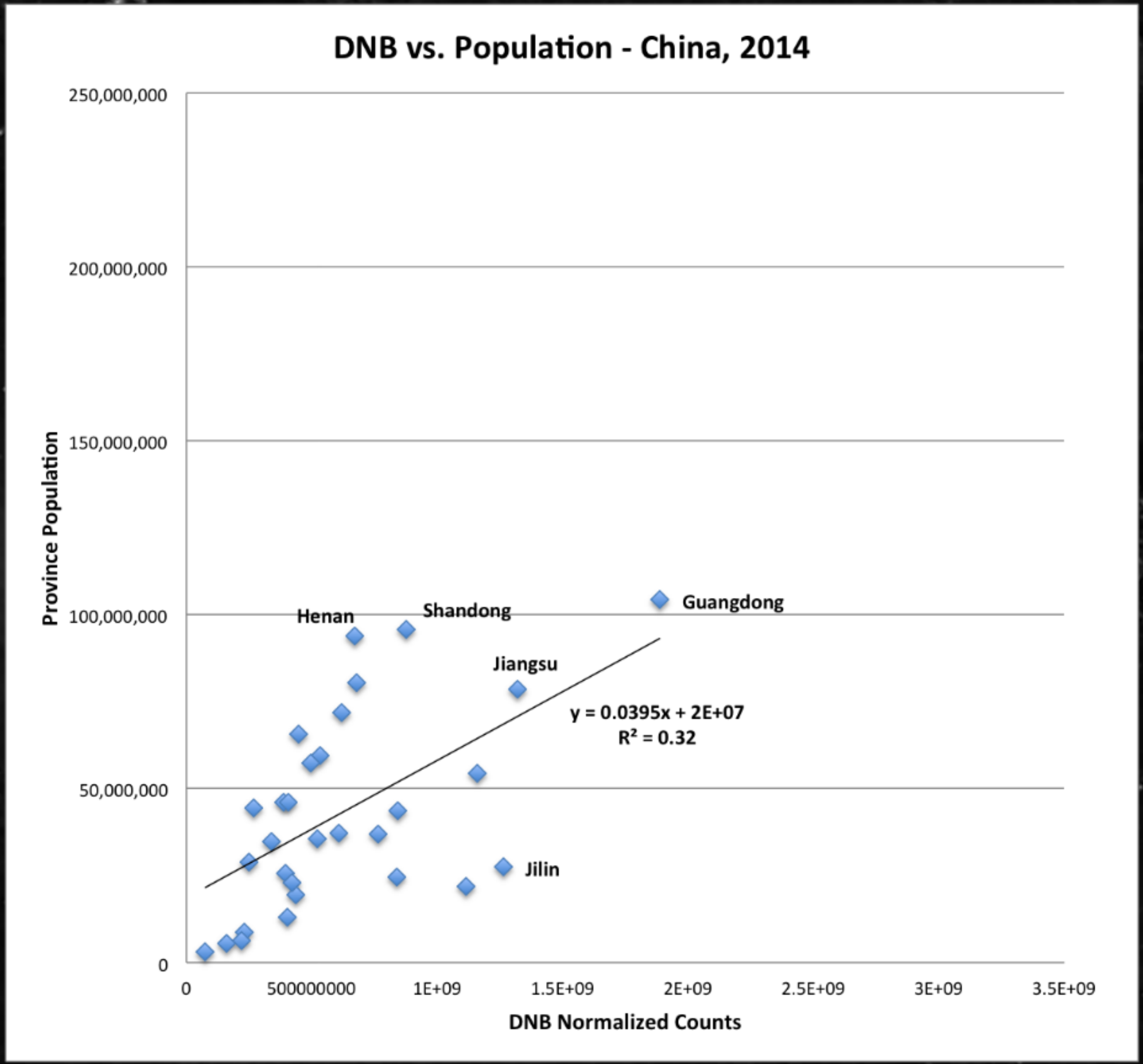


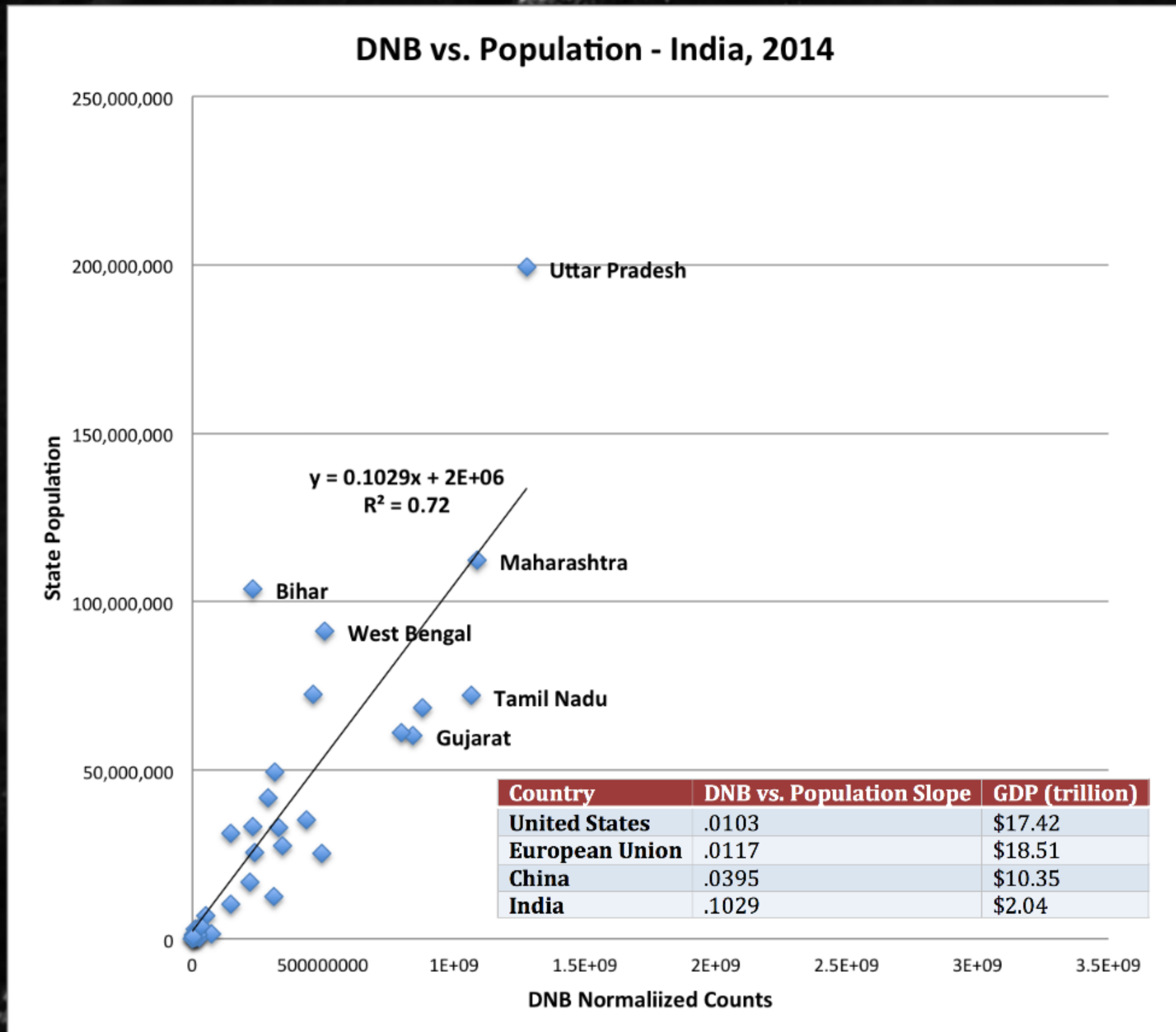
Four study regions:
1. United States
2. Euopean Union
3. China
4. India
B
A
Population
DNB


DNB vs. Population - United States, 2014
Previous work:
DMSP vs. Population
R-squared,
Linear: 0.69
Log: 0.61
(Sutton et al., 1997)
y = 0.0103x - 233383
R² = 0.81
California
Texas
Florida
New York
State Population
DNB Normalized Counts
250000000
200000000
150000000
100000000
50000000
0
500000000
1E+09
1.5E+09
2E+09
2.5E+09
3E+09
3.5E+09



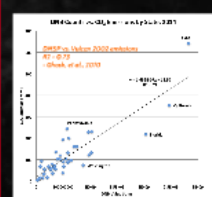
DNB vs. Population - European Union, 2014
Country Population
500,000,000
450,000,000
400,000,000
350,000,000
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
0
0
1E+09
2E+09
3E+09
4E+09
5E+09
6E+09
7E+09
DNB Normalized Counts
y = 0.0117x + 3E+06
R² = 0.76
Germany
United Kingdom
France
Italy
Spain


DNB vs. Population - China, 2014
Province Population
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
0
Henan
Shandong
Guangdong
Jiangsu
Jilin
y = 0.0395x + 2E+07
R² = 0.32
0
500000000
1E+09
1.5E+09
2E+09
2.5E+09
3E+09
3.5E+09
DNB Normalized Counts

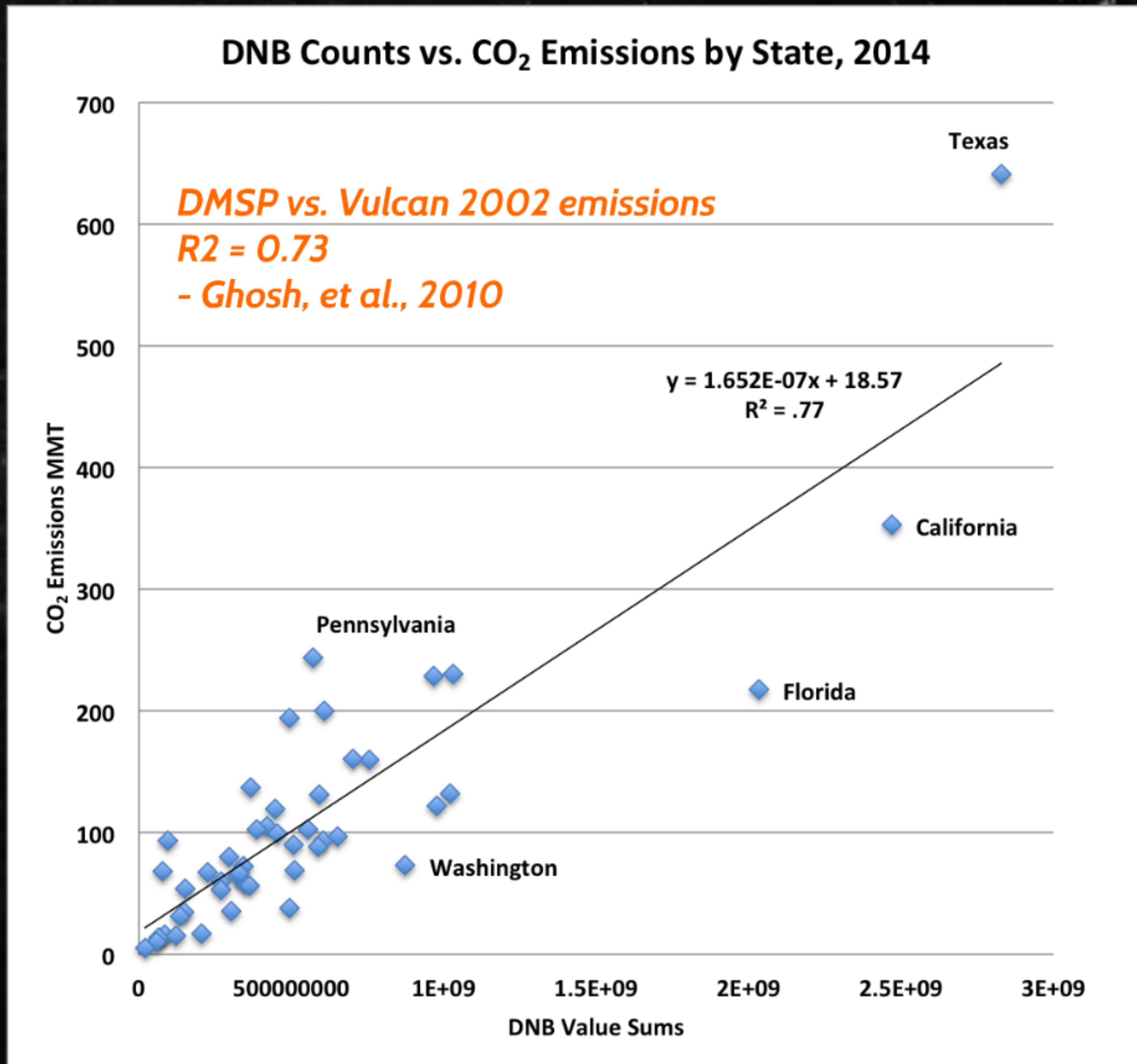


Country	DNB vs. Population Slope	GDP (trillion)
United States	.0103	$17.42
European Union	.0117	$18.51
China	.0395	$10.35
India	.1029	$2.04

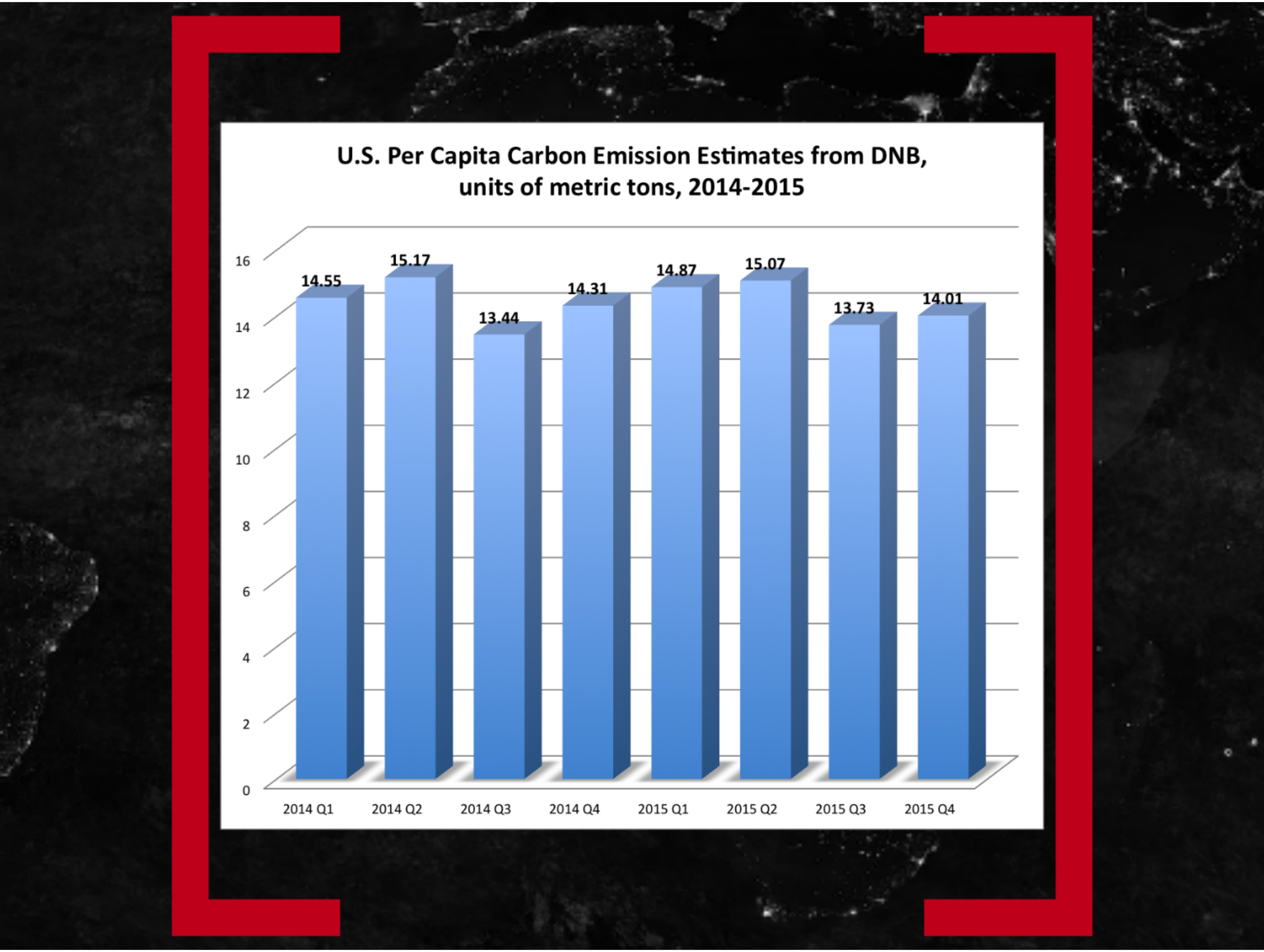
A 2

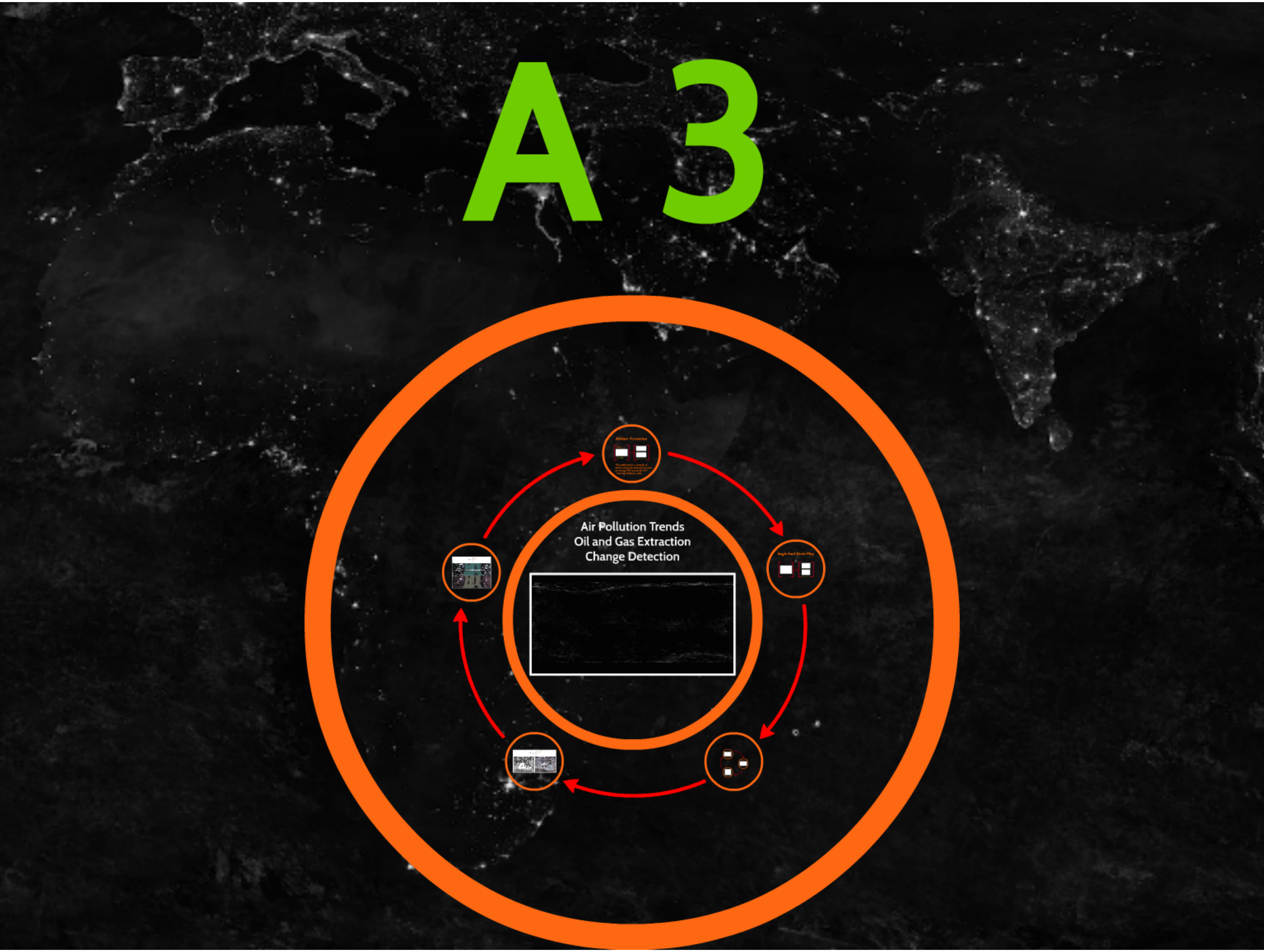


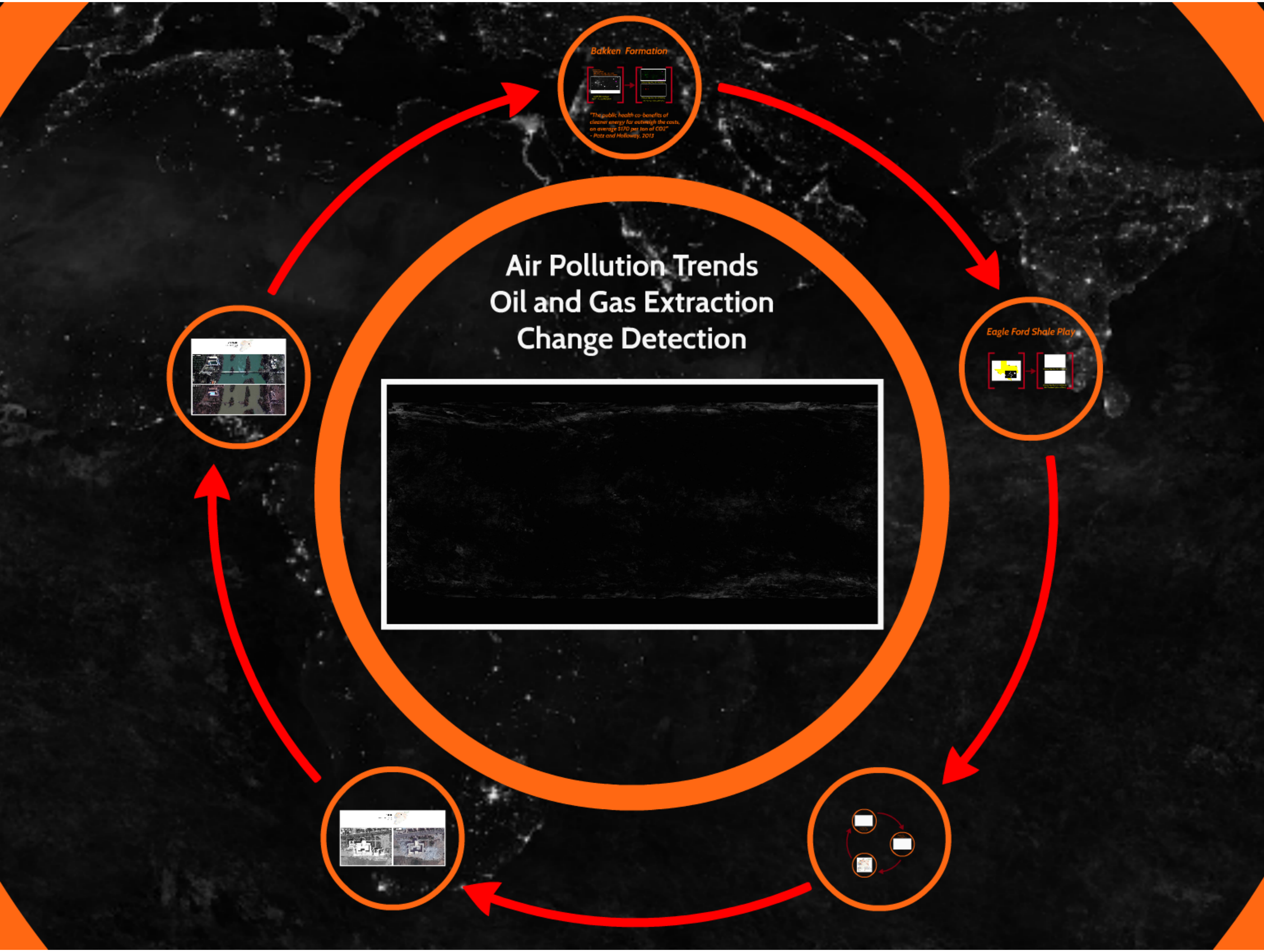
Emissions data: U.S. EIA (office within DoE)



Emissions data: U.S. EIA (office within DoE)

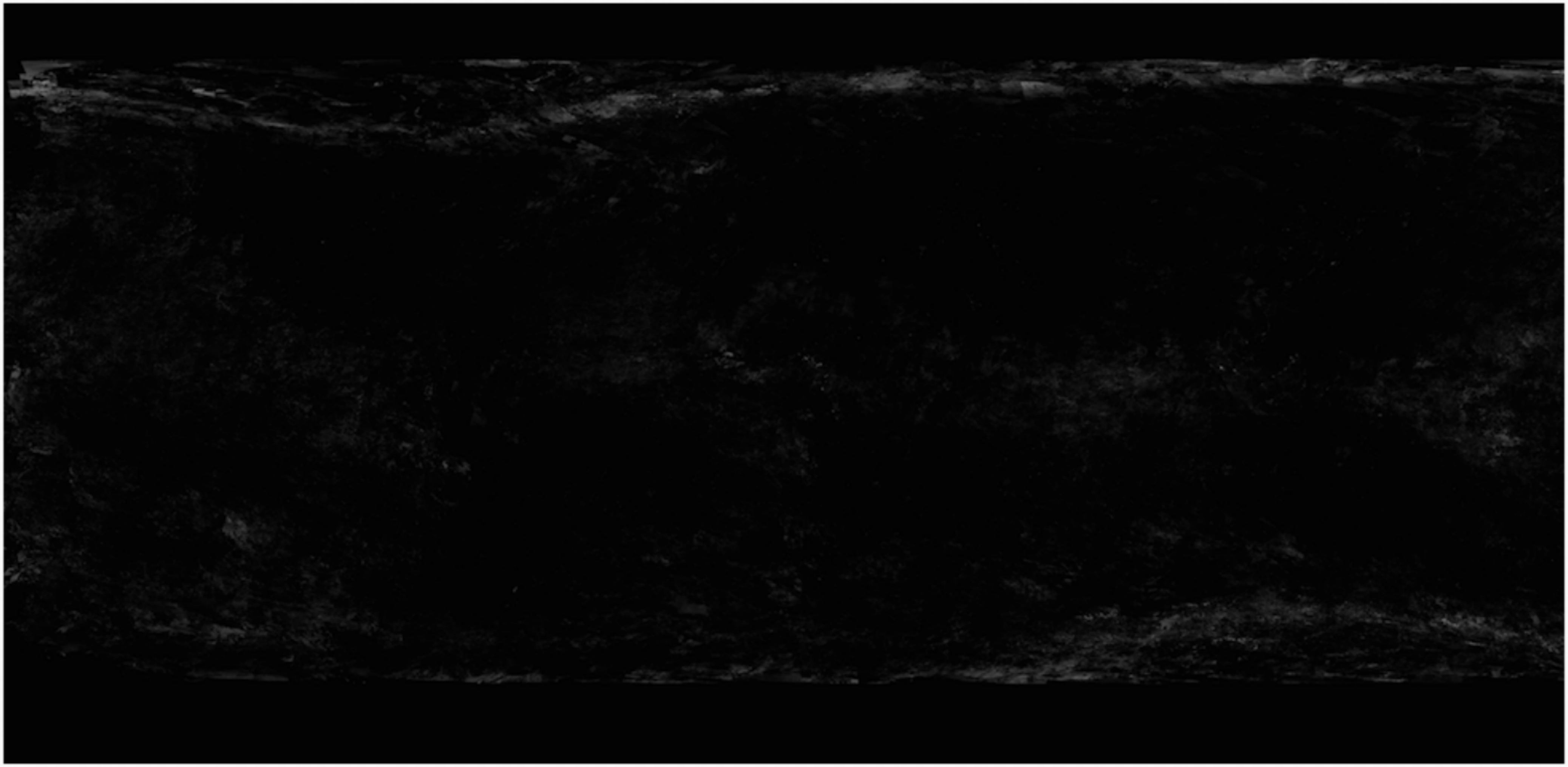

U.S. Per Capita Carbon Emission Estimates from DNB,
units of metric tons, 2014-2015
16
14
12
10
8
6
4
2
0
14.55
15.17
13.44
14.31
14.87
15.07
13.73
14.01
2014 Q1
2014 Q2
2014 Q3
2014 Q4
2015 Q1
2015 Q2
2015 Q3
2015 Q4


A3
Air Pollution Trends
Oil and Gas Extraction
Change Detection



Air Pollution Trends
Oil and Gas Extraction
Change Detection
Bakken Formation
"The public health co-benefits of cleaner energy far outweigh the costs, on average $170 per ton of CO2"
- Patz and Holloway, 2013
Eagle Ford Shale Play

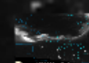
Change Detection

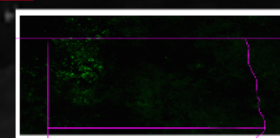


Bakken Formation

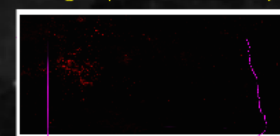
Bakken flaring:
- Loosely regulated
- 300 million cubic feet / day in 2014
- Close to 5% of total ND energy production

2014 DNB Average,
NOTE: Aurora Pollution





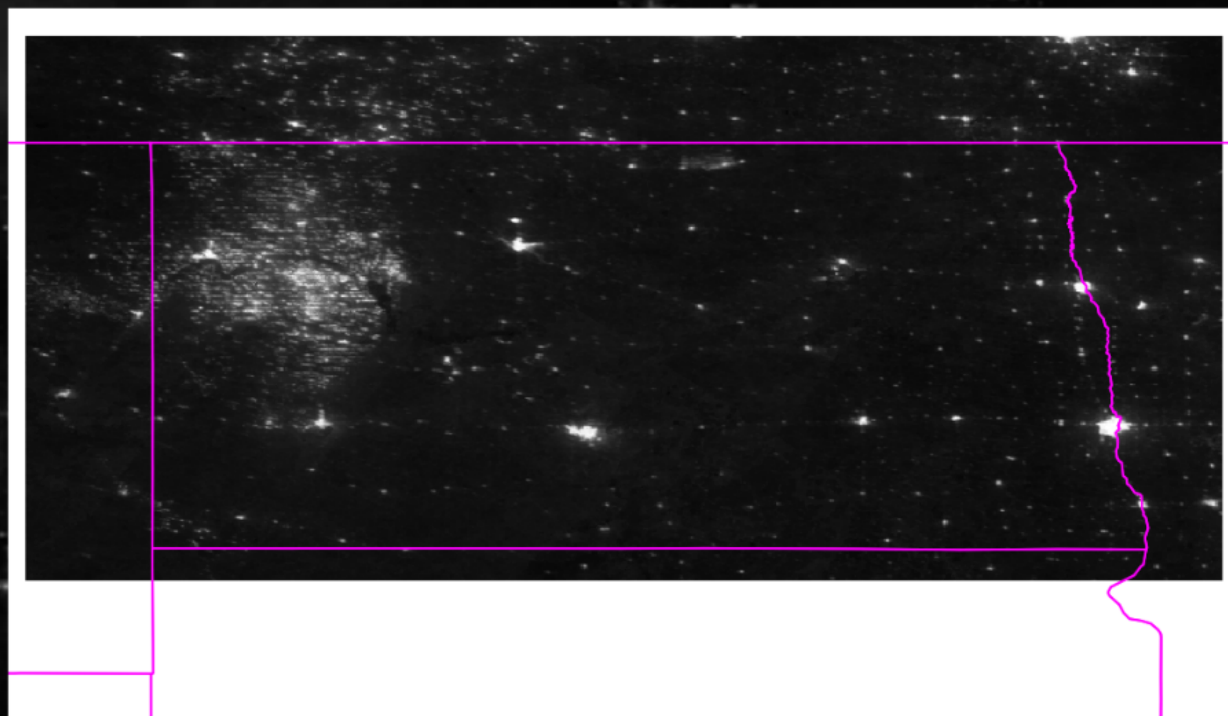
Change Map, Area Lit in 2014 Only



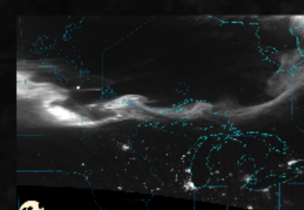
Change Map, Area Lit in 2015 Only
8% Decrease Lights and Flaring

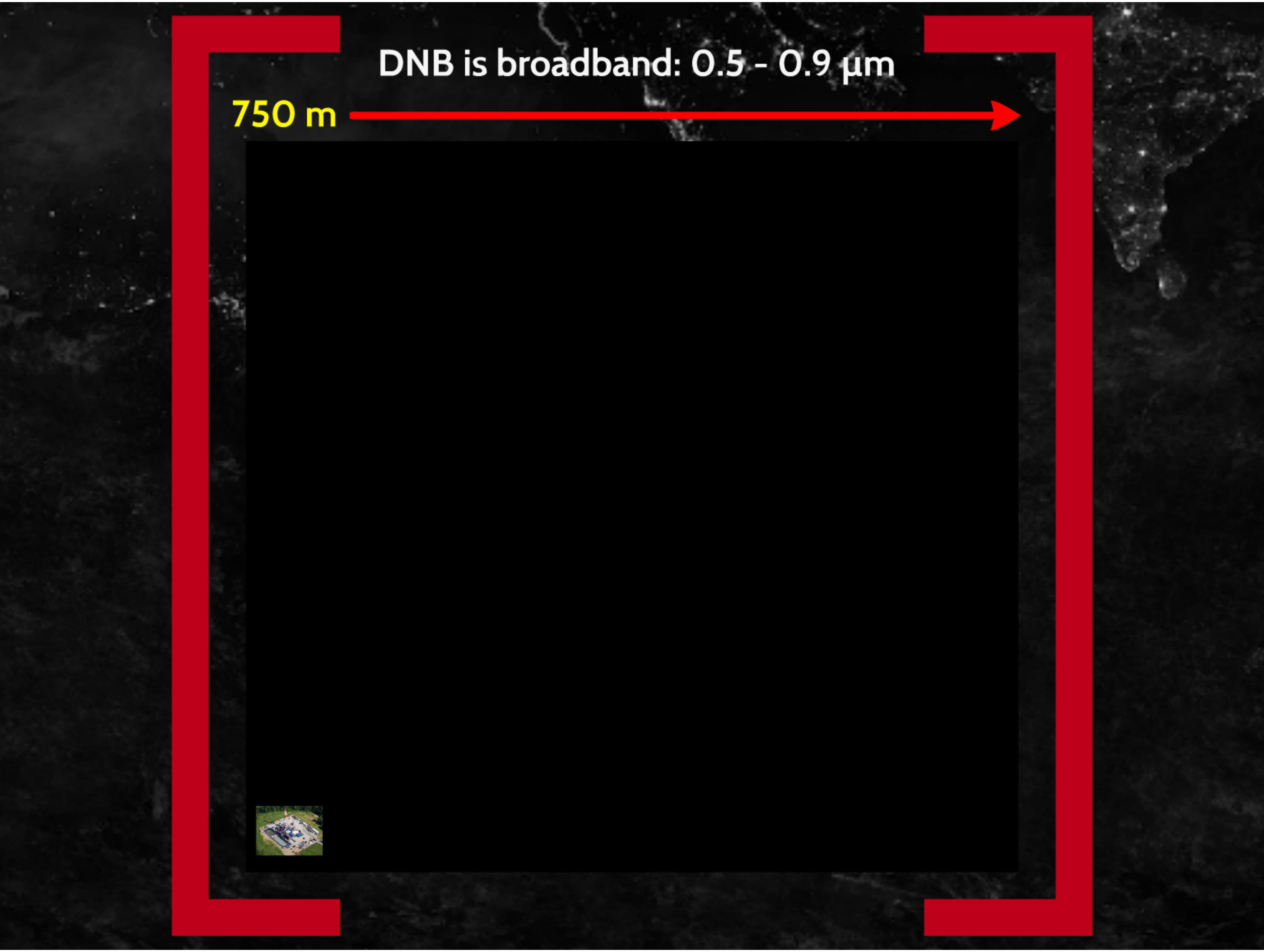
"The public health co-benefits of cleaner energy far outweigh the costs, on average $170 per ton of CO_2"
- Patz and Holloway, 2013

Bakken flaring:
- Loosely regulated
- 300 million cubic feet / day in 2014
- Close to 5% of total ND energy production



2014 DNB Average,
NOTE: Aurora Pollution




DNB is broadband: 0.5 - 0.9 µm
750 m

750 m

Flaring: Routine practice to dispose of co-produced gas

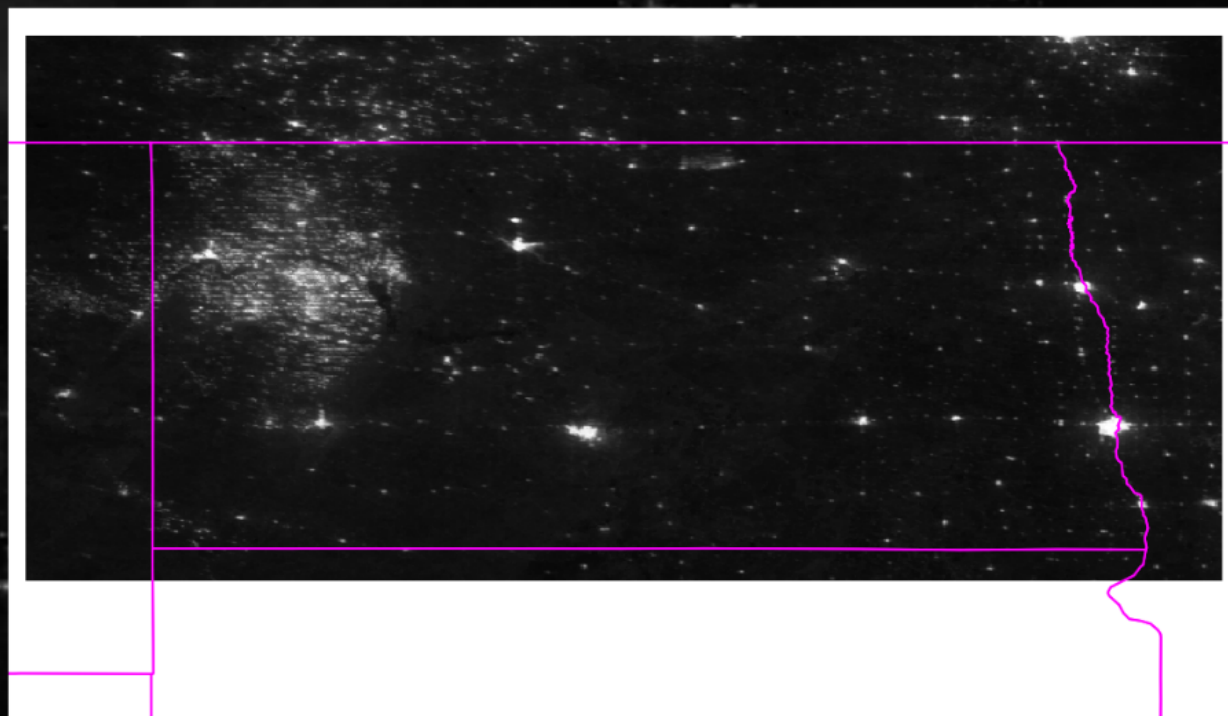
Total flaring, U.S., 2013:
7.4 billion cubic meters

1 flare:
Less than 1/5000 of a DNB pixel
Temperature: 1500 - 3000 K
$CH_4 + 2O_2 = CO_2 + 2H_2O + E_{out}$

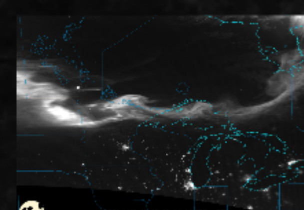
- Zhang, et al., Remote Sensing, 2015

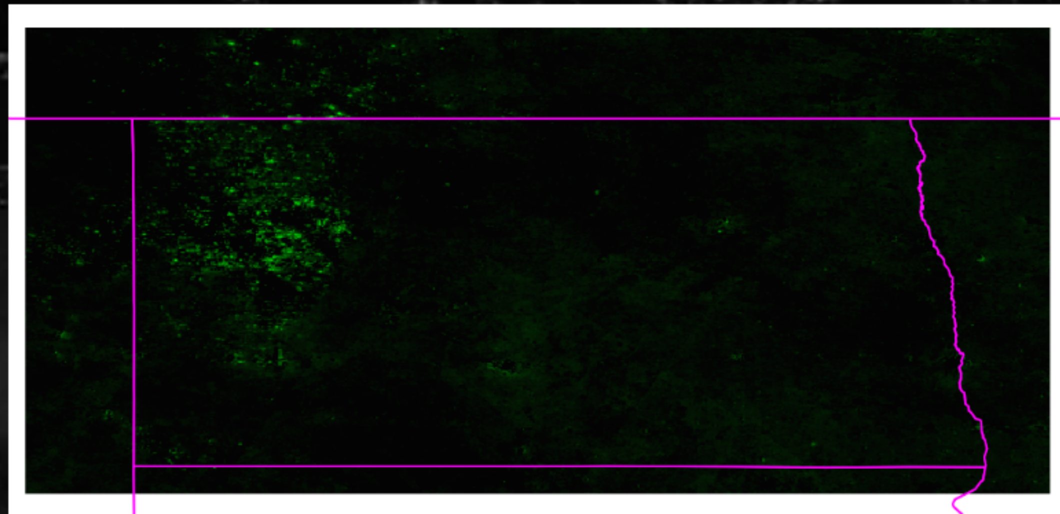
Bakken flaring:

- *Loosely regulated*
- *300 million cubic feet / day in 2014*
- *Close to 5% of total ND energy production*

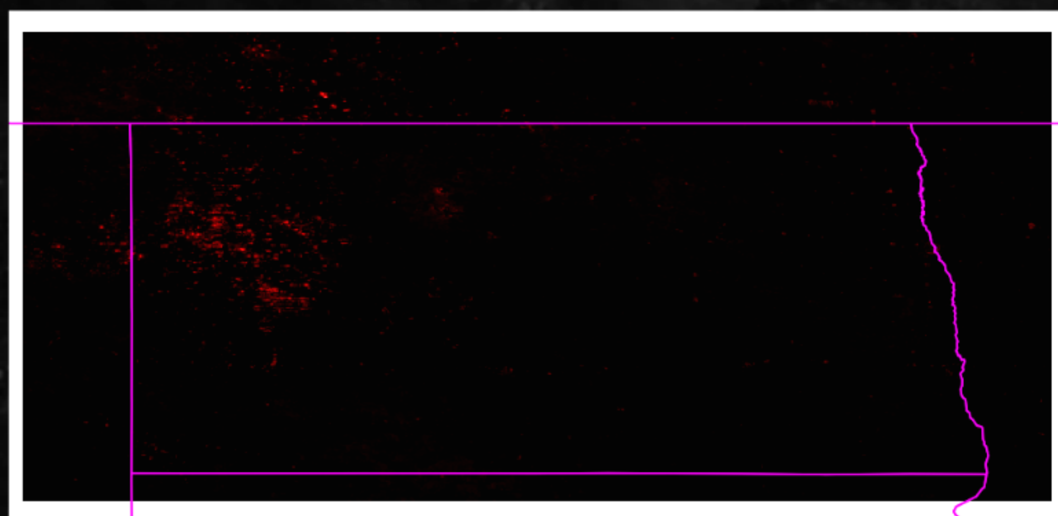


2014 DNB Average,
NOTE: Aurora Pollution





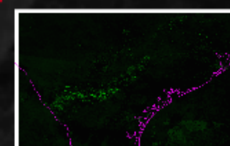
Change Map, Area Lit in 2014 Only



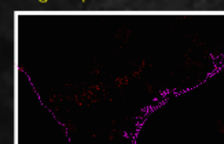
Change Map, Area Lit in 2015 Only

8% Decrease Lights and Flaring

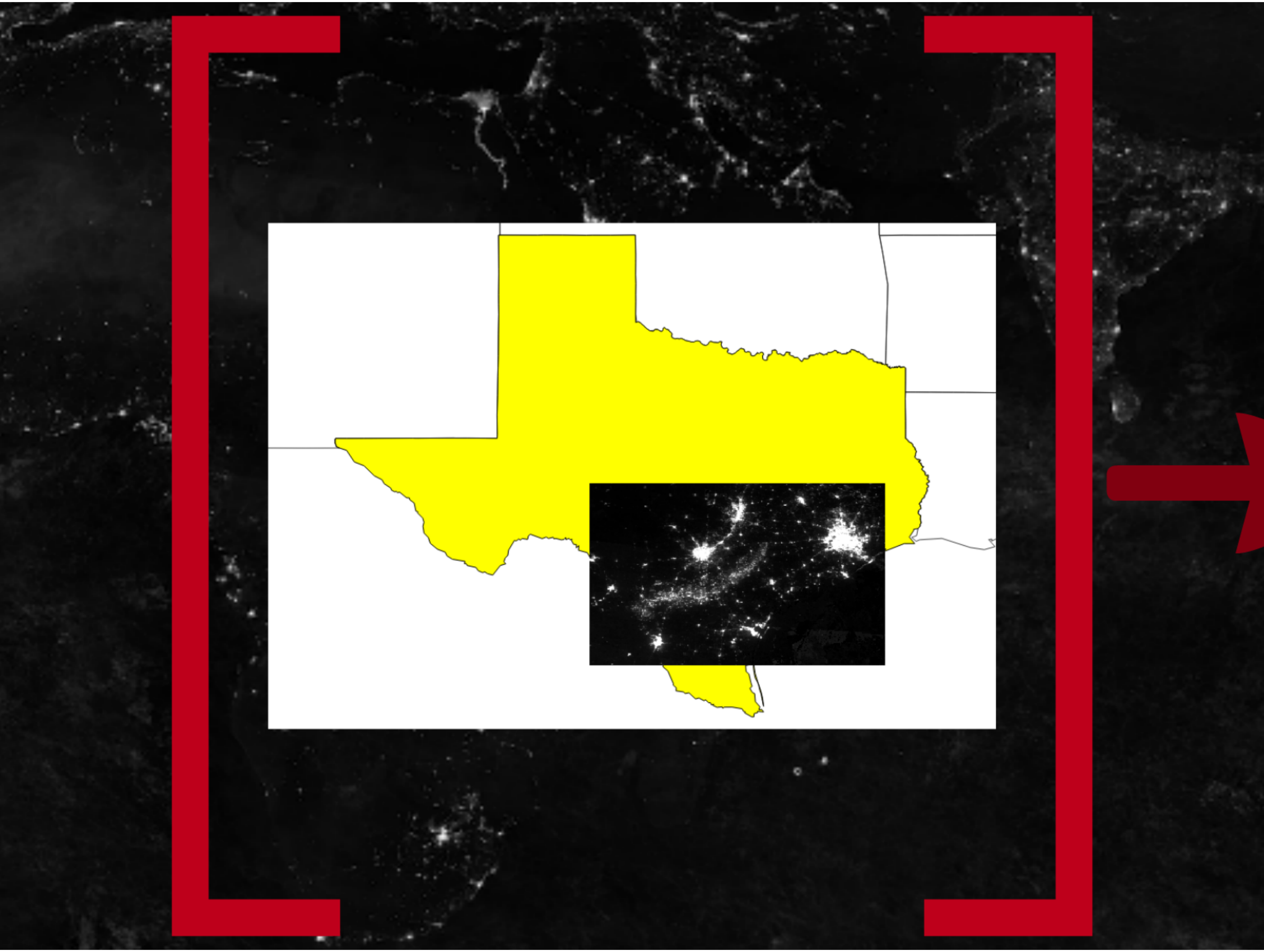
Eagle Ford Shale Play

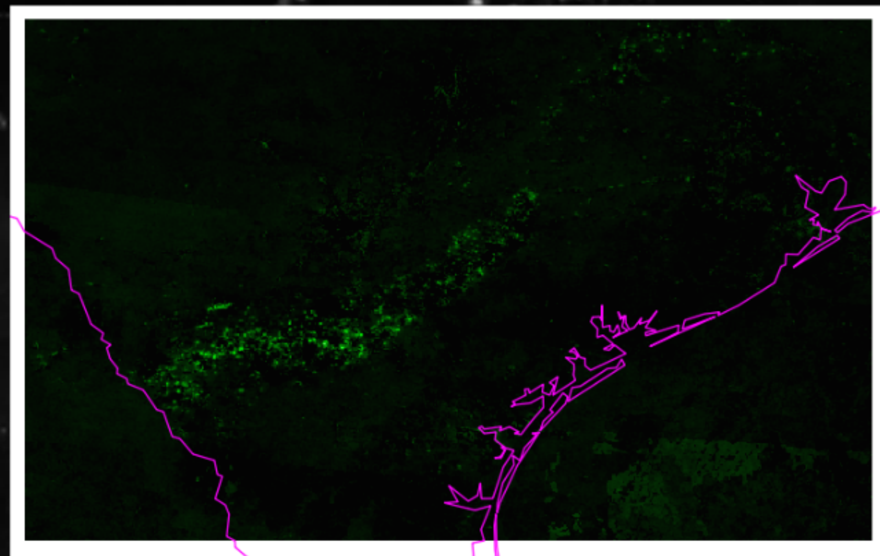


Change Map, Area Lit in 2014 Only



Change Map, Area Lit in 2015 Only
16% Decrease Lights and Flaring

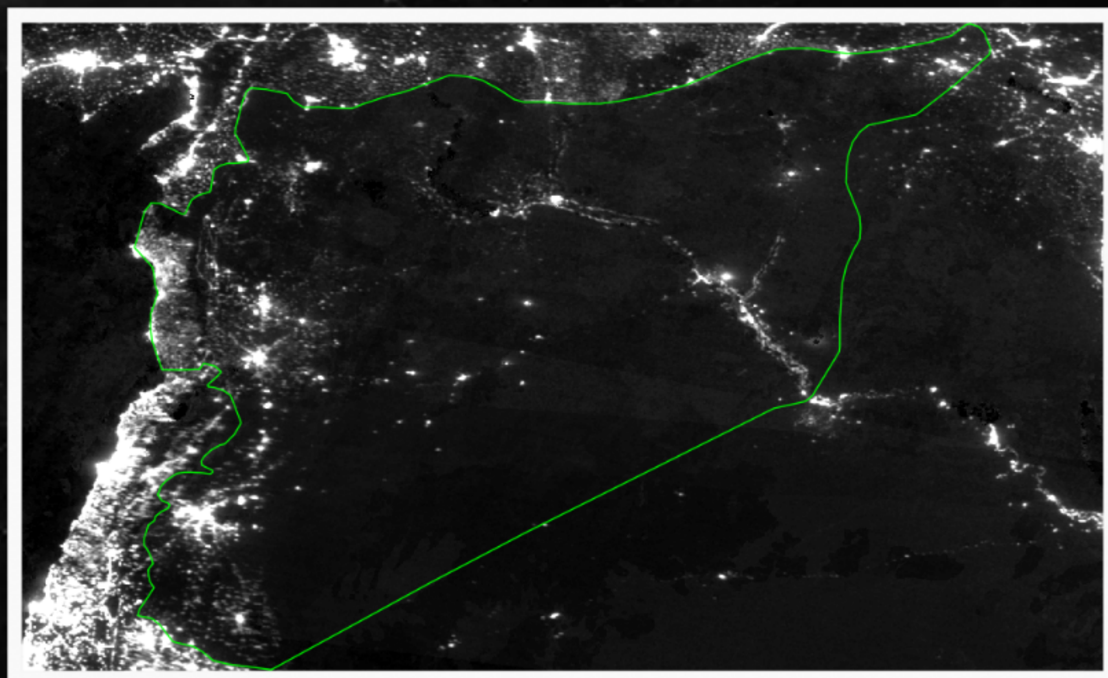




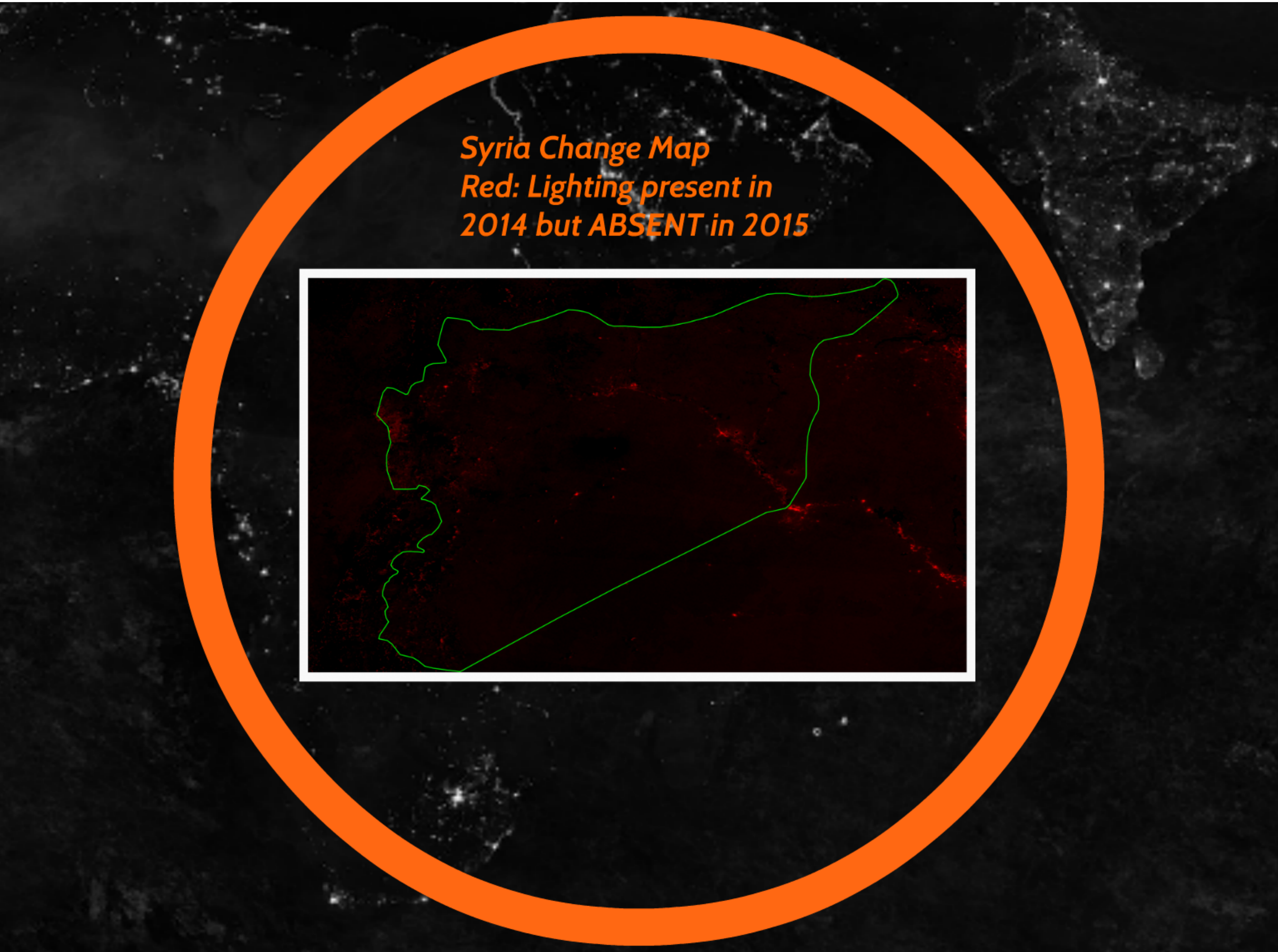
Change Map, Area Lit in 2014 Only

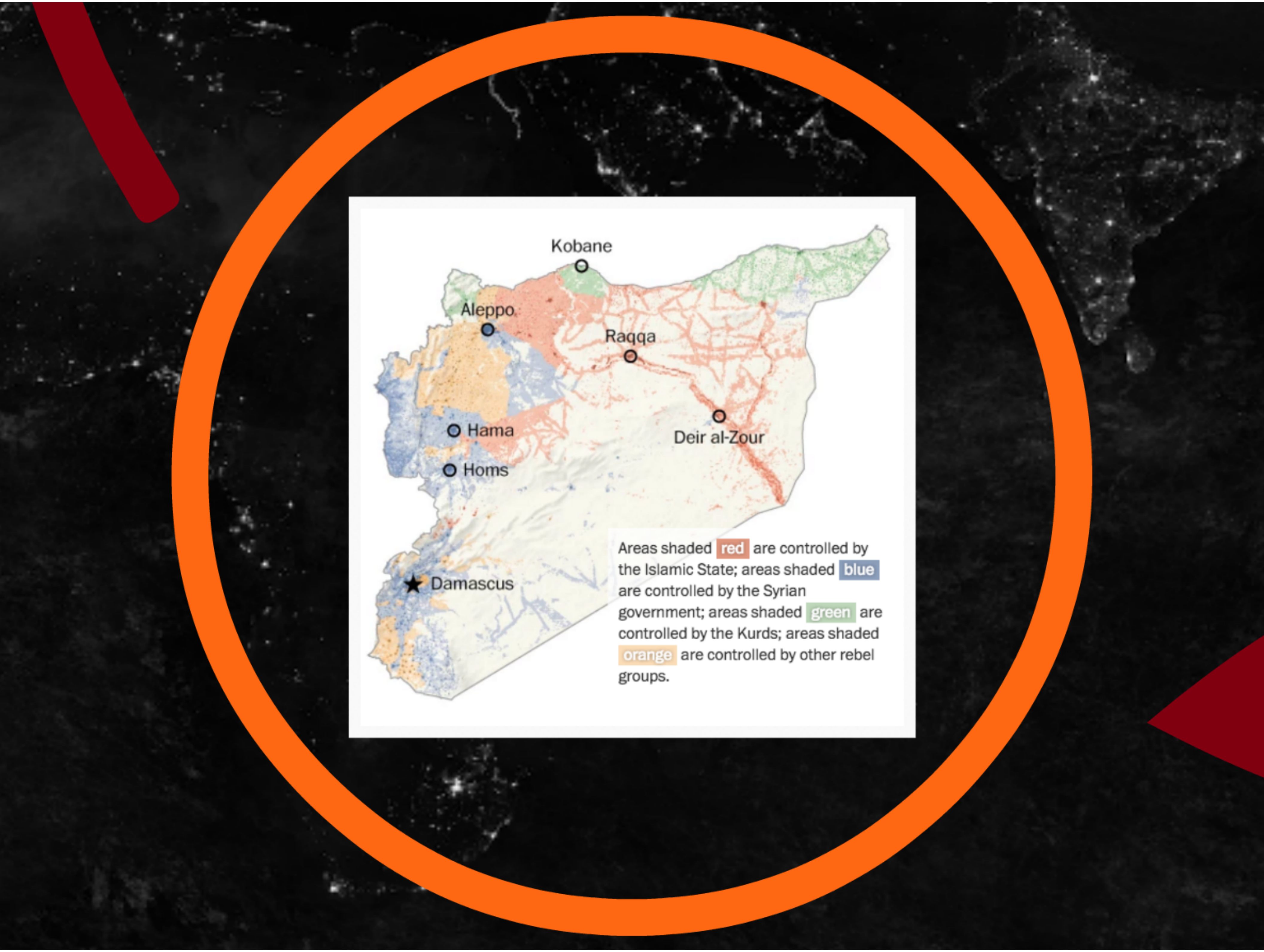
Change Map, Area Lit in 2015 Only

16% Decrease Lights and Flaring

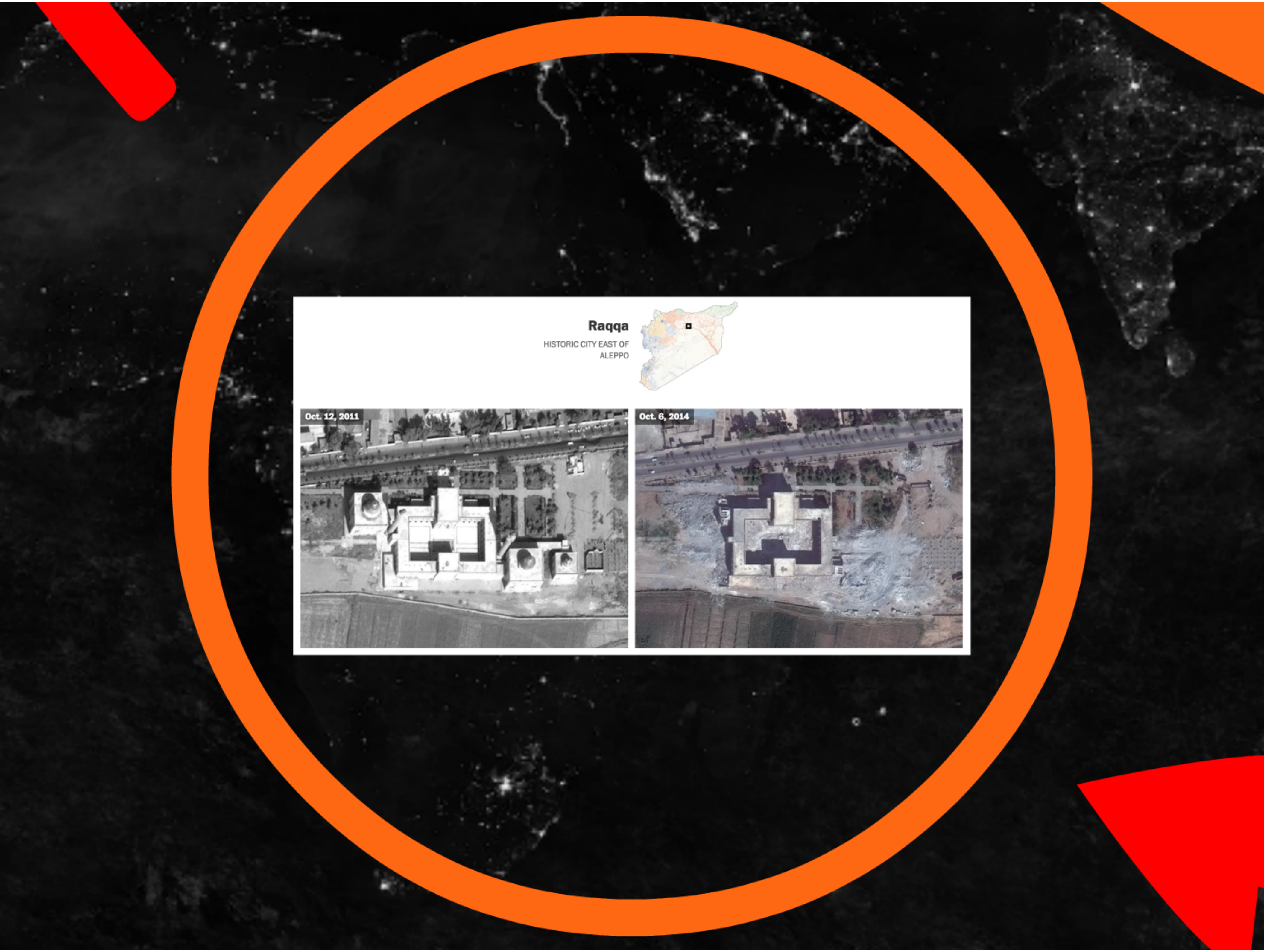


Additional Social Science applications of change detection using DNB

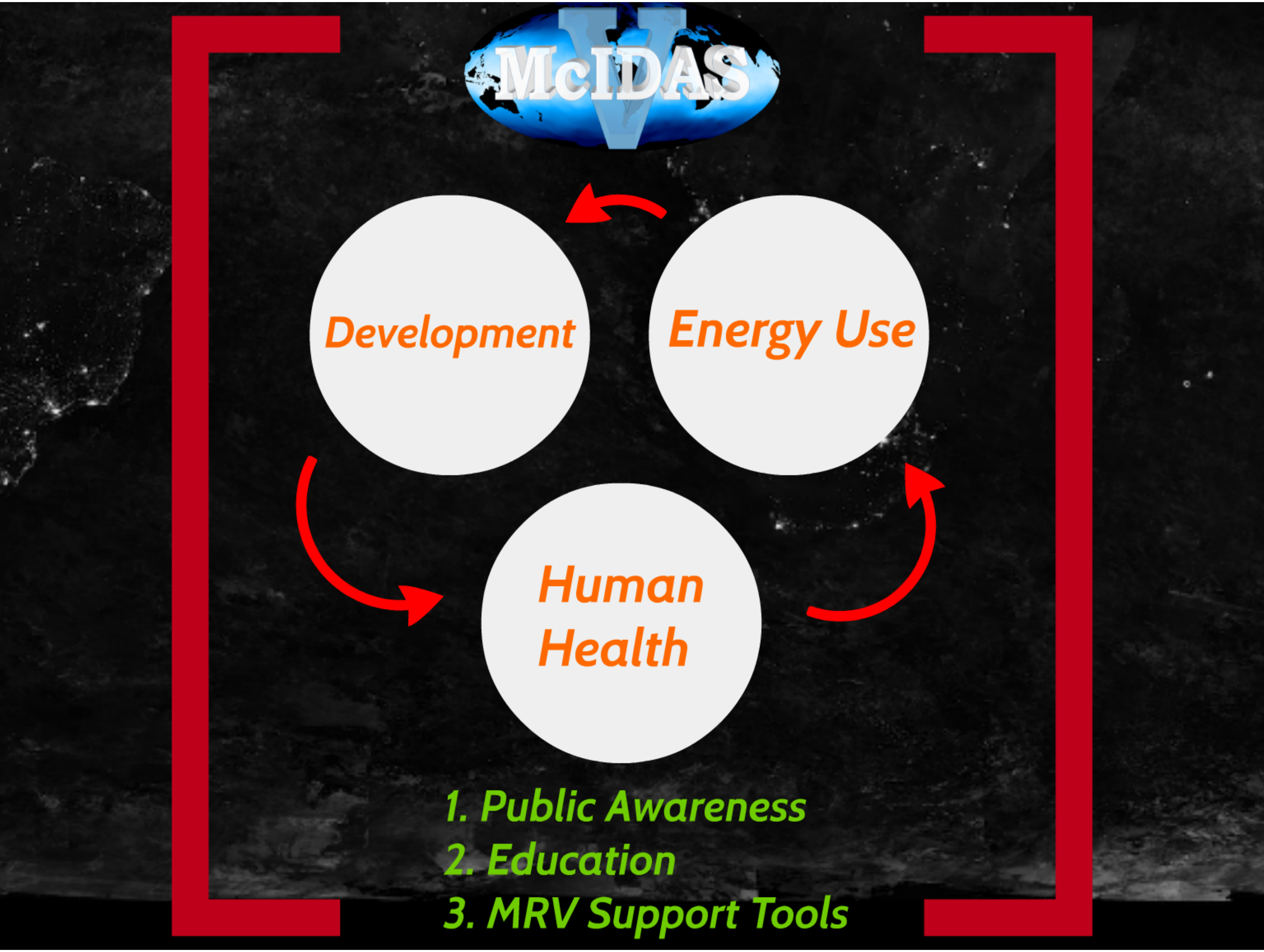

Syria Change Map
Red: Lighting present in
2014 but ABSENT in 2015



Areas shaded red are controlled by the Islamic State; areas shaded blue are controlled by the Syrian government; areas shaded green are controlled by the Kurds; areas shaded orange are controlled by other rebel groups.


Raqqa
HISTORIC CITY EAST OF
ALEPPO
Oct. 12, 2011
Oct. 6, 2014


Deir al-Zour
ALONG THE EUPHRATES,
NEAR IRAQ
Feb. 13, 2013
Nov. 25, 2014

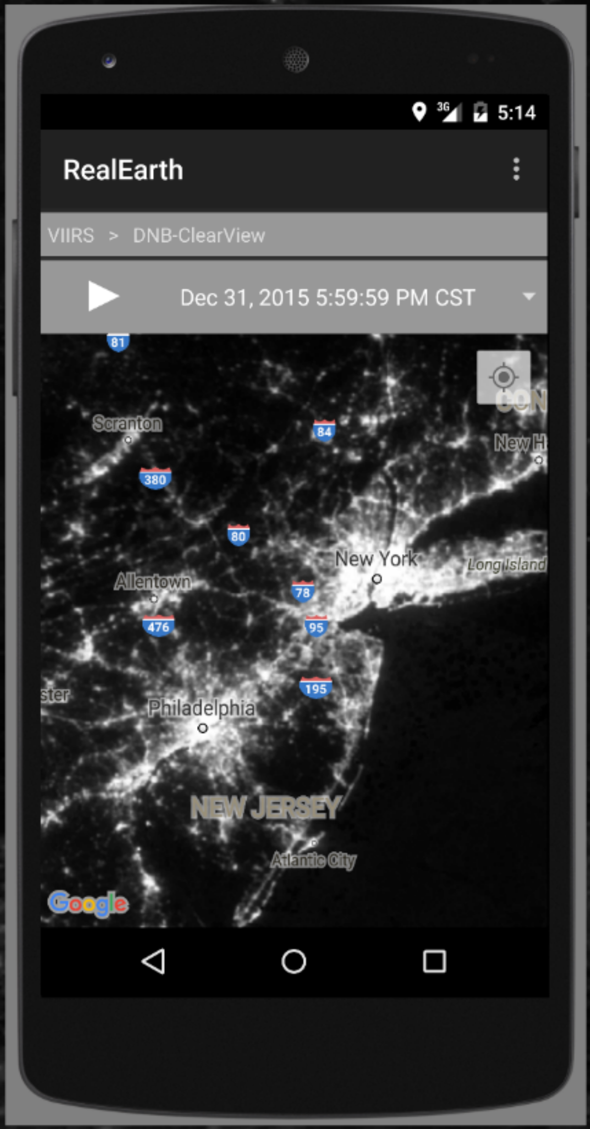

McIDAS V
Development
Energy Use
Human Health
1. Public Awareness
2. Education
3. MRV Support Tools

CIMSS Climate Data Portal

http://www.ssec.wisc.edu/cdp/main

RealEarth Mobile App

Product:
VIIRS: DNB ClearView



Example Animations:

http://www.ssec.wisc.edu/~tommyj/data/bangkok_animation.gif

http://www.ssec.wisc.edu/~tommyj/data/korea_animation.gif