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MOSAIC THEME RESULTS:
Global Wetlands Mapping Using ALOS PALSAR data

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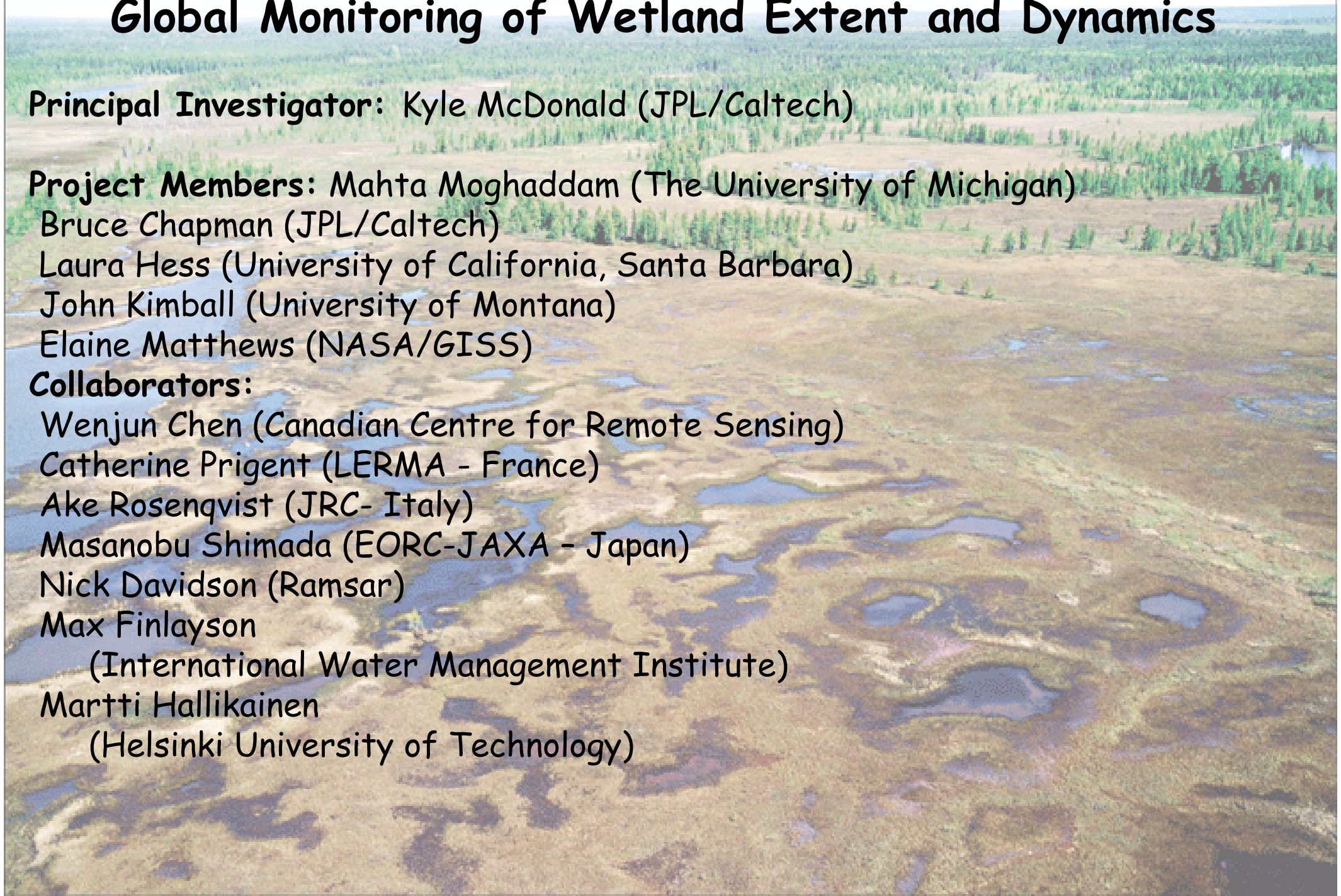
An Inundated Wetlands Earth System Data Record: Global Monitoring of Wetland Extent and Dynamics



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Laura Hess (University of California, Santa Barbara)
John Kimball (University of Montana)
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Catherine Prigent (LERMA - France)
Ake Rosenqvist (JRC- Italy)
Masanobu Shimada (EORC-JAXA – Japan)
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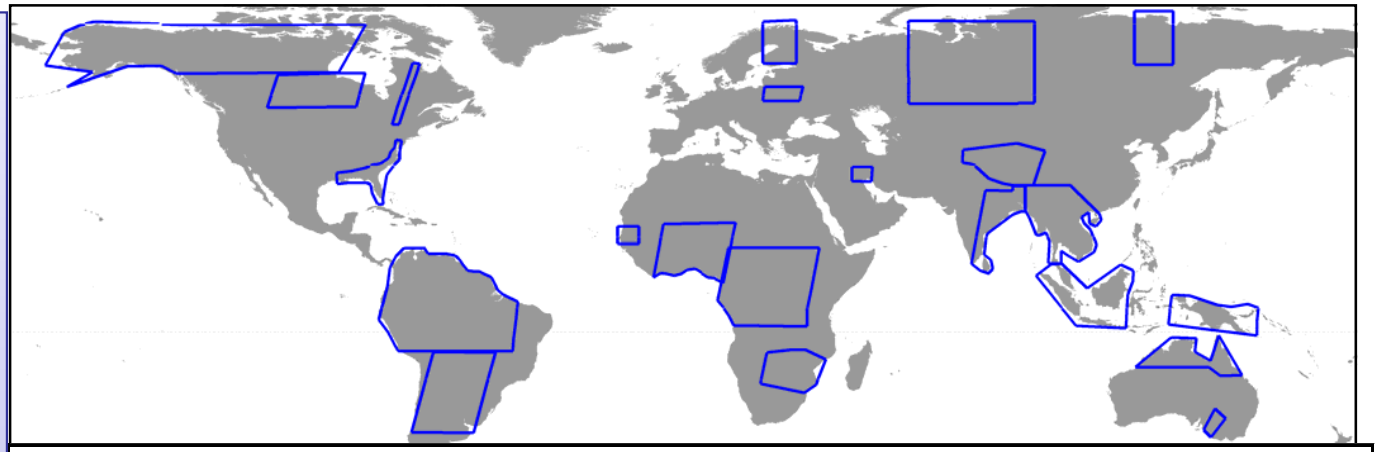
Max Finlayson
(International Water Management Institute)
Martti Hallikainen
(Helsinki University of Technology)

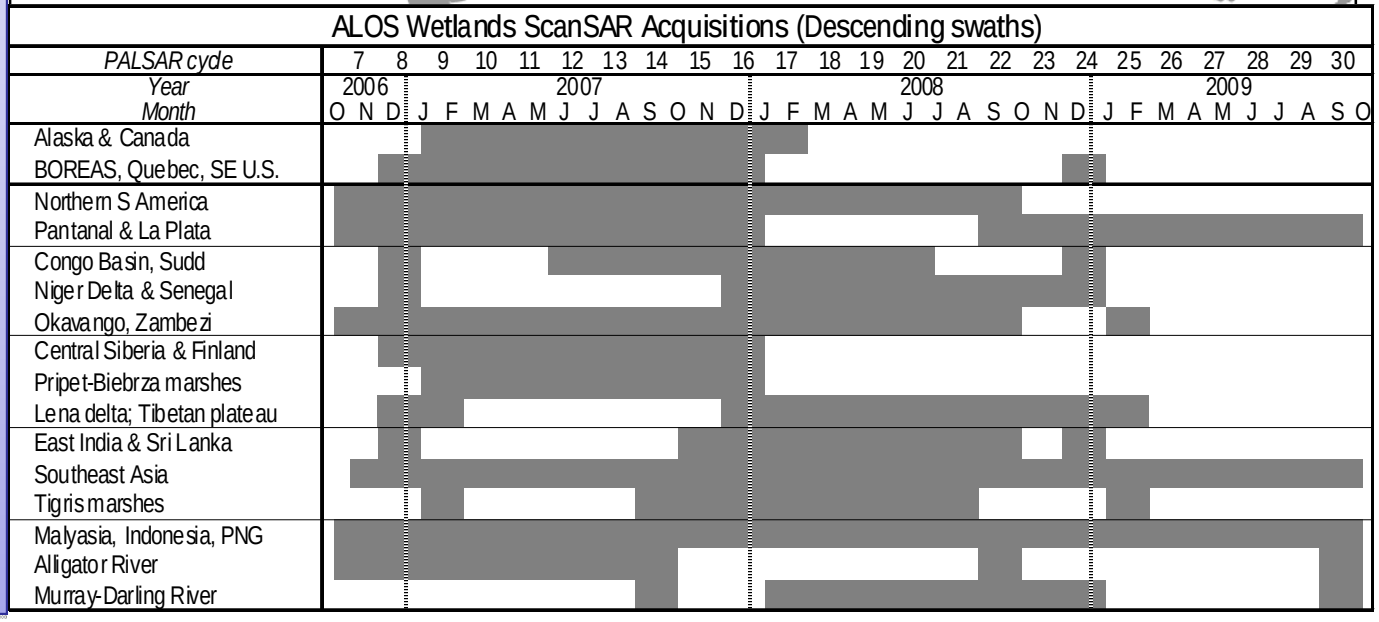
PALSAR Regional Coverage: ScanSAR regions

Science Products:

- Inundated wetland area (swath-by-swath)
- Principal wetland vegetation classes (non-vegetated, herbaceous, shrub, woodland, forest)
- Seasonally based summary products describing timing and extent of wetland inundation

Production is phased according to K&C acquisitions





Status

- N. America is almost complete
  - Missing 77 image strips
  - 2300 1deg tiles, a few hundred have some mosaicking errors that are being corrected
  - Will begin distribution end of summer after QA is complete.
    - Some minor errors are being corrected as each tile is inspected
- S. America
  - Calibrating image strips in progress
  - Missing some strips, Laura Hess may have them.
- Software is ready for ScanSAR mosaicking also, will begin this summer.

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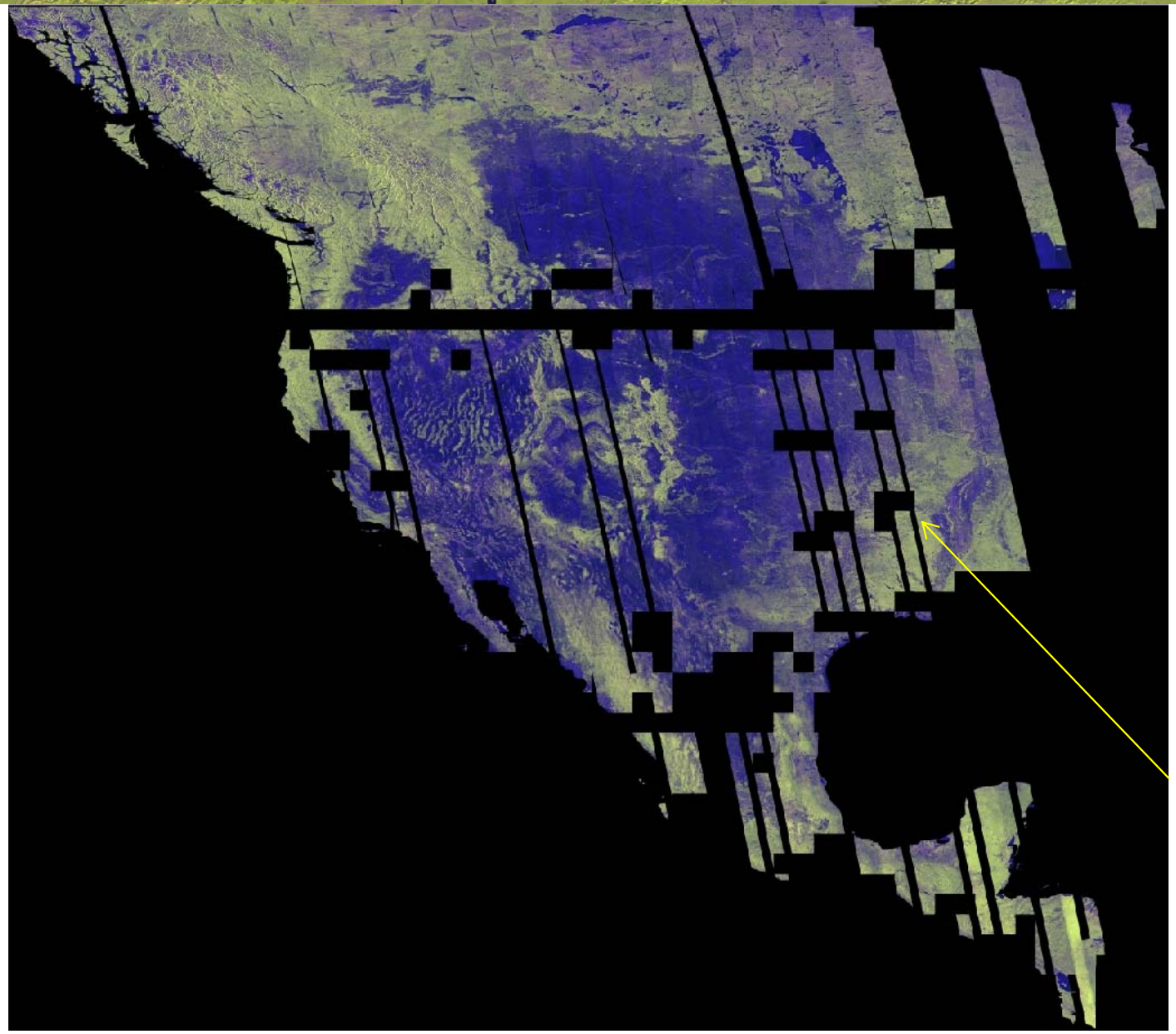

These ‘blacked out’ tiles had some mosacking errors that are being worked.

HH HV HH/HV

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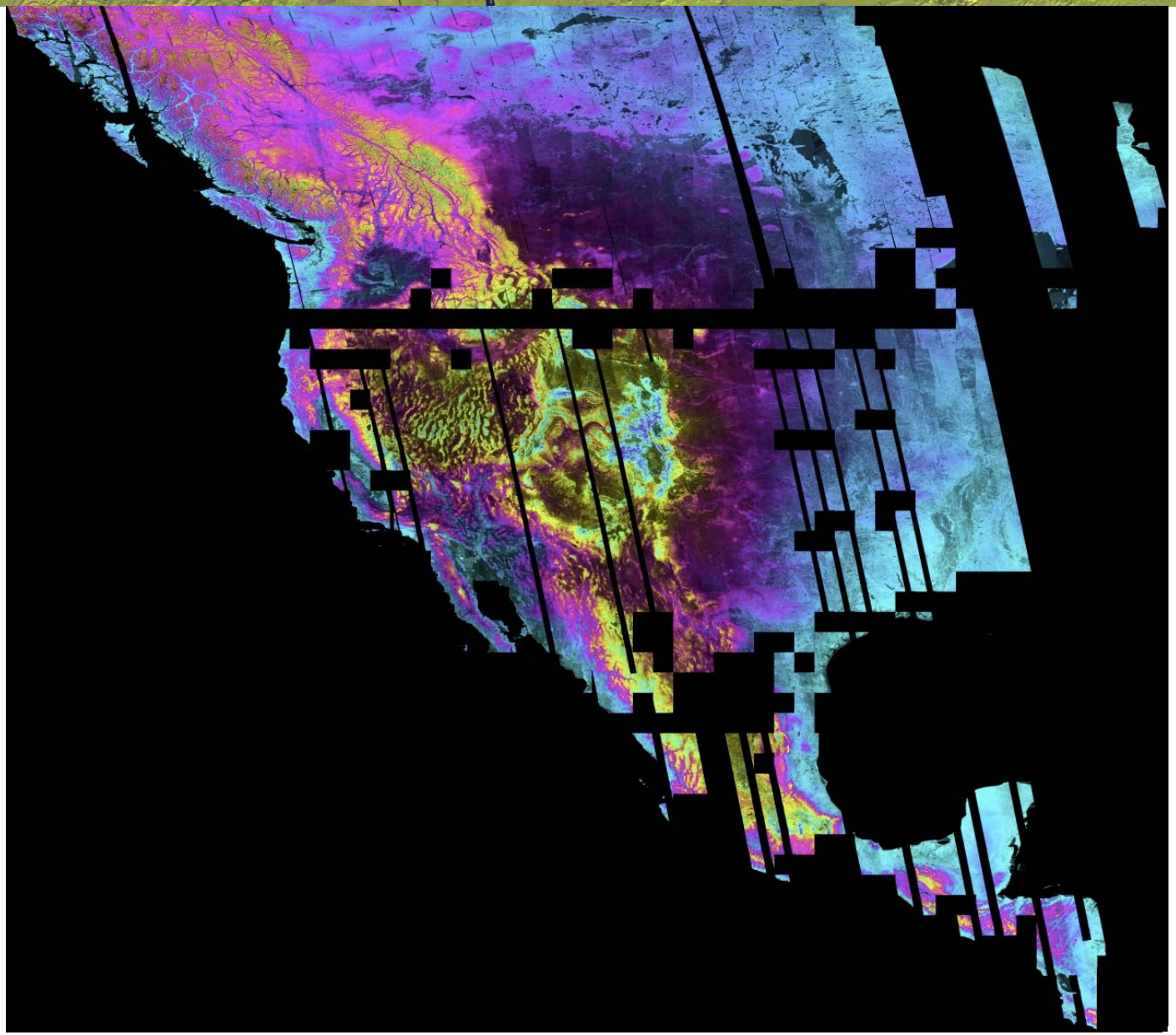
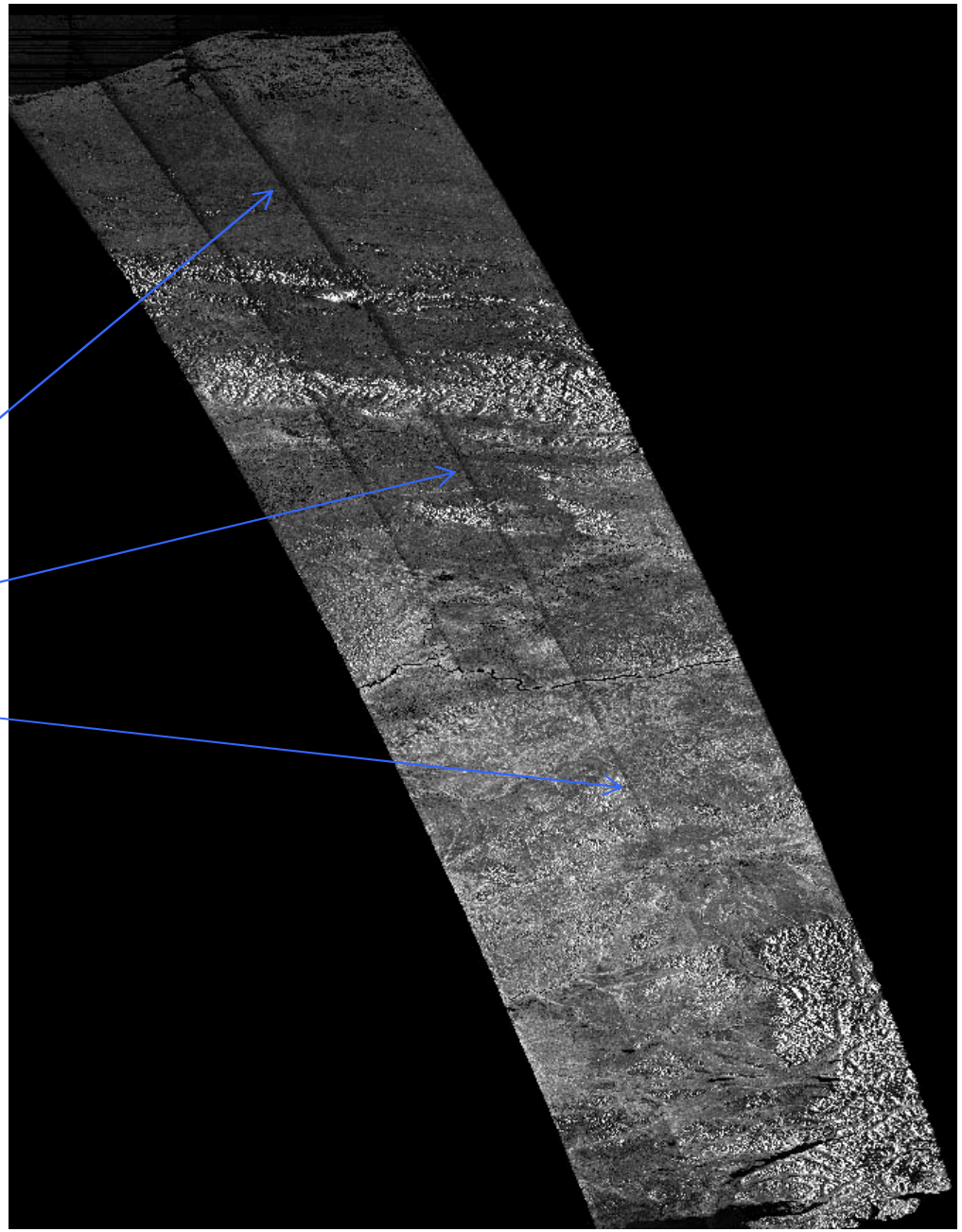


HH Brightness

Height: 0 to 3000 meters color wrap

Jet Propulsion Laboratory

HH mosaic of
PALSAR image strips



Alaska

The spatial extent of the 'fall off' in the near and far range appears to slowly vary along track.

Applying a single correction for an entire image strip does not entirely eliminate the problem

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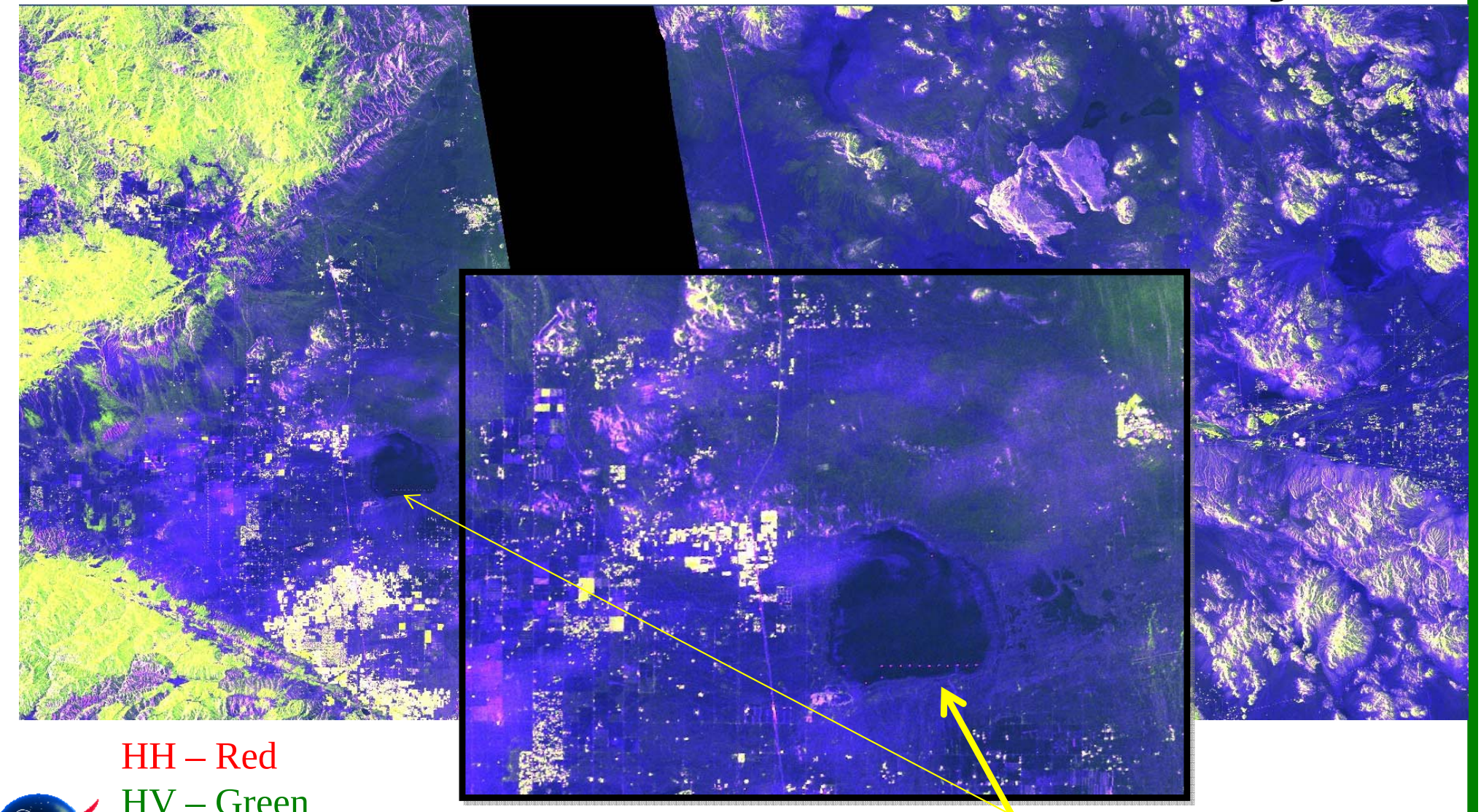
Rosamond Calibration Array



HH – Red

HV – Green

HH/HV - Blue

NASA

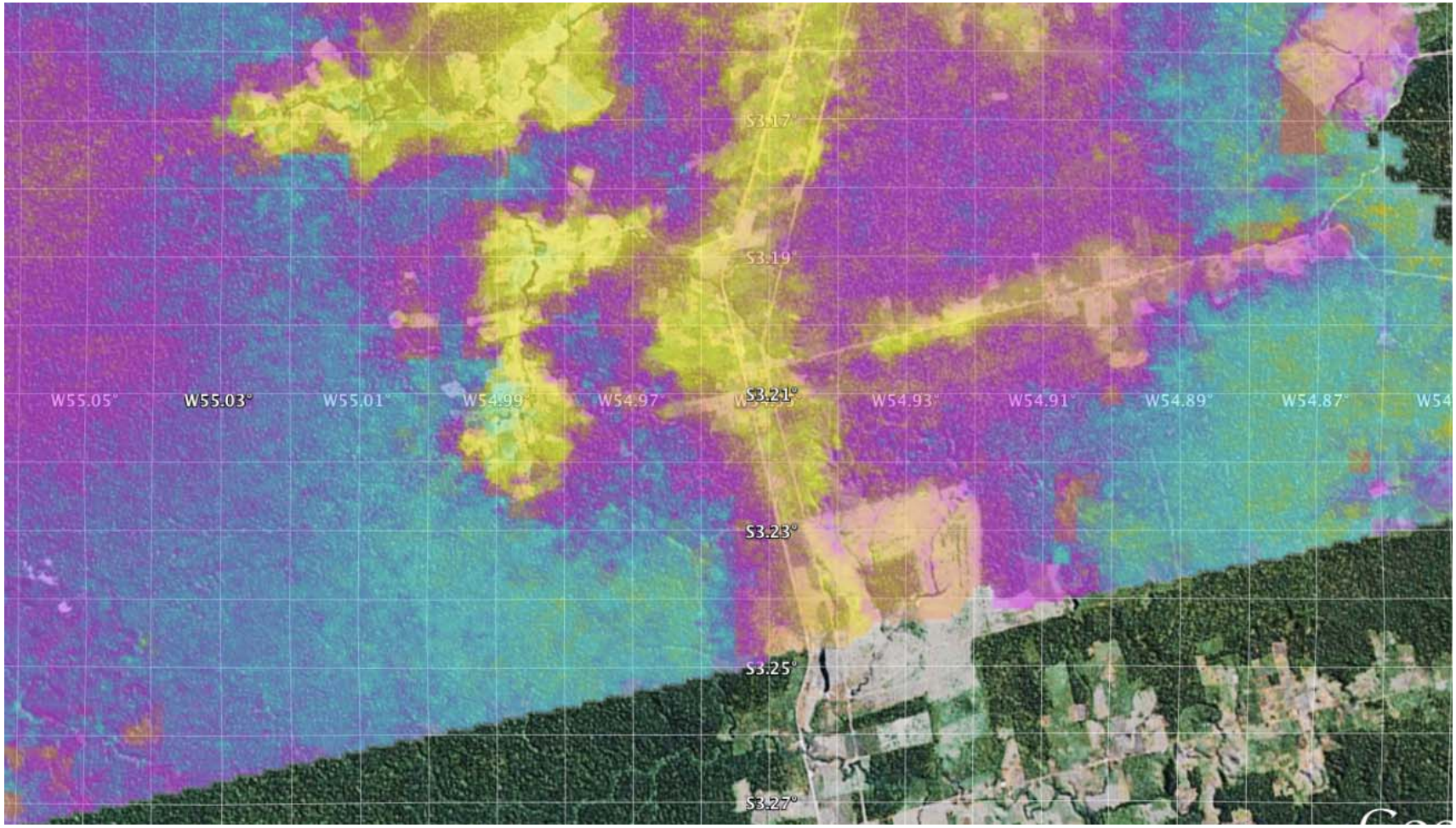
JPL

Jet Propulsion Laboratory

Missing data that needs to be ordered to complete mosaic

- 77 image strips from North America
  - 1000 cumulative degrees of latitude along track
- 39 image strips from South America
  - Laura/INPE may have some of these
  - 920 cumulative degrees of latitude
- 11 strips from South America are cut off at North shore of the continent, not sure if that has been corrected.

PALSAR interferometry



The phase of the unwrapped differential interferogram is shown partially transparent over the google earth image. There seems to be good correspondence between disturbed areas and the phase, that will be investigated more fully in in the field during August.

Output data format

- 1 byte
  - Small files - PREFERABLE
  - No endianess issues
  - May have saturated pixels
  - Must be dB to accommodate dynamic range of data
    - What is the maximum ΔDN that avoids loss of accuracy?
- 2 byte
  - Twice as large as 1-byte files
  - Little or no saturation
  - Can be either dB or linear amplitude

Output data format

- Linear units
  - Amplitude rather than power
  - Use same scale factor as JAXA
  - Similarity to other JAXA products
  - Familiar to other sensors and GRFM
- dB
  - Generally the quantity to which we eventually want to convert
  - Must be careful averaging pixels as we are in the log domain

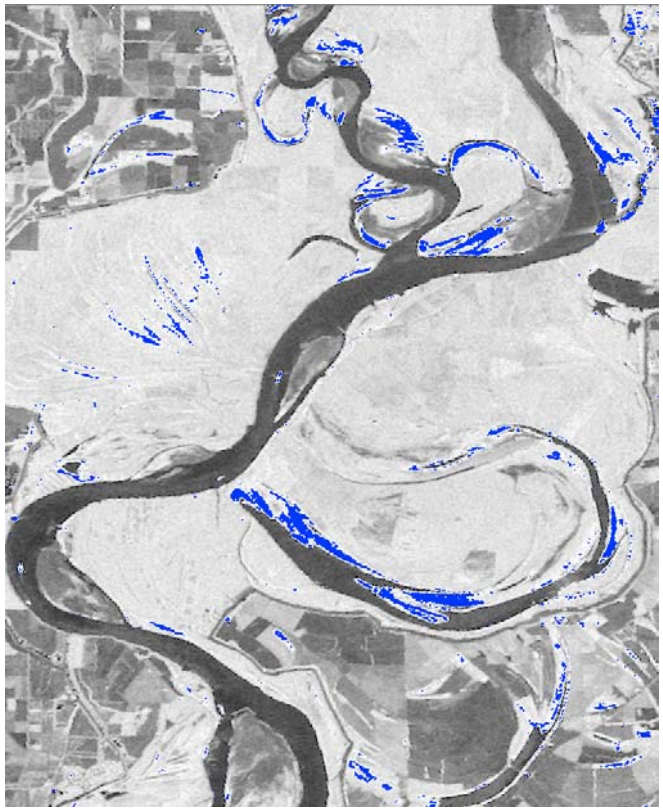
Converting to dB

Byte image conversion?

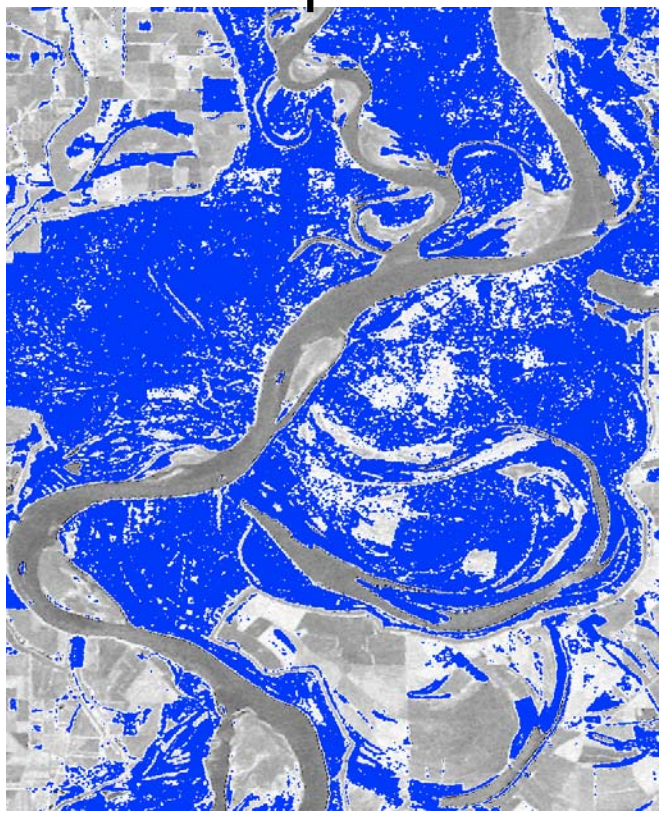
- We have 255 possible values
  - If 0.1 dB per ΔDN, then 25.5 dB can be accommodated (is that enough dynamic range?)
  - If 0.2 dB per ΔDN, then 51 dB can be accommodated (plenty of dynamic range)
- Can we squeeze data into 0.1 dB per ΔDN?
- DN=0 corresponds to ‘offset’ in dB
  - It is the minimum dB value that can be accommodated.

Conversion to one byte (dB)

0.1 dB per ΔDN



-30 dB to -4.5 dB



-35 dB to -9.5 dB

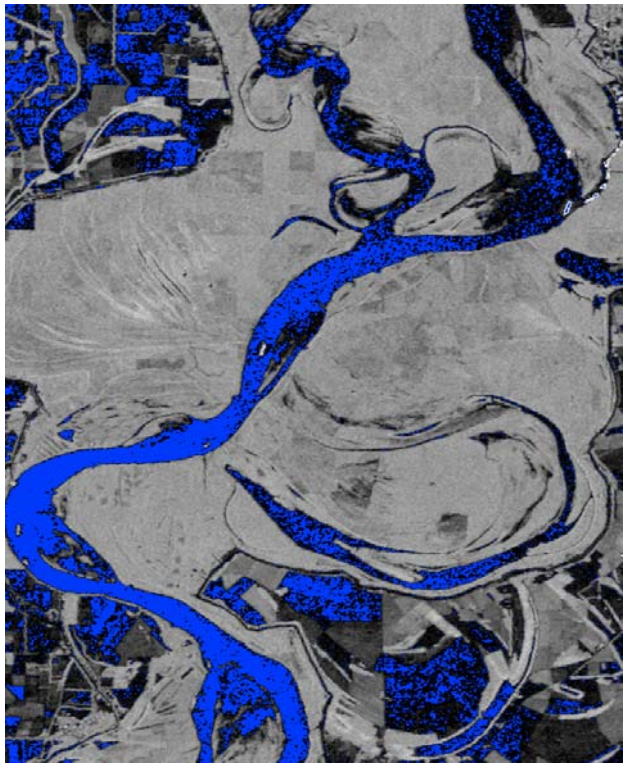
-40 dB to -14.5 dB

Saturation:

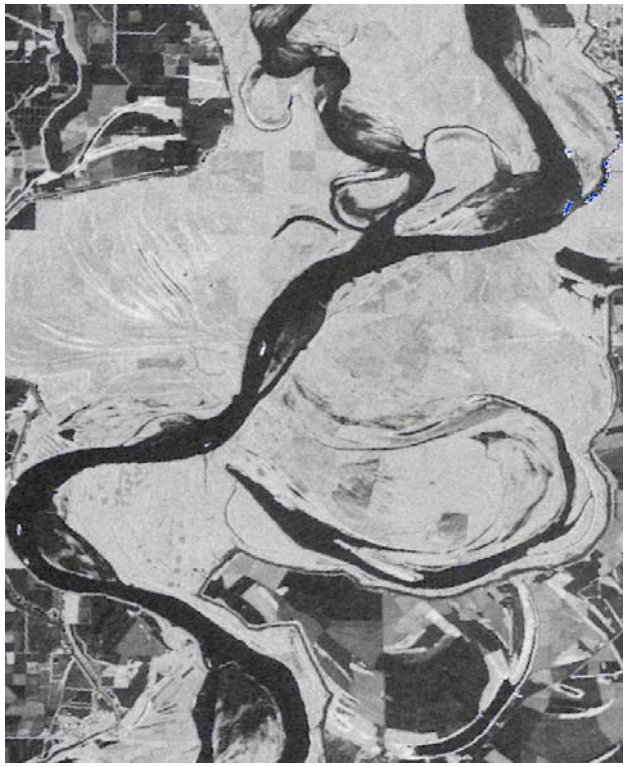
HH

Tile : N33W092

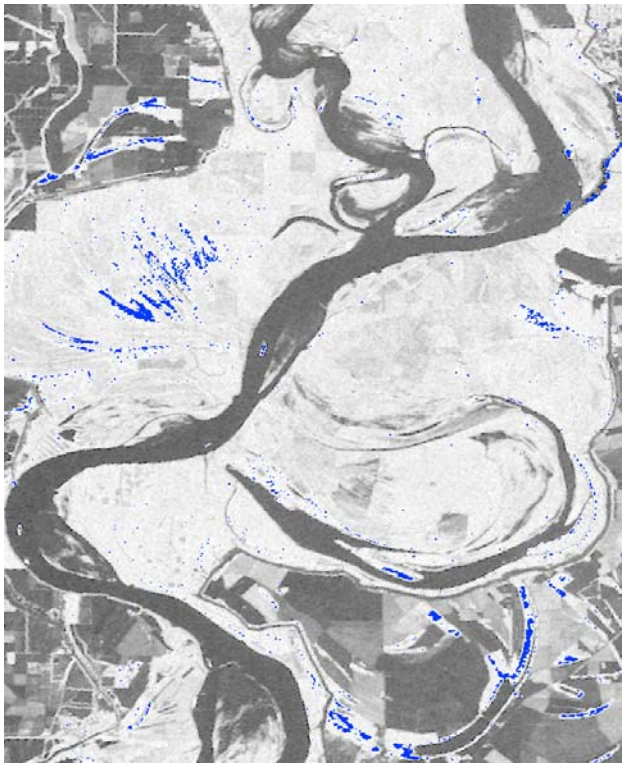
Conversion to one byte (dB)
0.1 dB per ΔDN



-30 dB to -4.5 dB



-35 dB to -9.5 dB



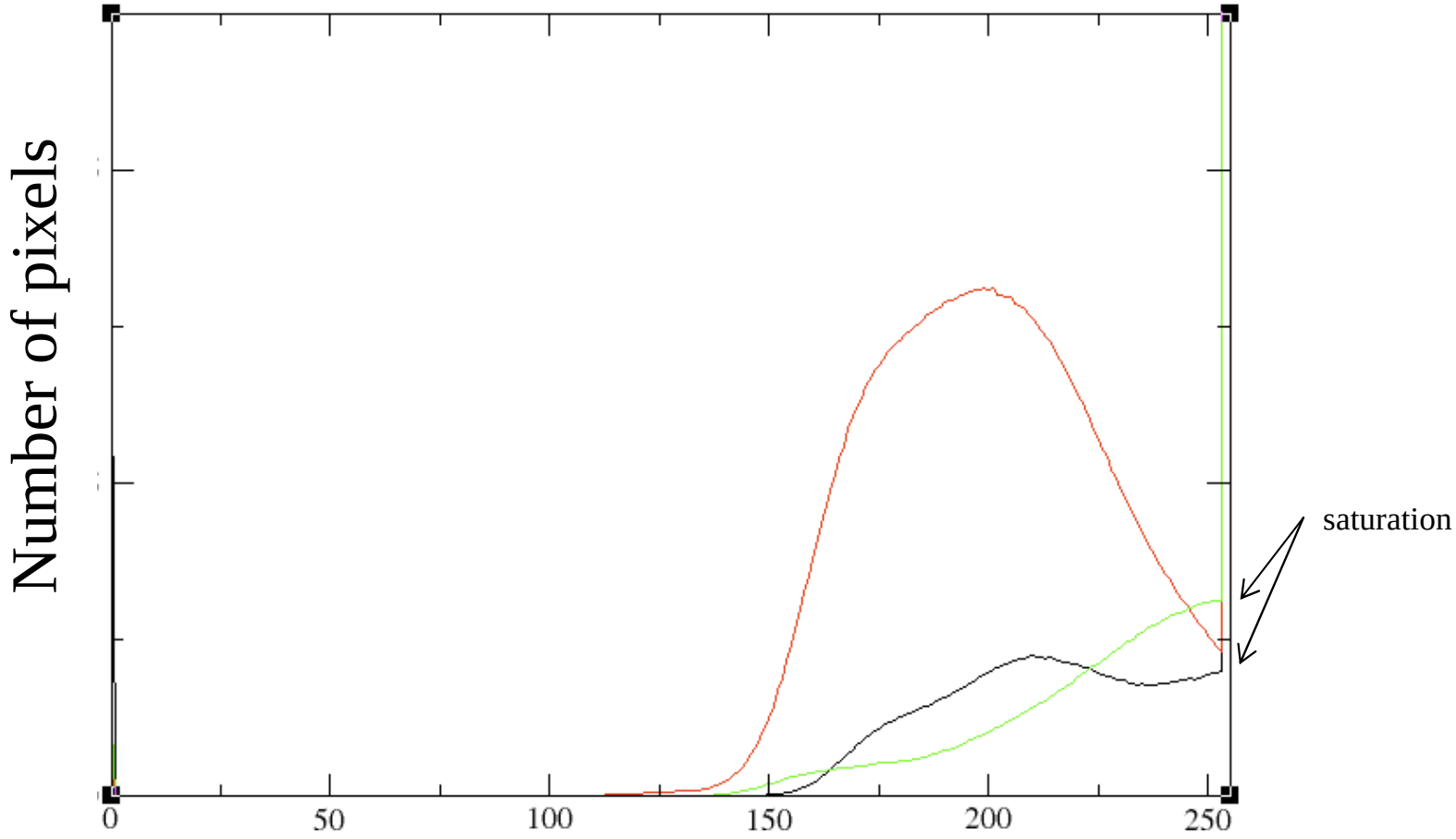
-40 dB to -14.5 dB

Saturation:

HV

Tile : N33W092

HH histogram of dB values
ΔDN=0.1 dB
offset = -40 dB



Tile : N33W092
N50W110
N50W125

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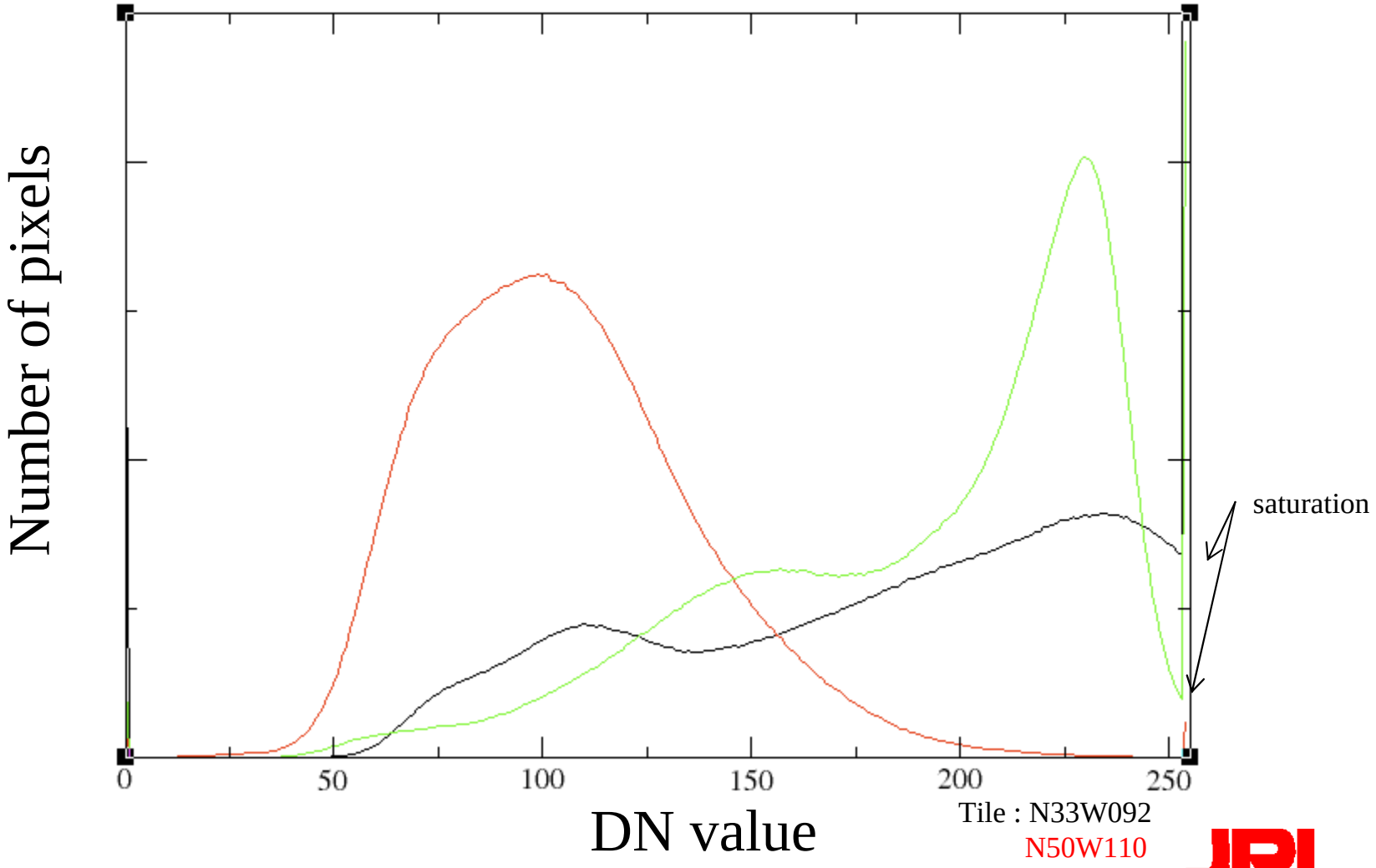
HH histogram of dB values
ΔDN=0.1 dB
offset = -30 dB



Tile : N33W092
N50W110
N50W125

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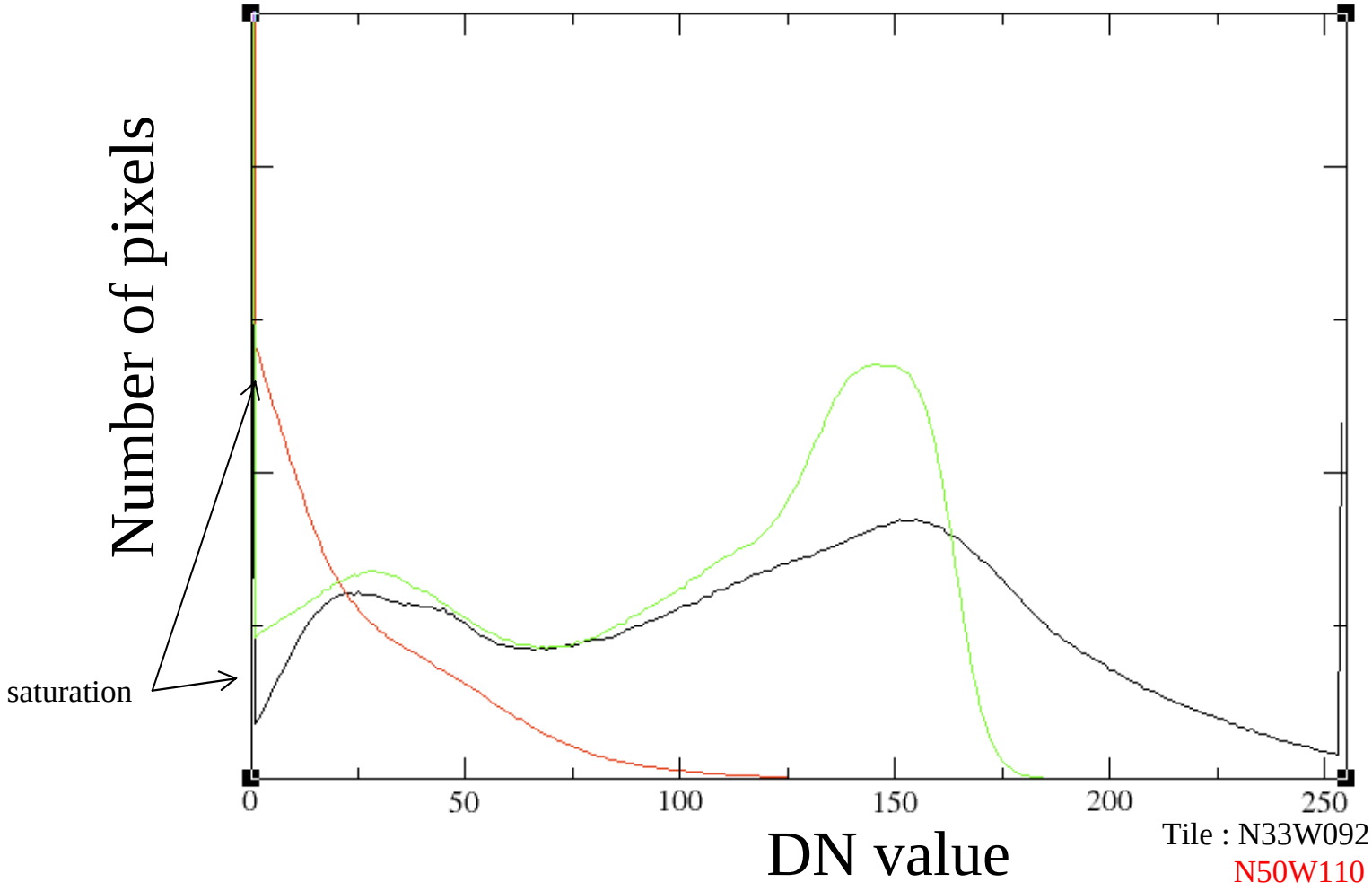
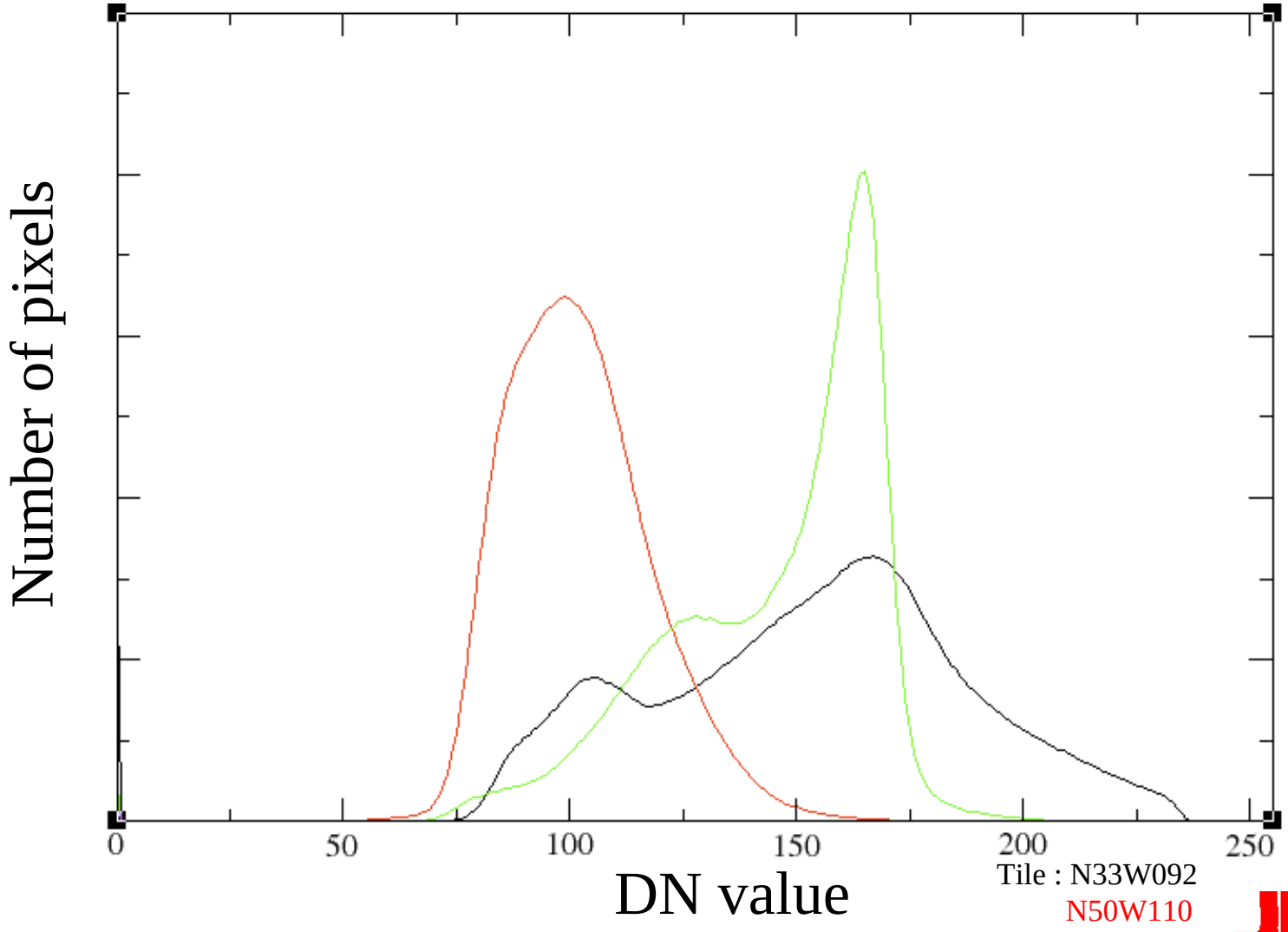
HV histogram of dB values
ΔDN=0.1 dB
offset = -30 dB



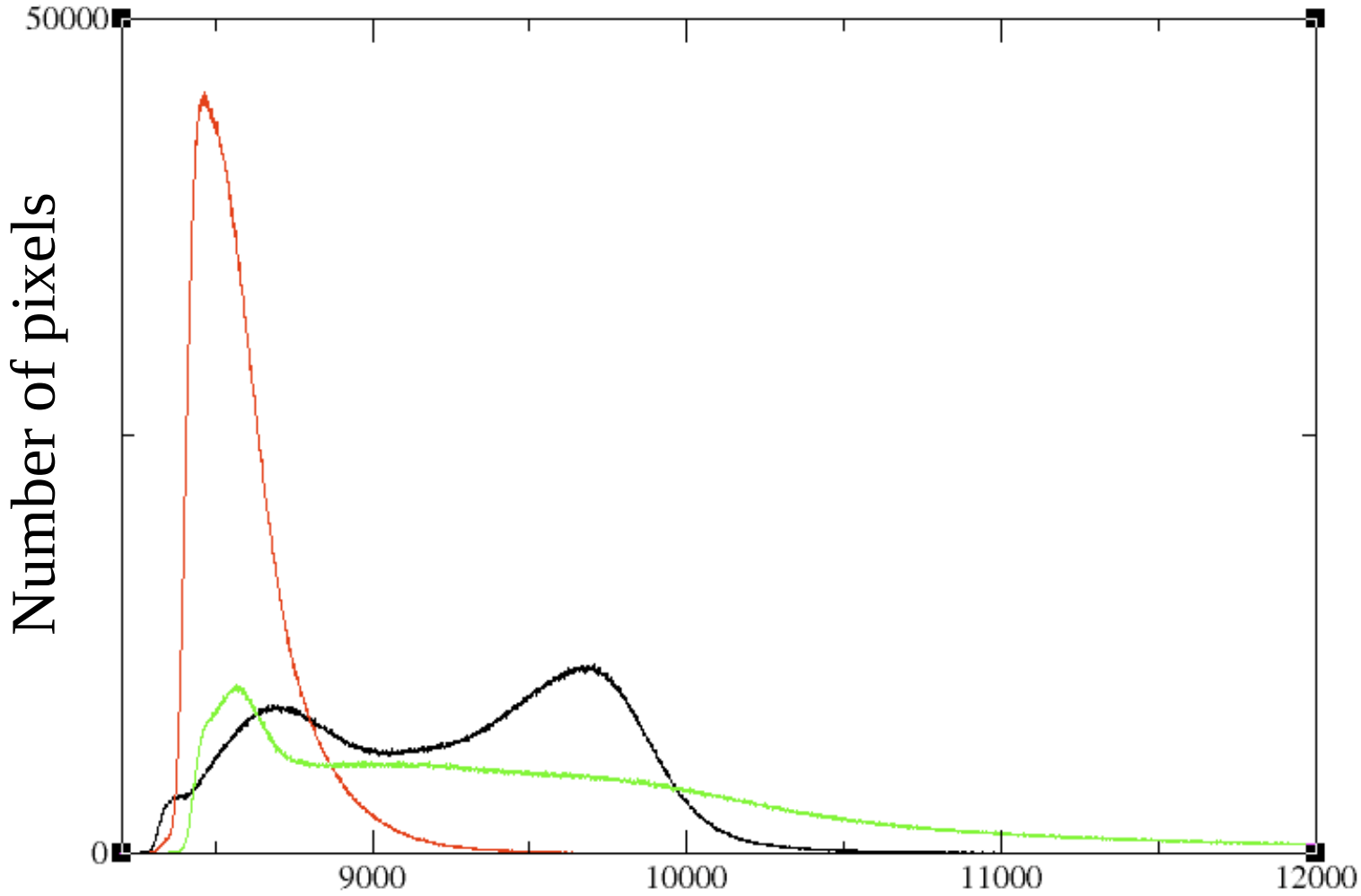
Tile : N33W092
N50W110
N50W125

HH histogram of dB values
ΔDN=0.2 dB
offset = -40 dB



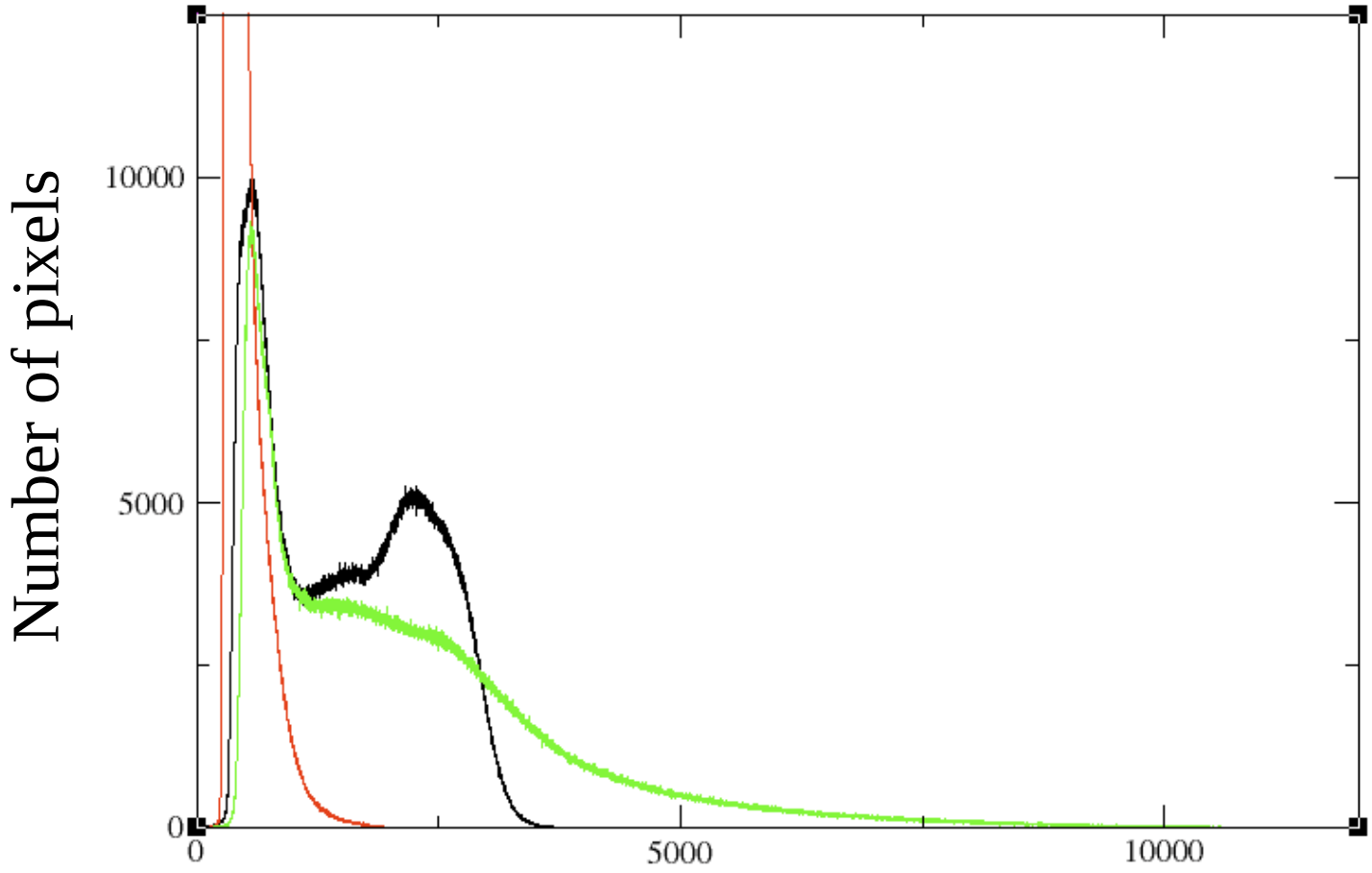
Tile : N33W092
N50W110
N50W125

HH histogram of i2 values



Tile : N33W092
N50W110
N50W125

HV histogram of i2 values



Tile : N33W092
N50W110
N50W125

Conclusions

- 1 byte vs 2 byte
  - 1 byte
    - Must use 0.2 dB per ΔDN
    - Can use minimum of -40 dB (max=+11 dB)
    - Smaller size files
  - 2 byte
    - Large scale images should not have saturation problems
    - Can save either dB or linear amplitude
- dB vs linear units
  - Linear
    - Familiar amplitude values
    - Can find average power easily (after squaring the pixels)
  - dB
    - Most users eventually want to know values in these units
    - Log scaling of images looks nice
    - Image statistics can be misinterpreted

Conclusions

- Header (Metadata) files
  - We should have a separate file describing the image data
  - I prefer this format (but can be any…)

```
set_name                =   mag             !  Somewhat arbitrary name
Set_rows                =   15000           !  Number of Rows
Set_cols                =   15000           !  Number of Columns
set_hddr                =   0               !  HDR bytes
Set_tail                =   0               !  Tail bytes
row_hddr                =   0               !  Header bytes prefixing each line
Row_tail                =   0               !  Trail bytes at end of each line
Val_endi                =   BIG ENDIAN      !  Endianess
Val_frmt                =   REAL*4          !  Format (real*4, integer*2 ,byte*1, etc)
row_mult                =   5.000000        !  Pixel spacing in row direction
row_addr                =   1909717.        !  Upper coordinate of file
Col_mult                =   5.000000        !  Pixel spacing in column direction
col_addr                =   664769.0        !  Right Coordinate of file
Val_mult                =   1.000000        !  Multiplicative scale factor for each DN
val_addr                =   0.0000000E+00   !  Additive scale factor for each DN
val_minv                =   -9.9999999E+26  !  Minimum Valid DN value
val_maxv                =   9.9999999E+26   !  Maximum Valid DN value
val_null                =   -10000          !  Null Value
set_plat                =   0.0000000E+00   !  Peg Latitude
Set_plon                =   -1.623156       !  Peg Longitude
set_phdg                =   0.0000000E+00   !  Peg Heading
set_proj                =   UTM             !  Projection name
```

Acknowledgements

- This research was undertaken within the framework of the ALOS Kyoto & Carbon Initiative. The ALOS data were provided by JAXA EORC.
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