Dave M. Johnson
Geographer

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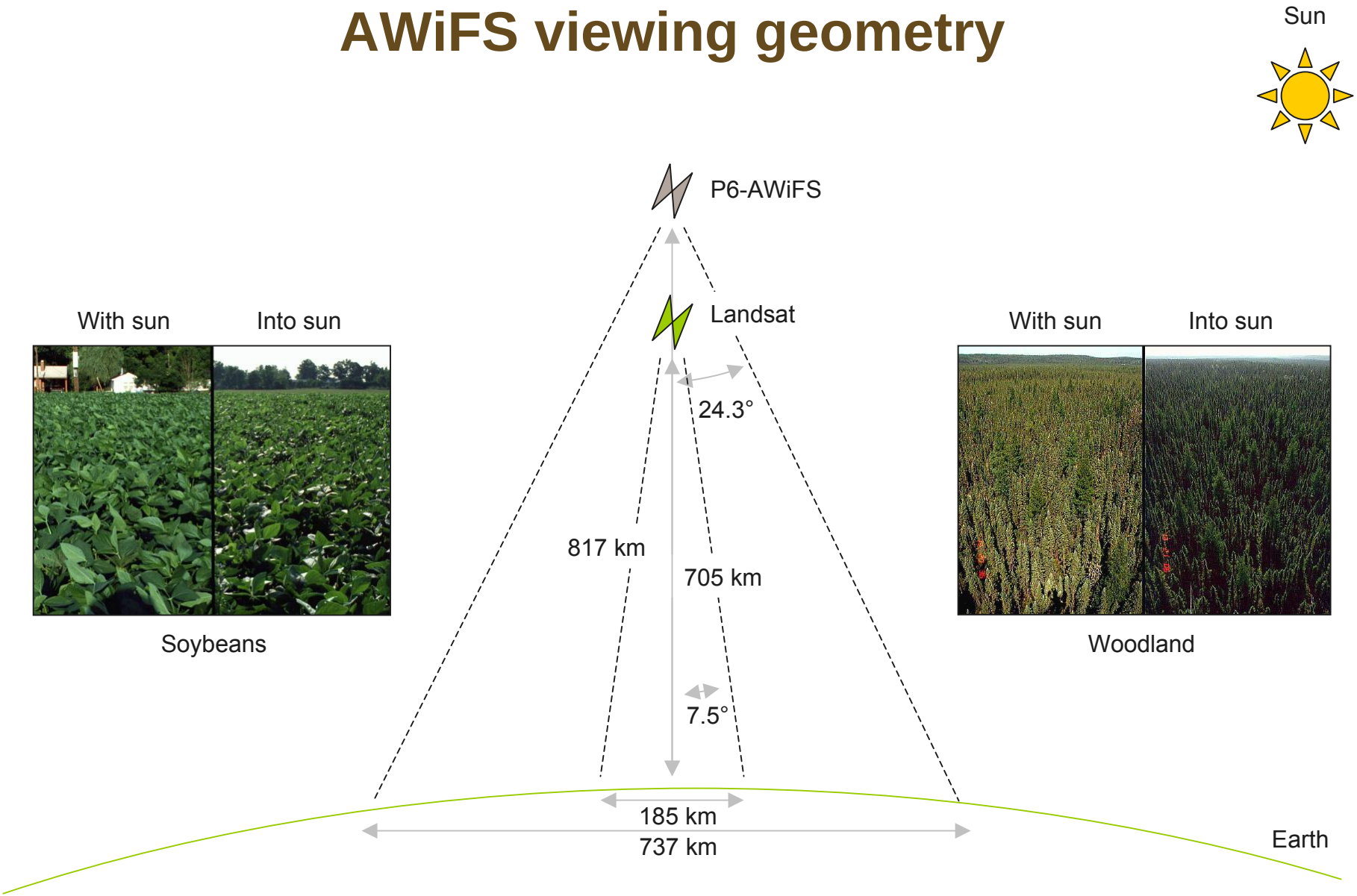
Cropland classification accuracy as a function of AWiFS incidence angle

AWiFS viewing geometry



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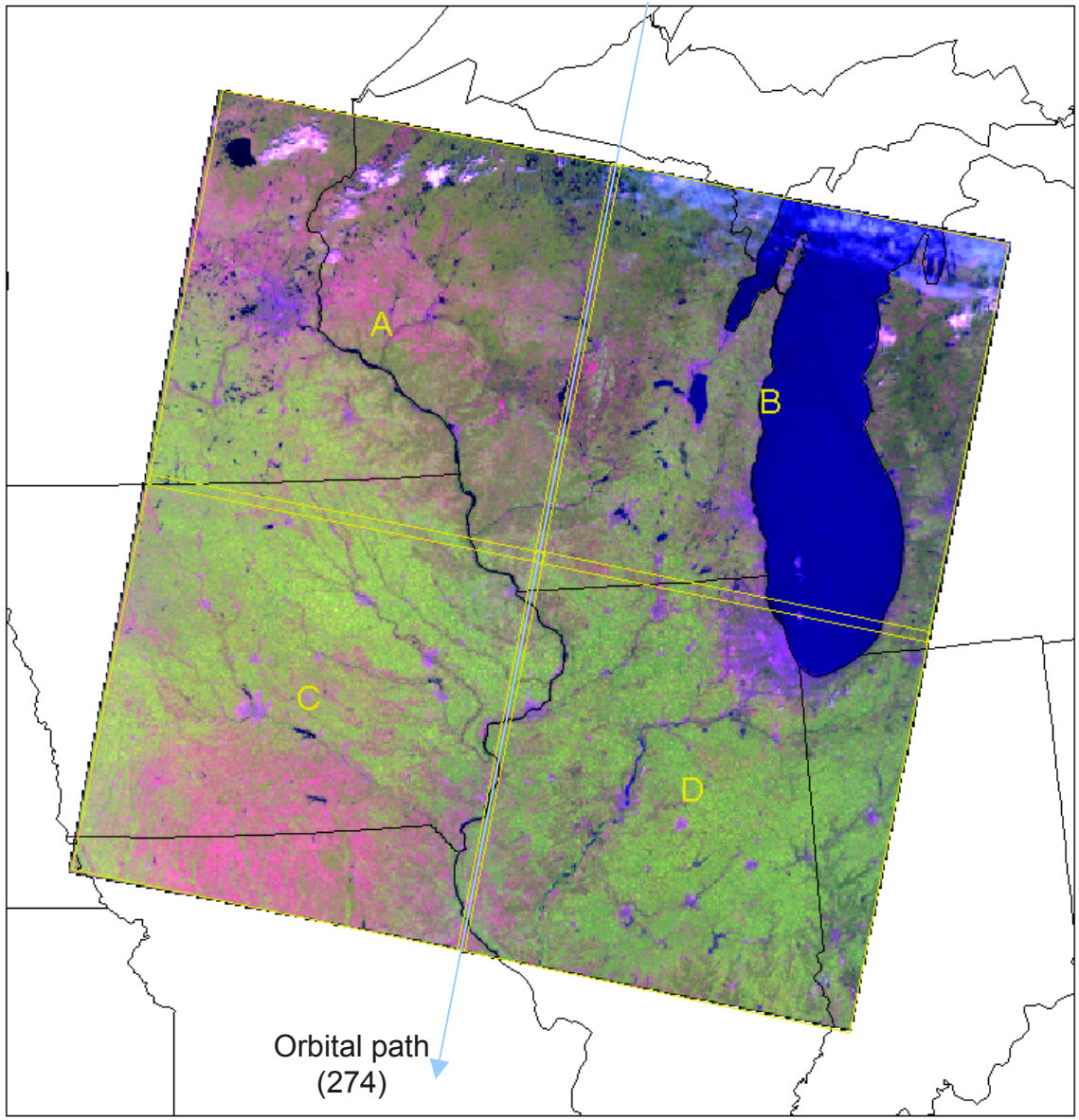
Example four quad, same date/path AWiFS collect



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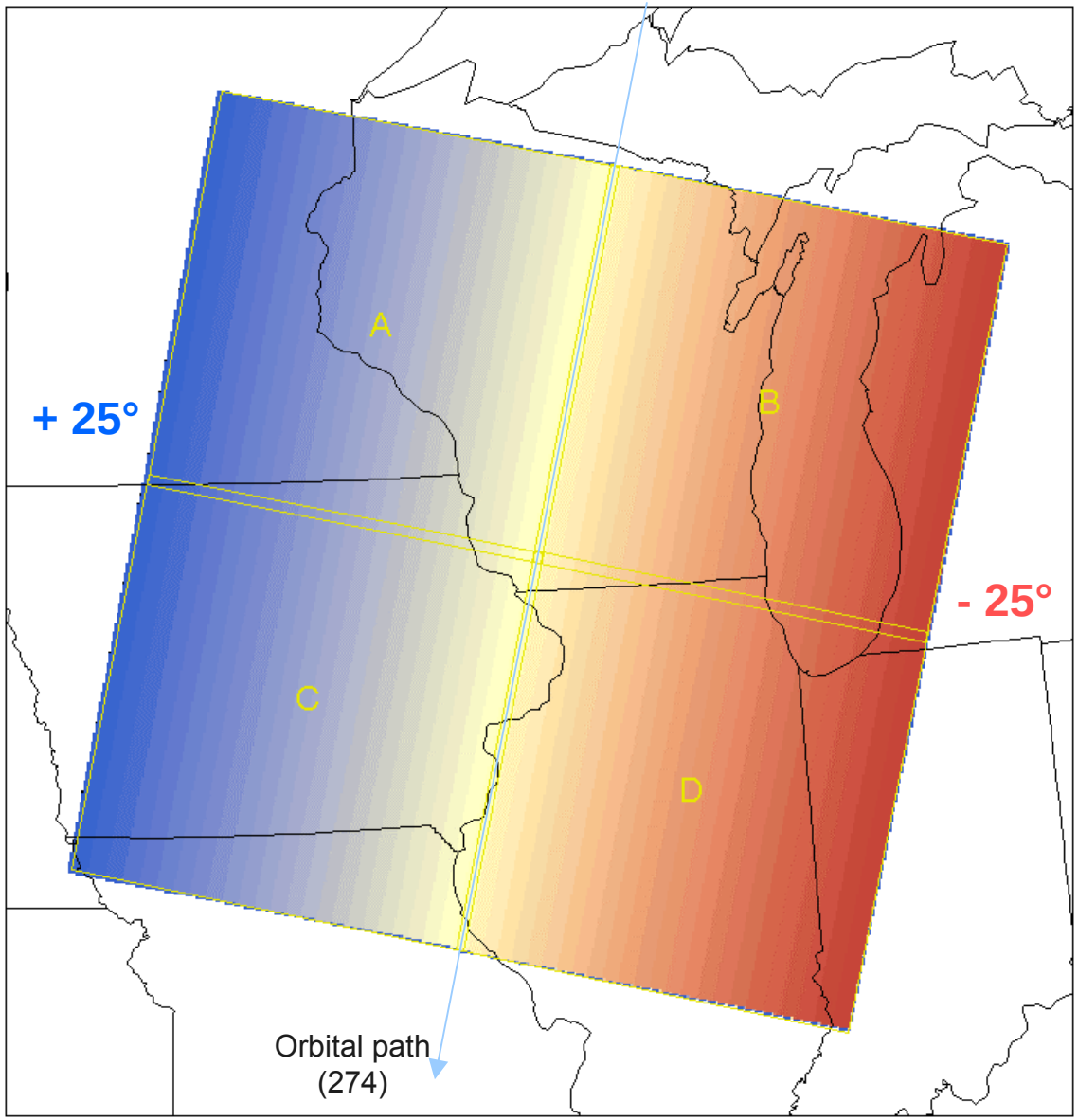
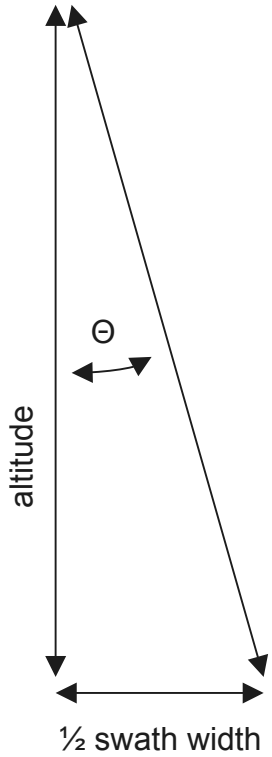
Angle from nadir calculation

Measured swath
Width: ~745 km





Θ = arctan(opp./adj.)

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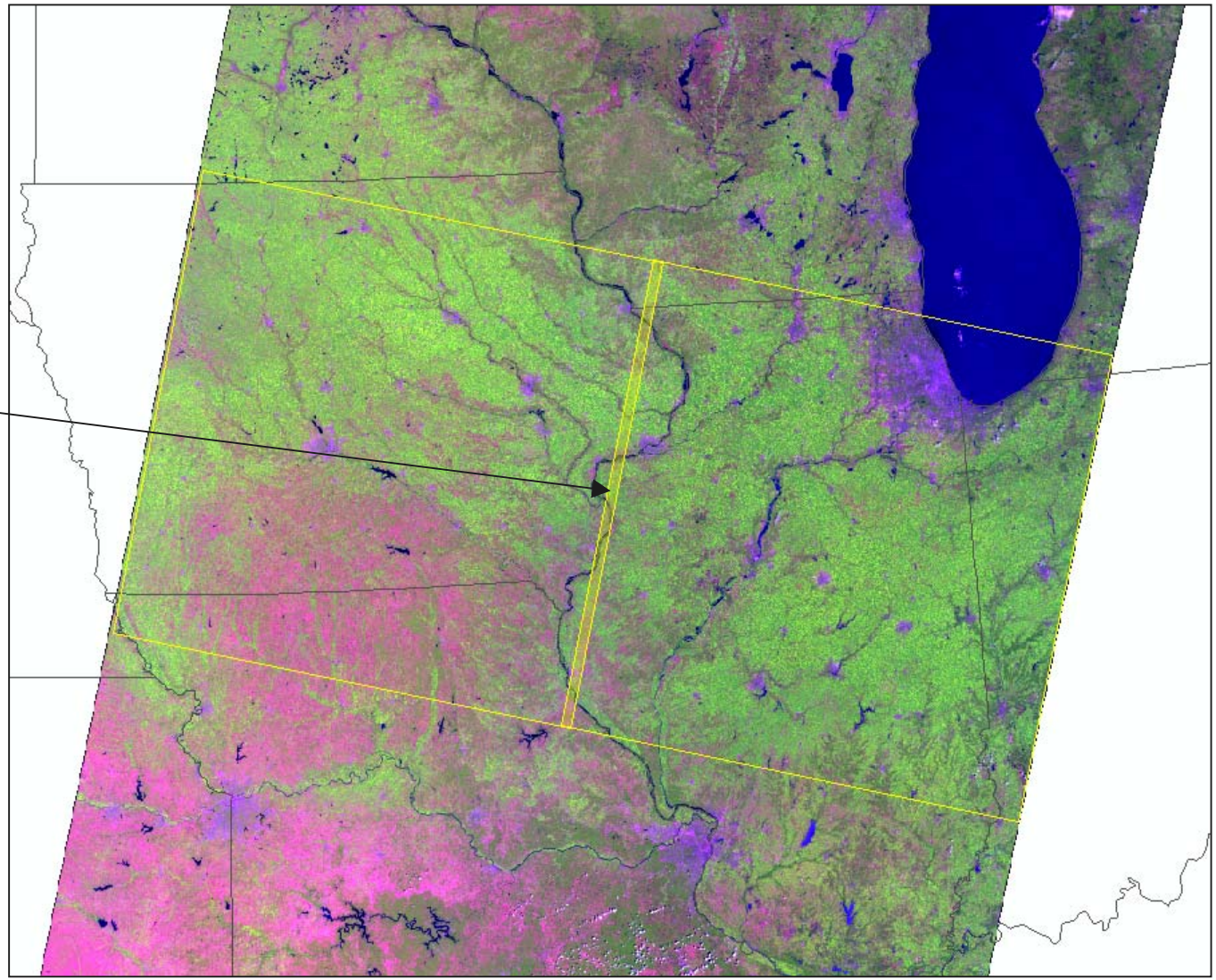
Comparison of nadir overlap area



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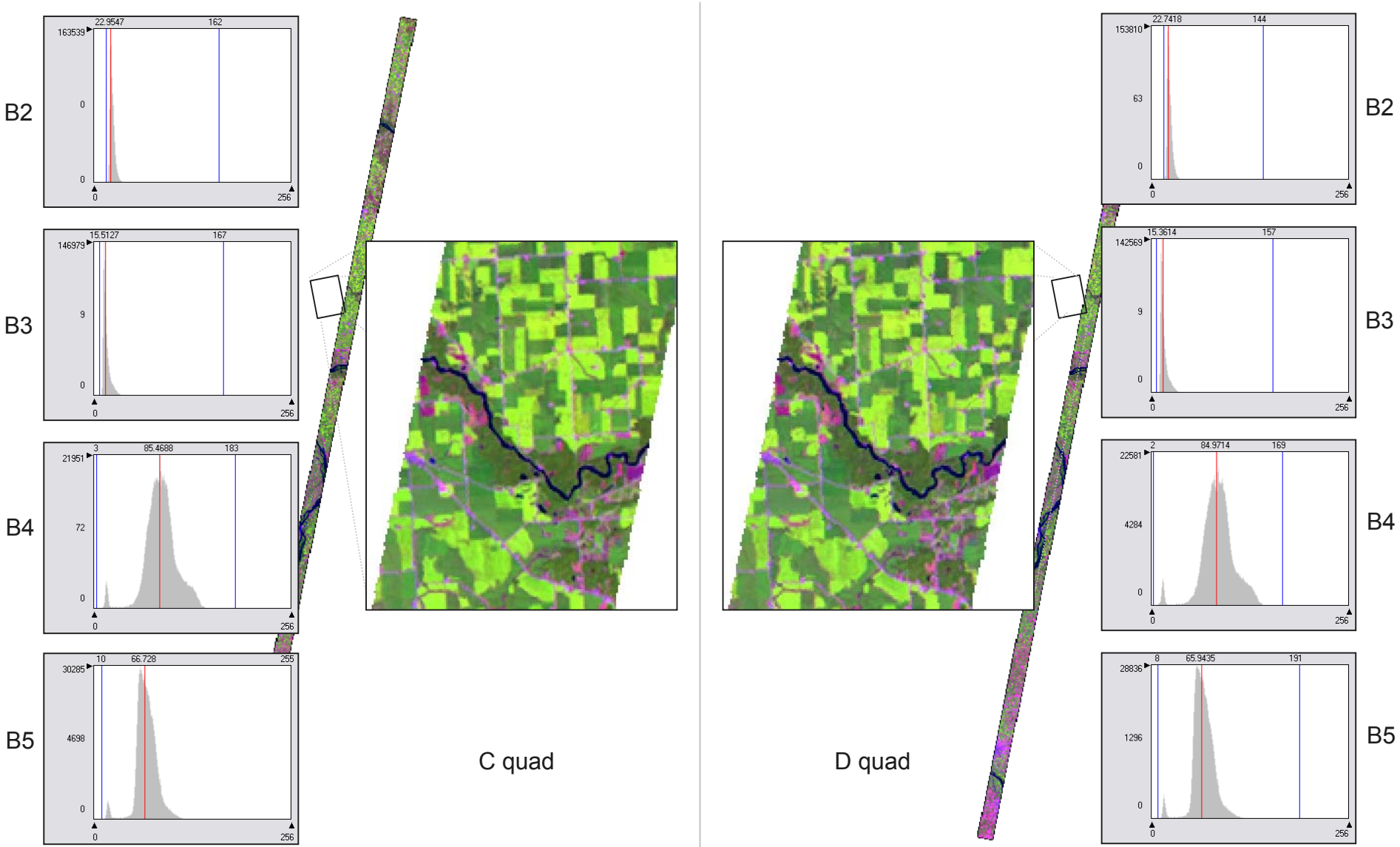
Inspection of nadir overlap area



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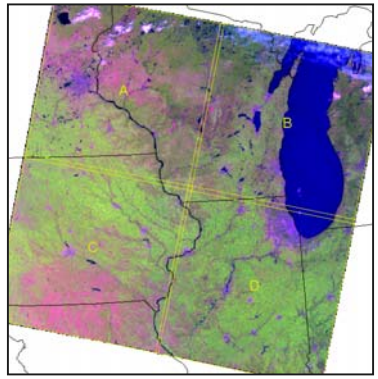
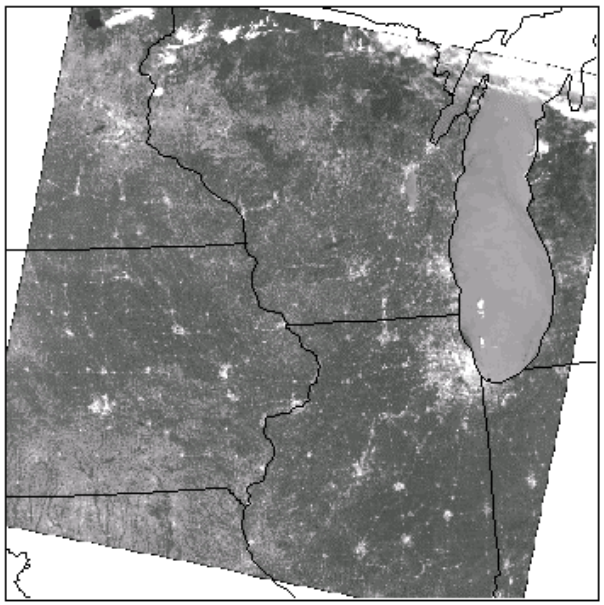
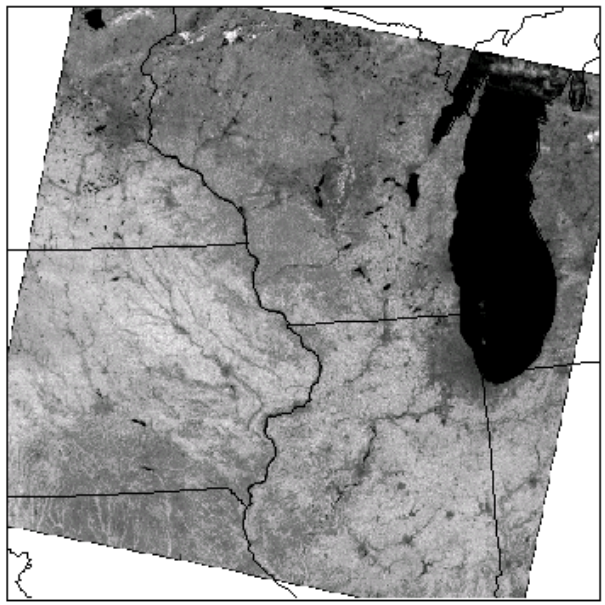
Inspection of across swath reflectance

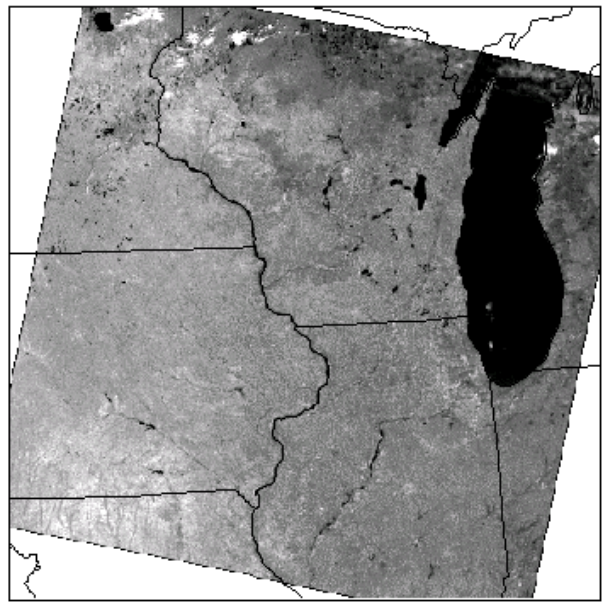




Band 2 - Red



Band 3 - Near Infrared



Band 4 - Shortwave Infrared

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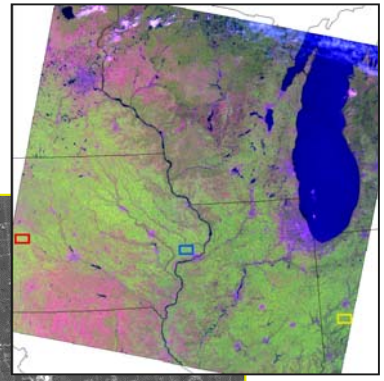
Across track reflectance



Band 2

Red

Band 3

NIR

Band 4

SWIR

West

Nadir

East

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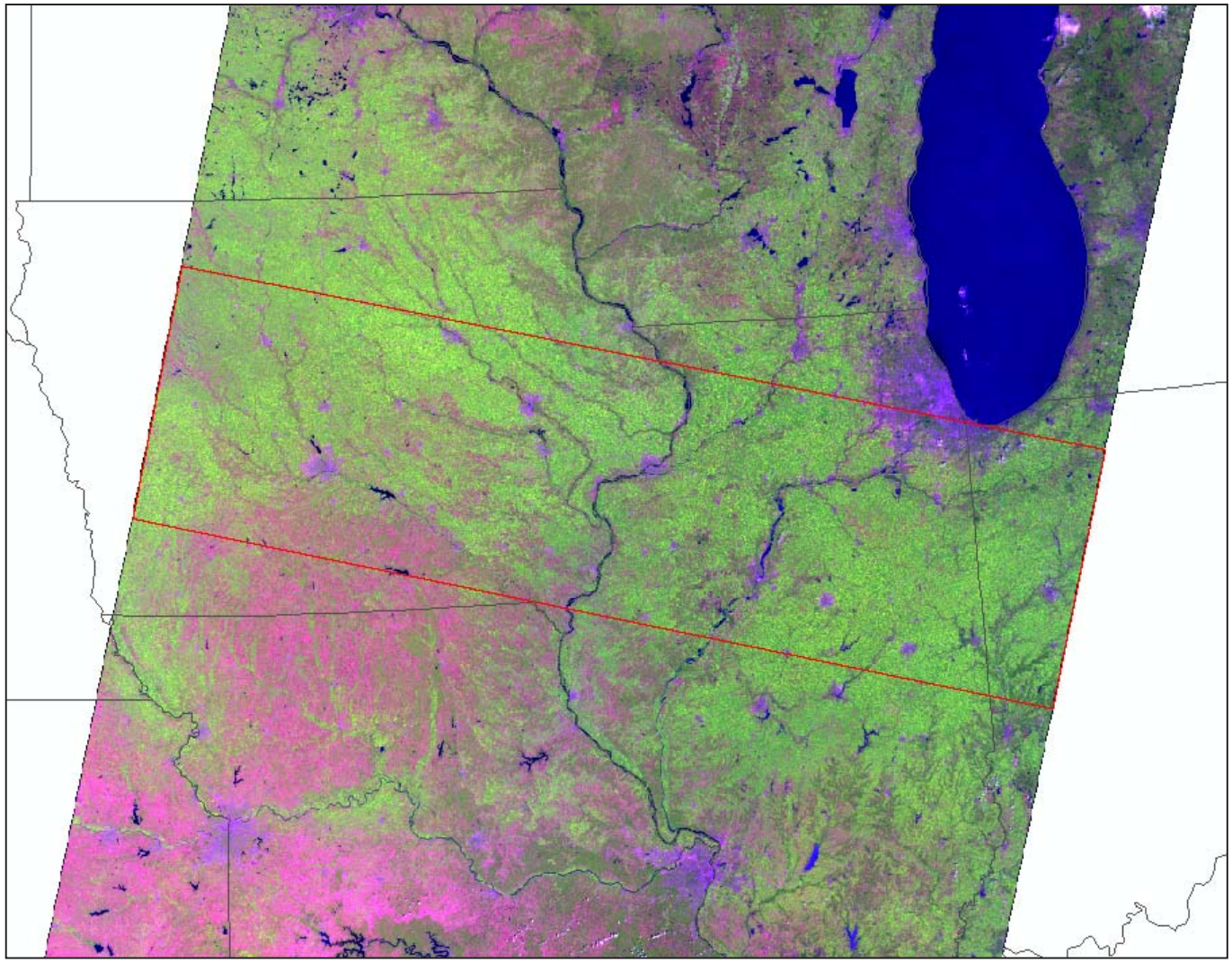
Classification across track study area



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Dominant cover types in region

Cropland
Corn
Soybeans
Winter Wheat
Alfalfa

Non cropland
Grassland
Woodland
Developed
Water

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Classification methodology

1) Mosaic (if needed) same-date AWiFS quads and reproject to common USGS Albers Conic Equal Area projection with 56 m grid cells

2) Sample spatially AWiFS imagery at known ground truth areas (USDA FSA CLU/578 data for agriculture categories and USGS 2001 NLCD for non-agriculture categories)

3) Data-mine samples using Boosted Classification Tree Analysis to derive best fitting decision rules (implemented within Rulequest See5.0)

4) Apply derived decision rules back to input data

5) Create land cover map

6) Assess map accuracy (using independent set of ground truth)

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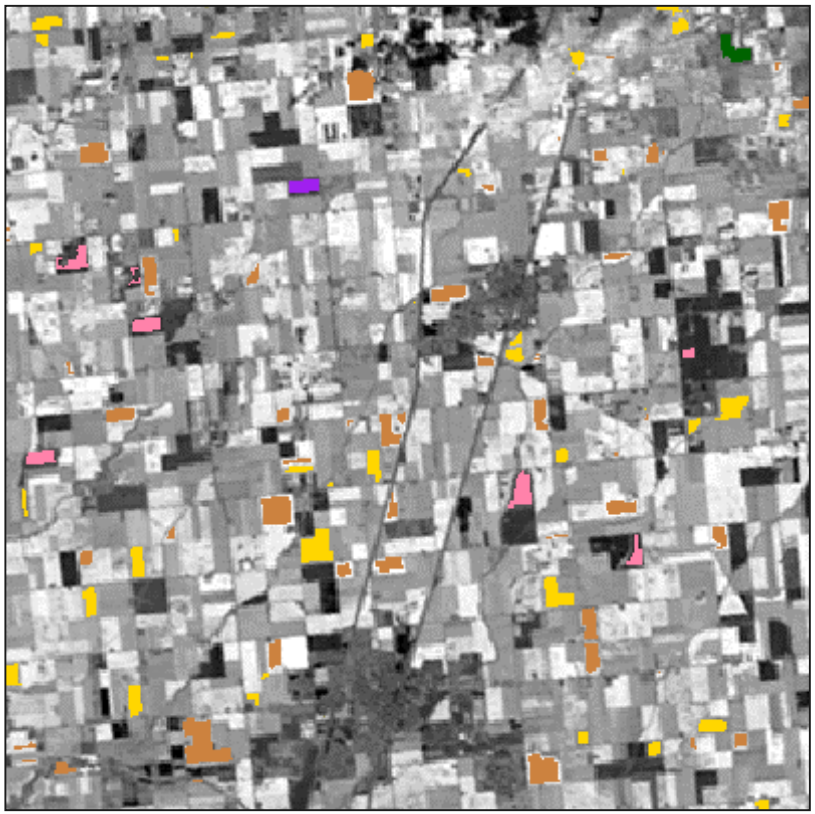
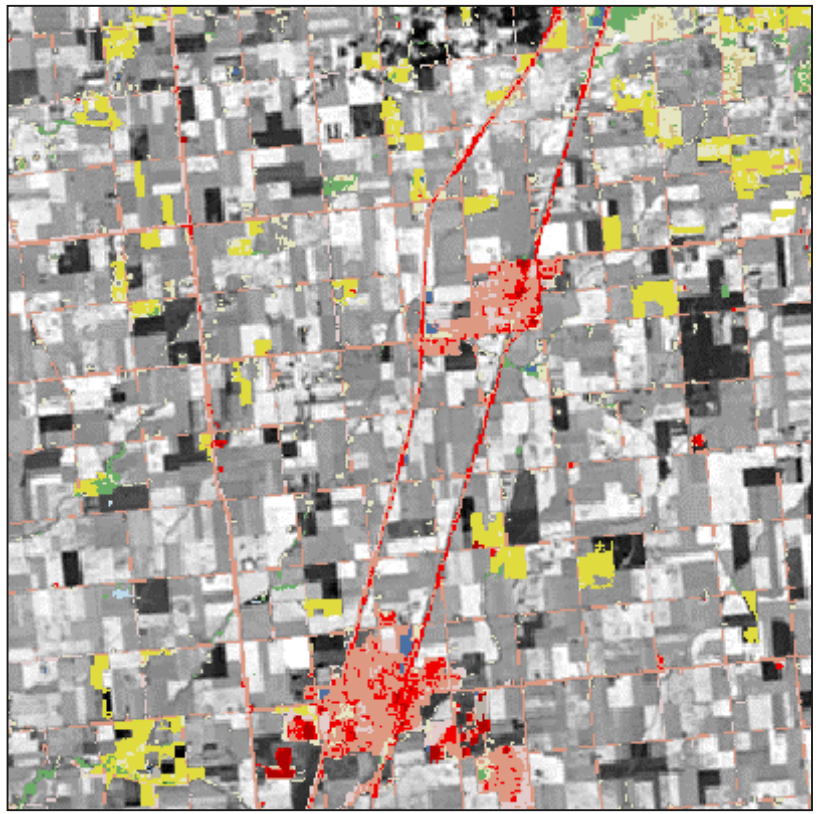
Example ground truth sampling



USDA 2006 Farm Service Agency CLU/578 Data



USGS 2001 National Land Cover Dataset

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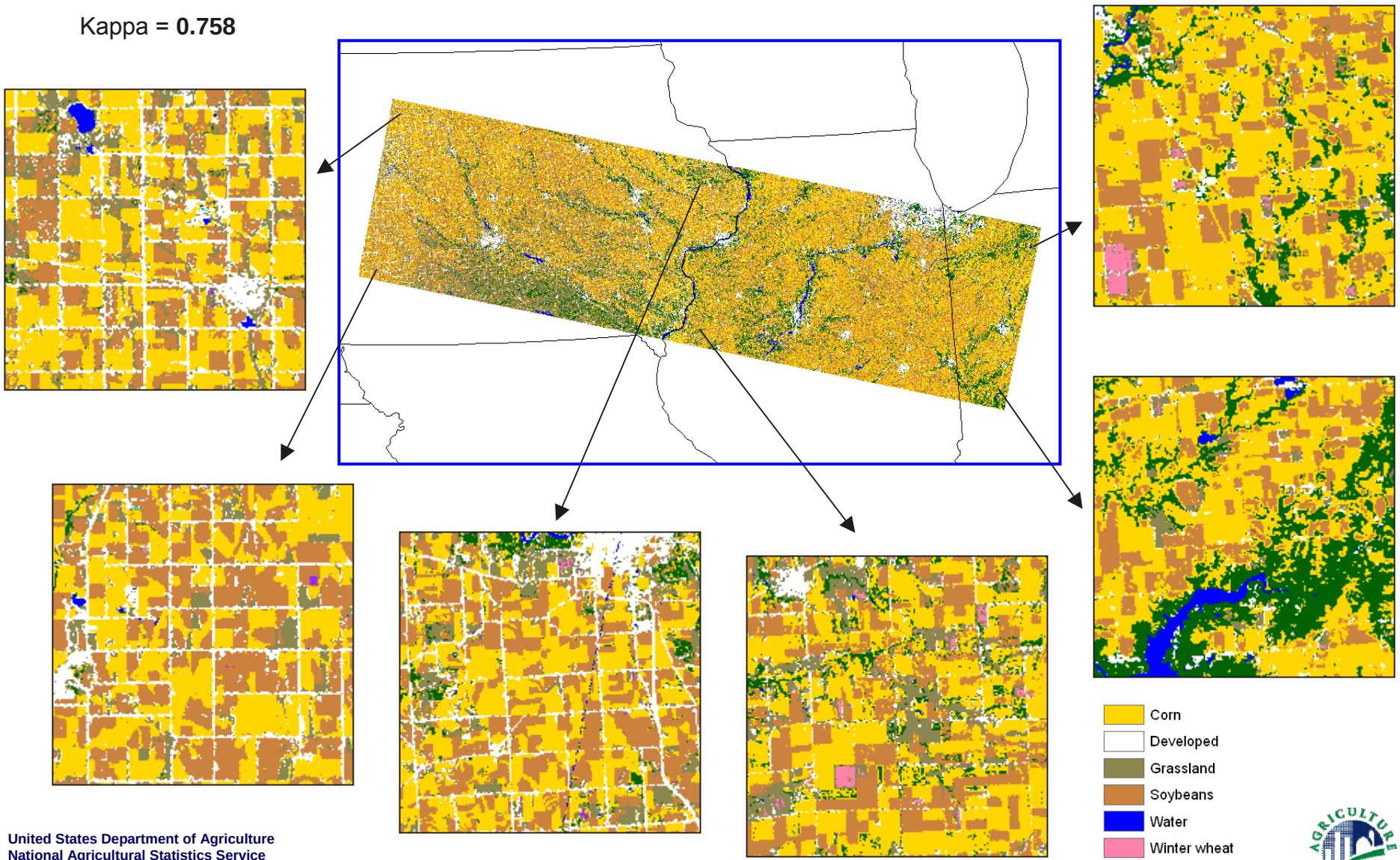
Full swath classification output

Overall Accuracy = **82.5%**

Kappa = **0.758**



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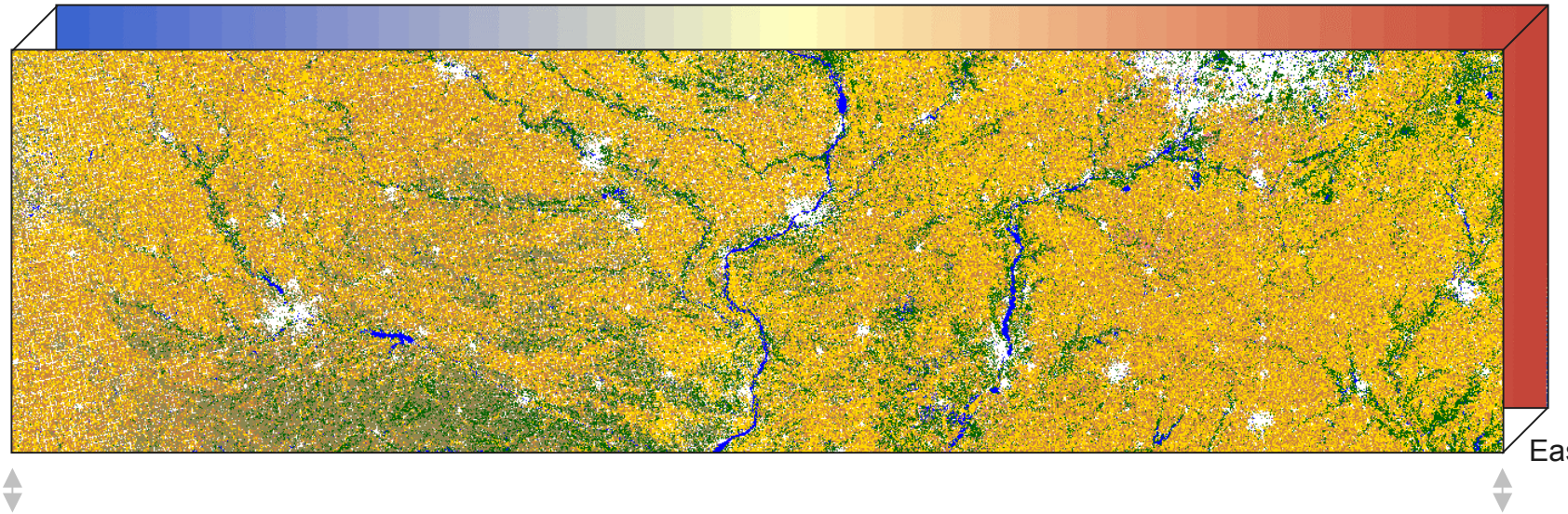
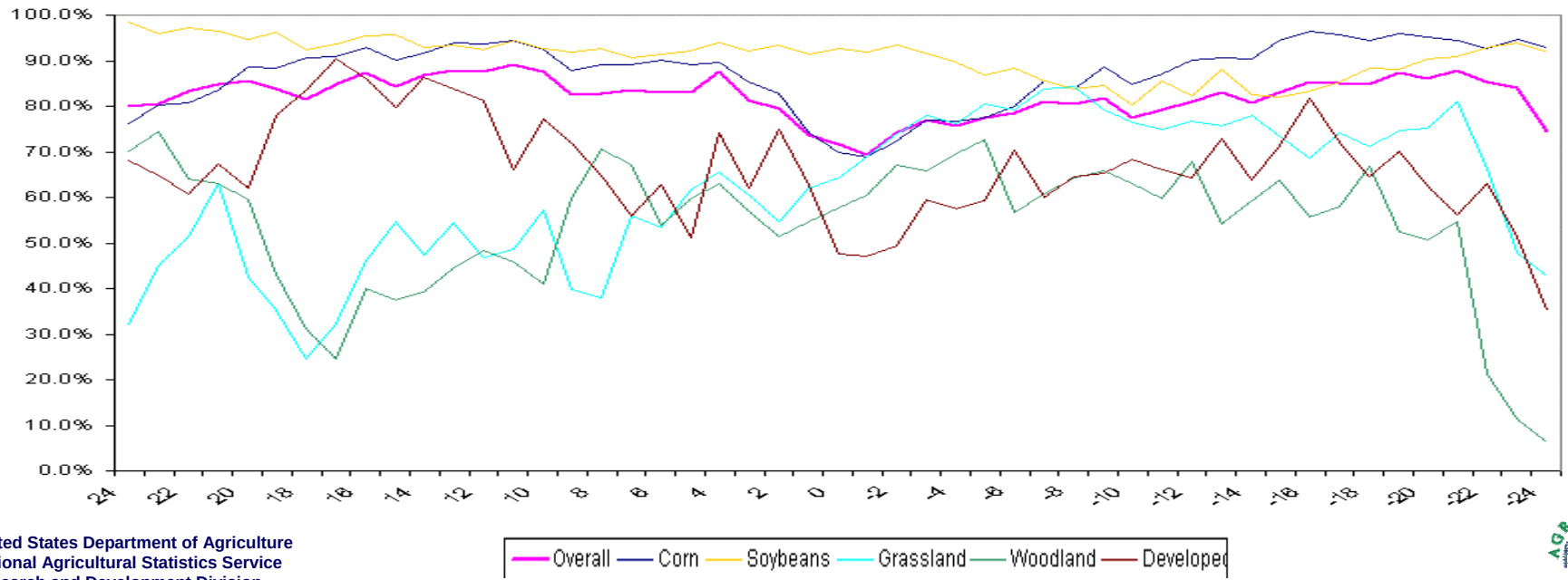
Accuracy as a function of angle from nadir





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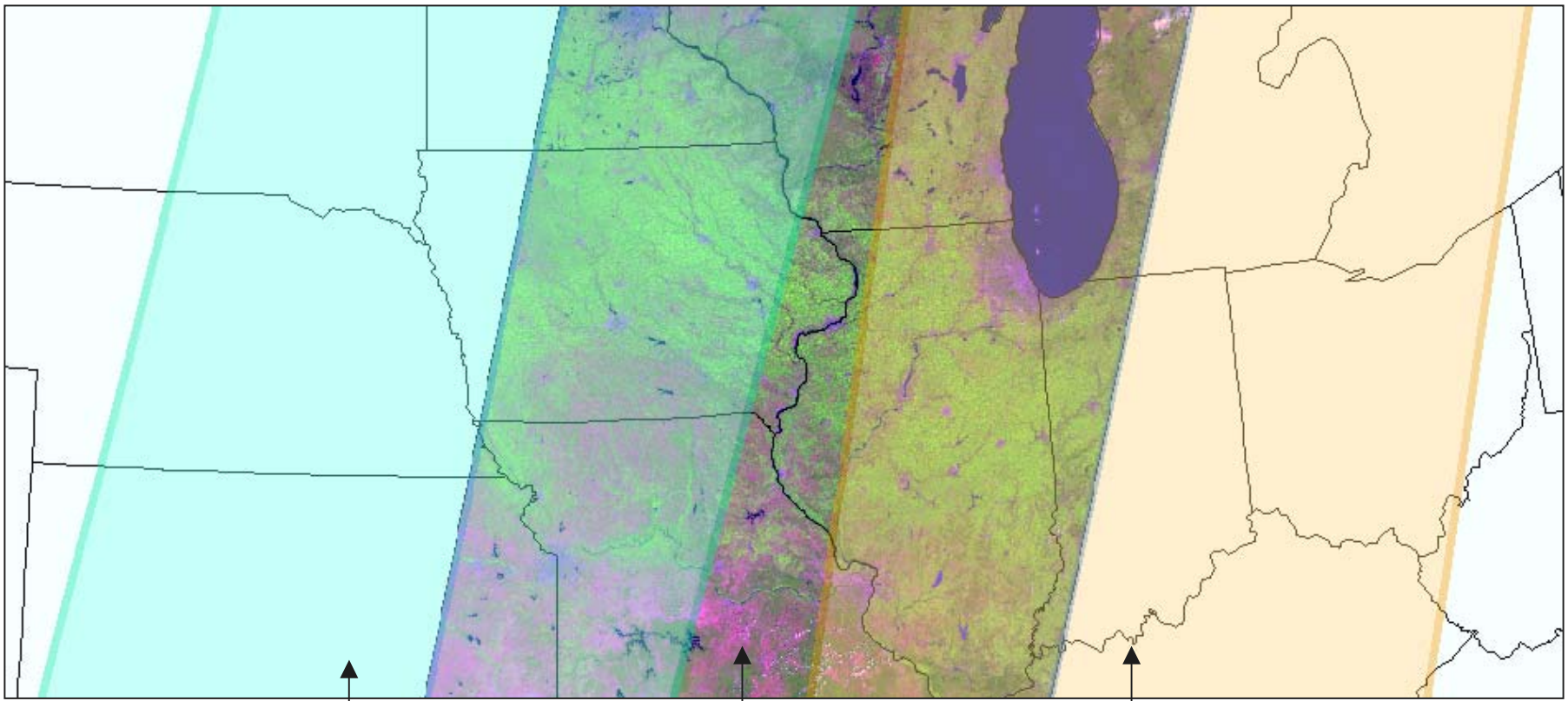
Collects one day before and one day after



30 July 2006
(path 269)

31 July 2006
(path 274)

1 August 2006
(path 279)

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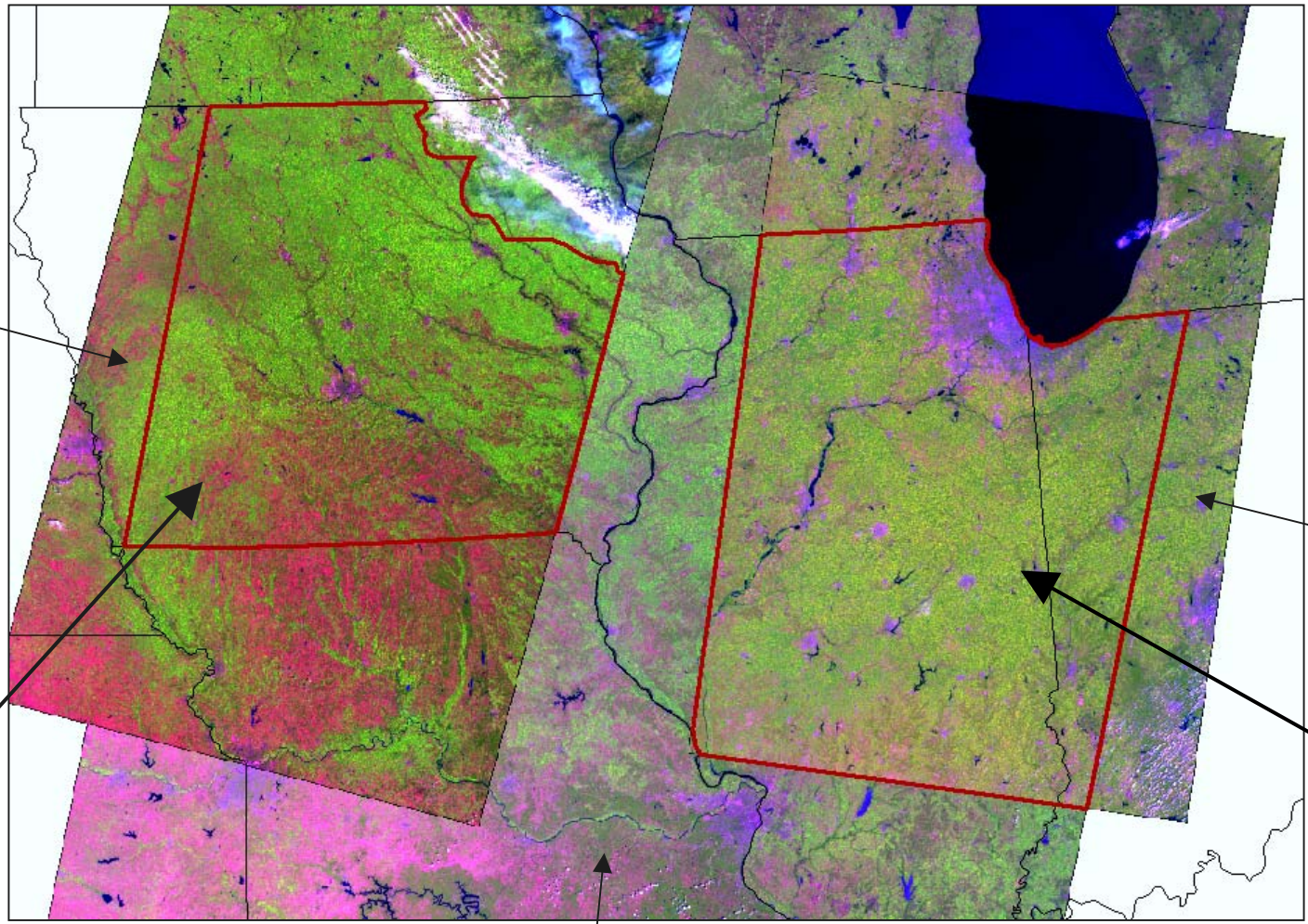
Overlap study areas



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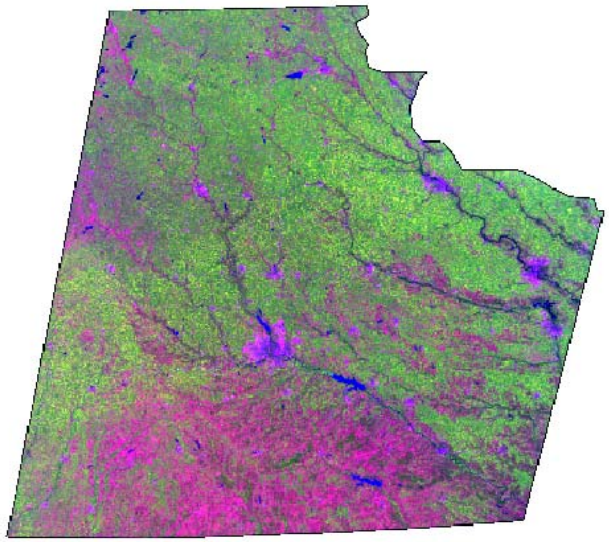
One day different classifications: case A

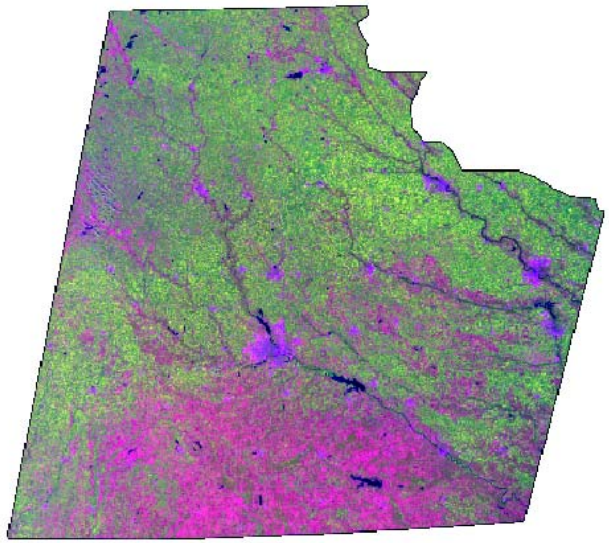
30 July 2006

East



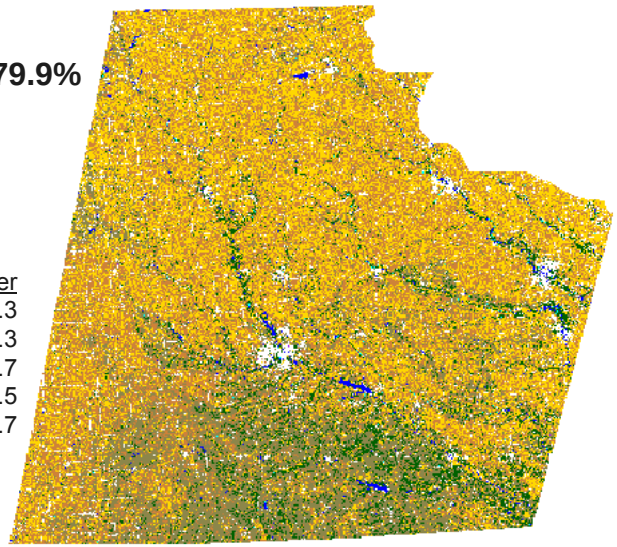
31 July 2006

West



Overall Accuracy: **79.9%**
Kappa: **0.725**

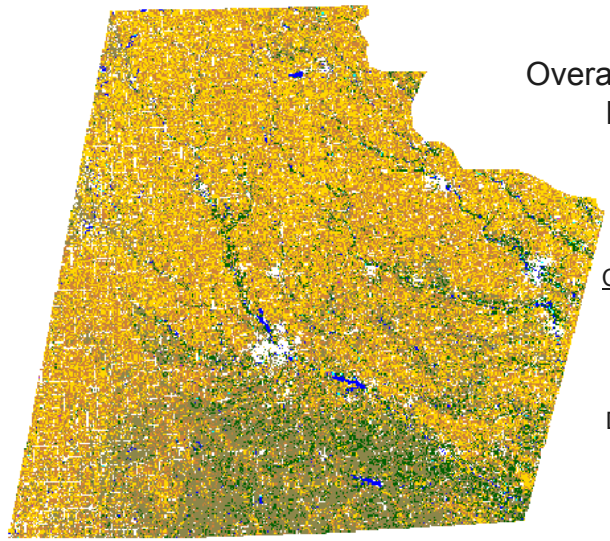
Cover Type	Prod.	User
Corn	94.1	84.3
Soybeans	88.6	83.3
Grassland	72.4	77.7
Woodland	64.3	61.5
Developed	39.7	58.7



Average Angle: **-13.4°**

Overall Accuracy: **83.6%**
Kappa: **0.771**

Cover Type	Prod.	User
Corn	95.0	89.5
Soybeans	92.8	88.8
Grassland	75.2	78.0
Woodland	61.9	60.0
Developed	57.9	63.1



Average angle: **15.4°**

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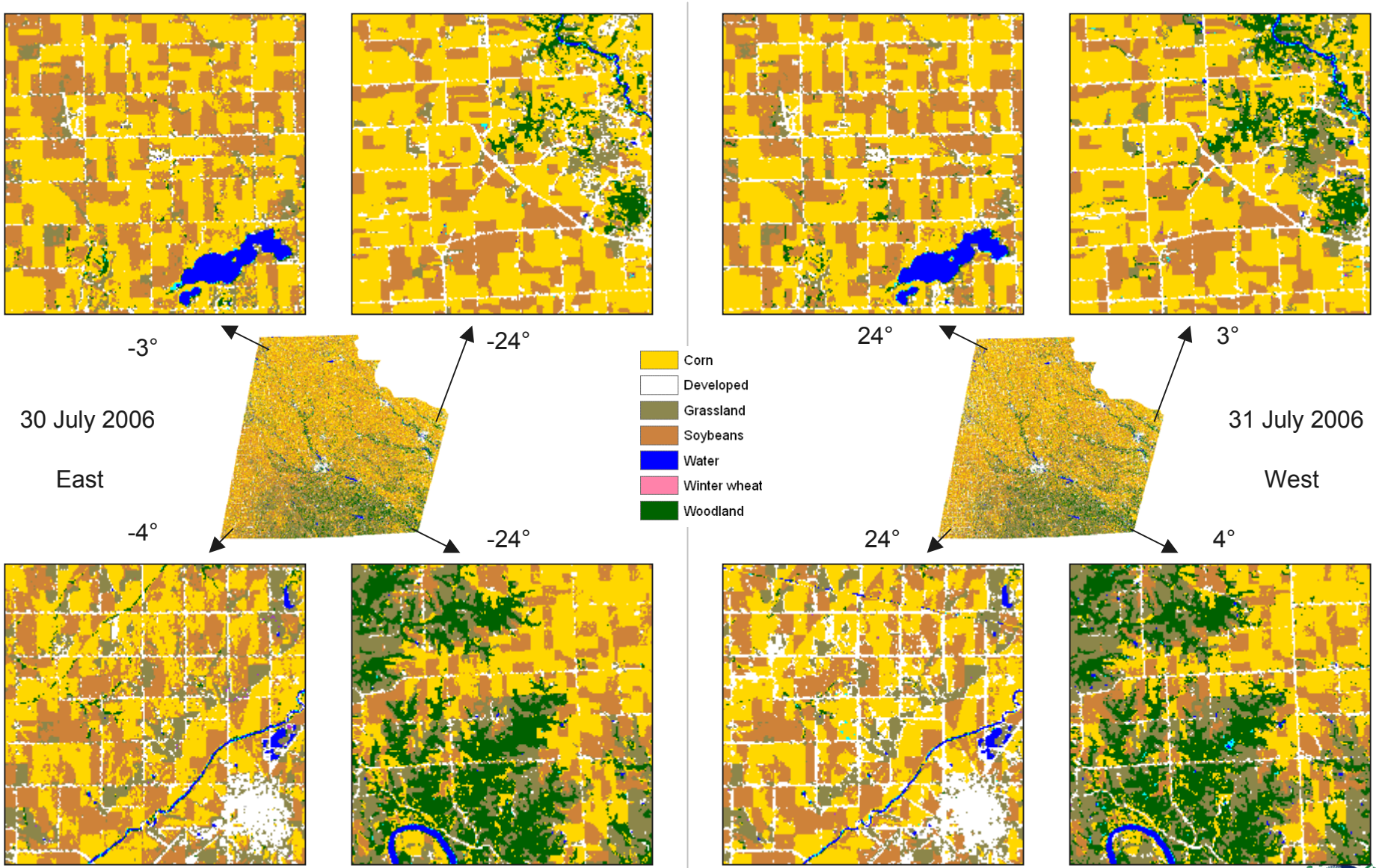
Closer inspection: case A



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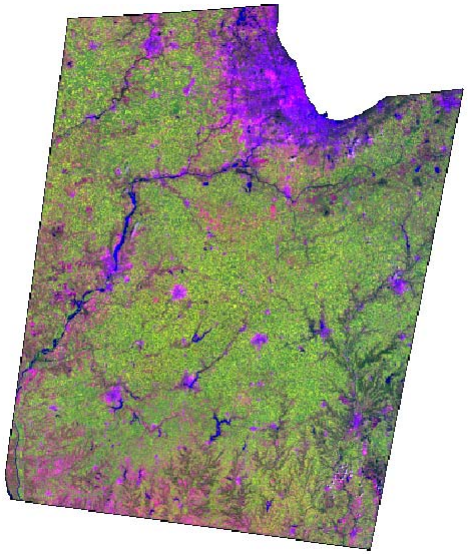
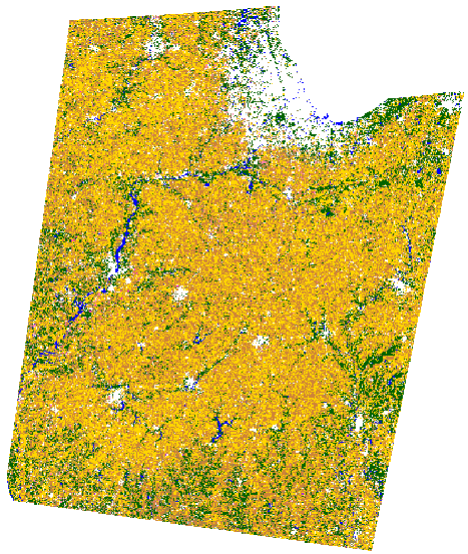
One day different classifications: case B

31 July 2006

East





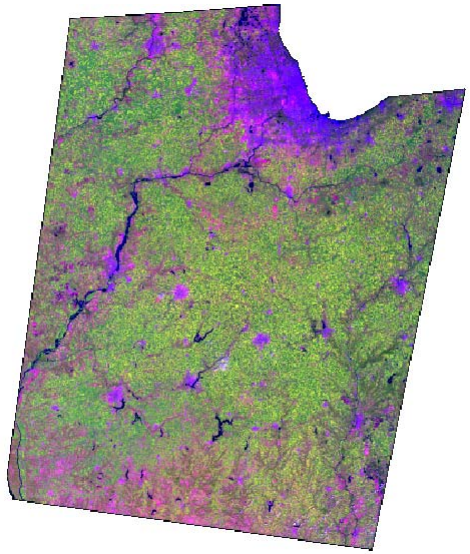
Overall accuracy: **82.4%**
Kappa: **0.751**

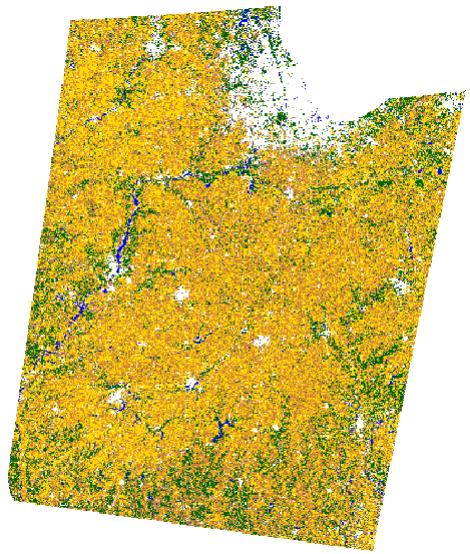
Cover Type	Prod.	User
Corn	95.5	86.6
Soybeans	94.7	89.9
Grassland	35.2	47.3
Woodland	67.8	65.7
Developed	53.3	77.4

Average Angle: **-14.4°**

1 August 2006

West





Overall accuracy: **82.3%**
Kappa: **0.750**

Cover Type	Prod.	User
Corn	95.0	86.8
Soybeans	95.6	90.4
Grassland	39.3	49.2
Woodland	63.2	62.9
Developed	53.8	77.7

Average Angle: **15.0°**

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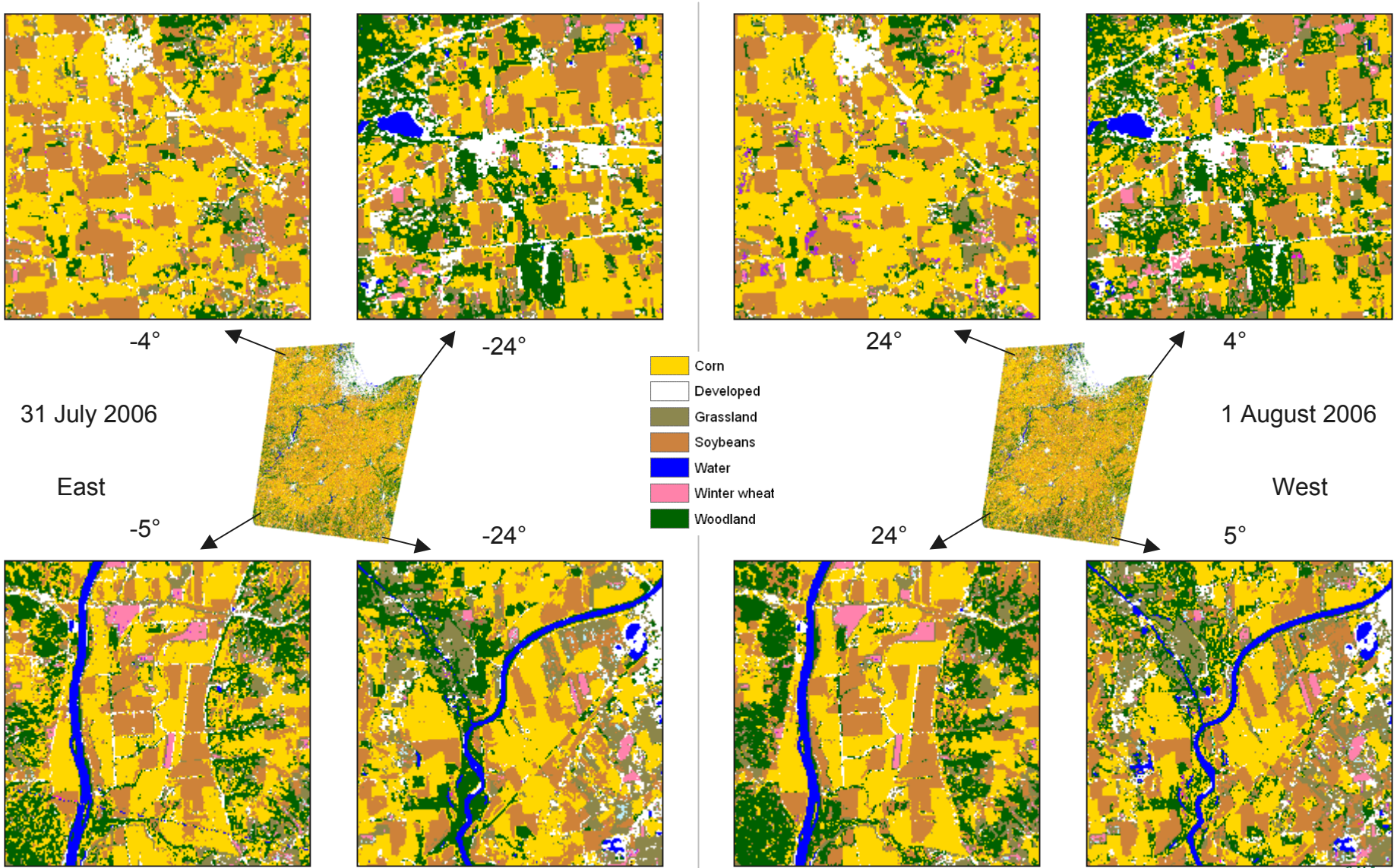
Closer inspection: case B



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Conclusions !

- Incidence angle appears to have minor impact on classification accuracy
- Nadir may not be the best viewing angle despite being best native resolution
- Developed category seems to have the most to lose (or gain) as a function of incidence angle
- Wide swath sensor improves data coverage even if edge pixels compromised

For the future ?

- Investigate other AWiFS data sets / dates
- Investigate other cover types
- Closer inspection of geometric registration
- Undergo true Bidirectional Reflectance Distribution Function (BRDF) analysis

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