Integration of the PRI and fAPARchl Products for Carbon Monitoring

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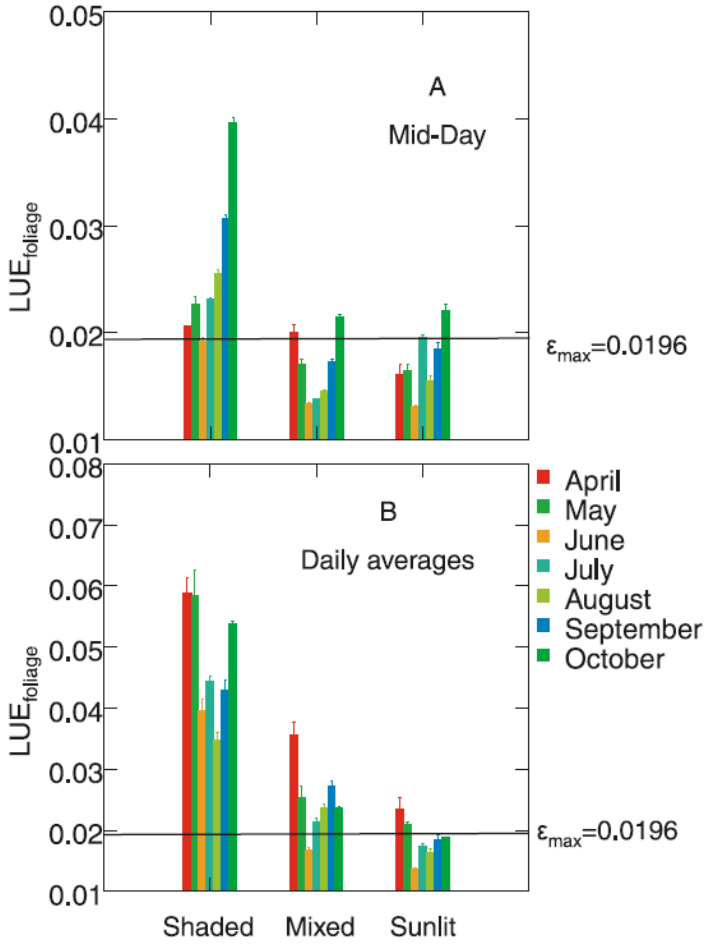
Objectives

- Two of the HyspIRI Products: PRI & fAPARchl
- GEP = LUE x PAR x fAPAR

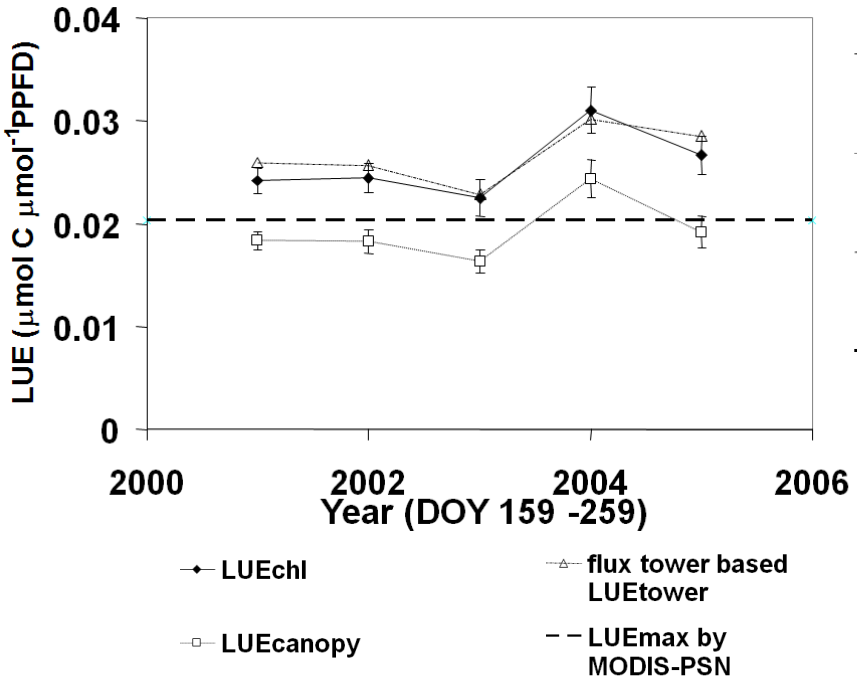
- Photochemical Reflectance Index (PRI)
  - physiological condition: xanthophyll signal@531nm
  - correlation with LUE
- fAPARchl
  - enhanced fAPAR
  - derived from inversion radiative transfer modeling

- ?? Integration of PRI and fAPARchl: estimates of GEP directly from spectral observations

Previous work

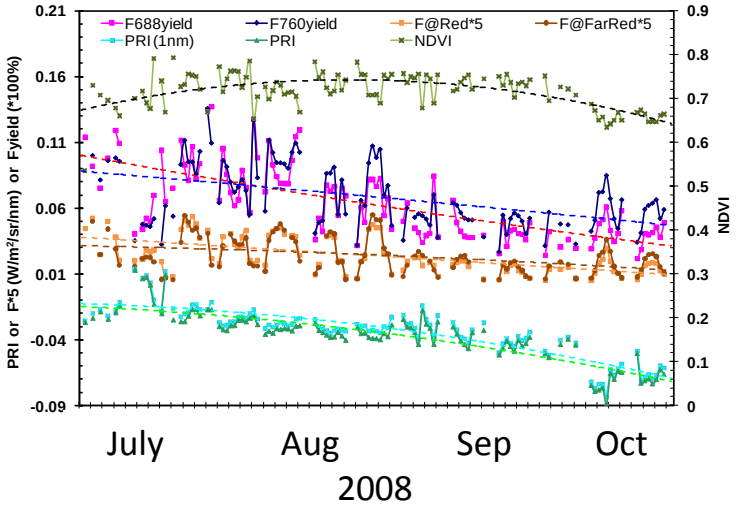


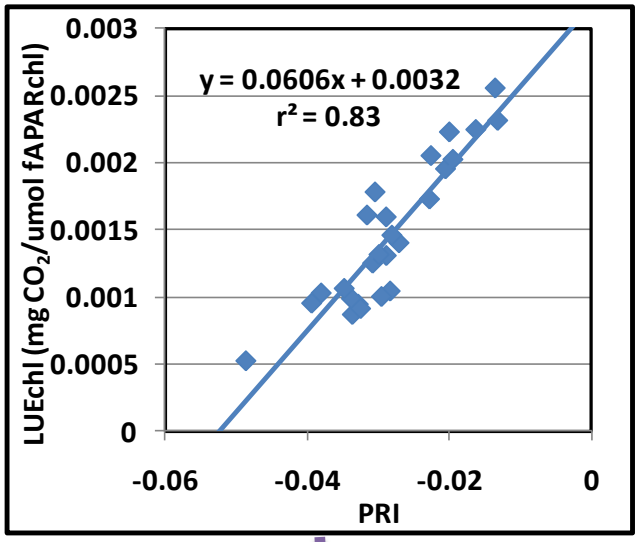
Middleton et al., 2009. *Canadian Journal of Remote Sensing.*

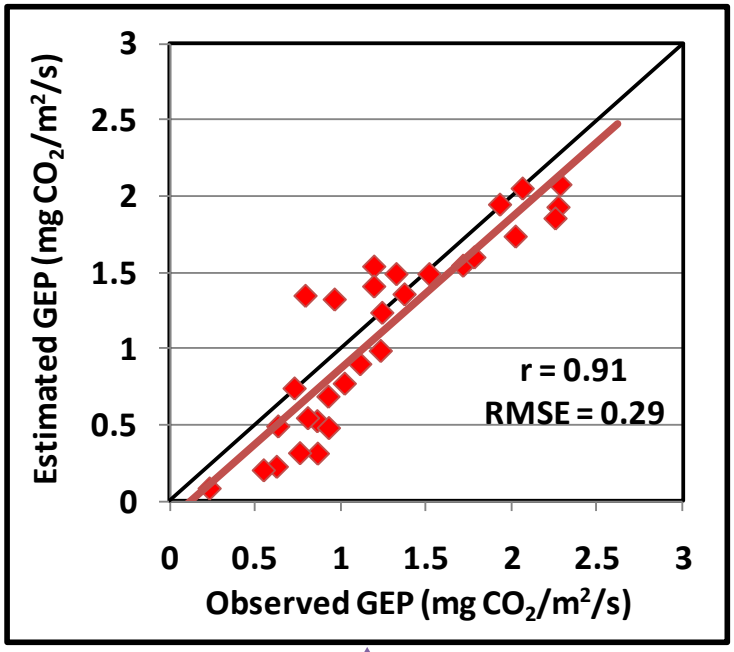


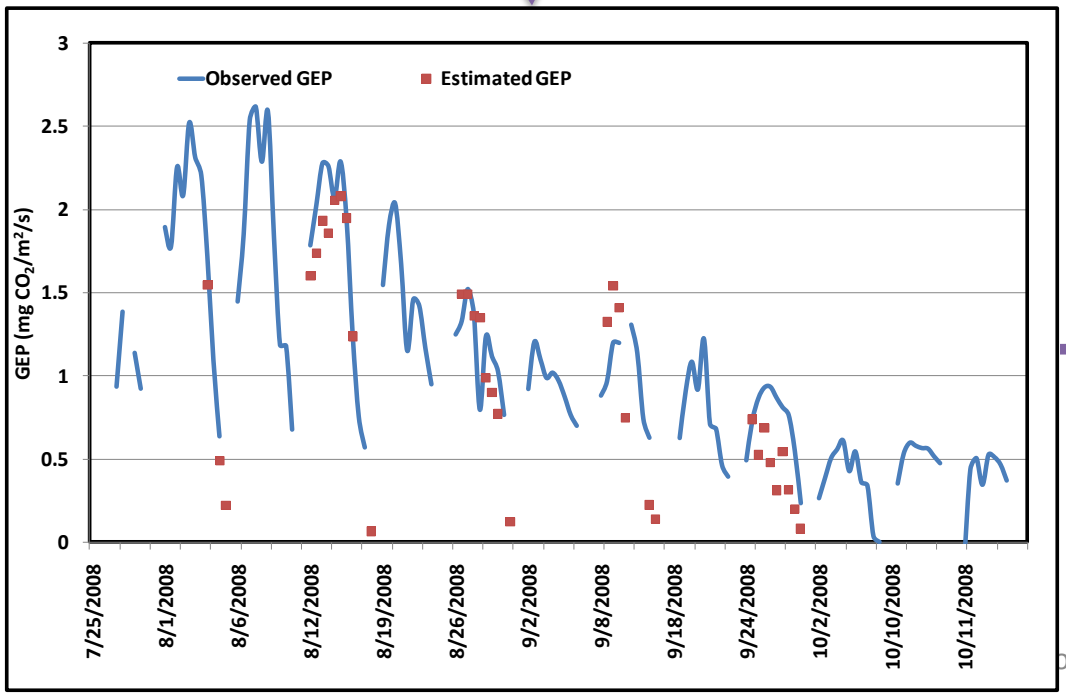
Zhang et al., 2009. *Remote Sensing of Environment.*

- GEP = *f*(PRI, PAR, fAPARchl)
- Start at canopy level, then scale up to imagery
- What we did:
  weekly field campaign,
  OPE3 corn field of USDA BARC, summer of 2008
- What we got:
  tower based CO_2 and PAR; spectral observations for corn canopies




y = 0.0606x + 0.0032
r² = 0.83
LUEchl (mg CO2/umol fAPARchl)
PRI
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.06
-0.04
-0.02
0


r = 0.91
RMSE = 0.29
Estimated GEP (mg CO2/m²/s)
Observed GEP (mg CO2/m²/s)
3
2.5
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3

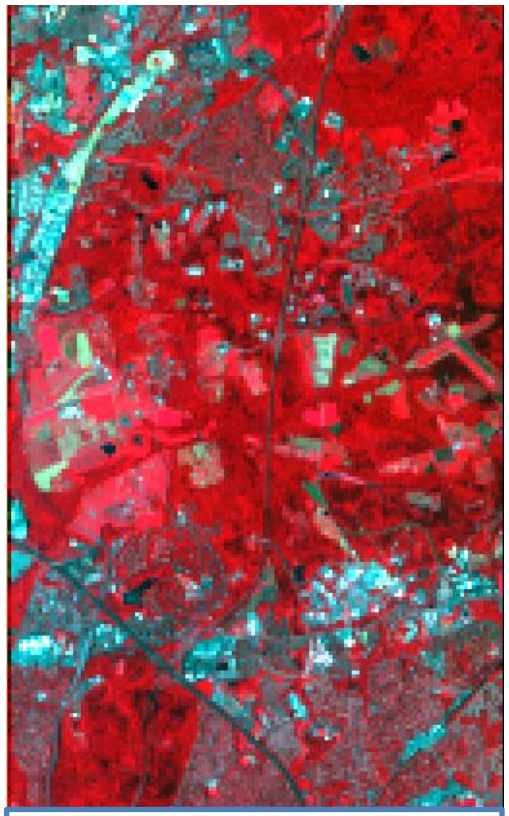

Observed GEP
Estimated GEP
GEP (mg CO2/m²/s)
3
2.5
2
1.5
1
0.5
0
7/25/2008
8/1/2008
8/6/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/8/2008
9/18/2008
9/24/2008
10/2/2008
10/10/2008
10/11/2008

Going Regional and Global

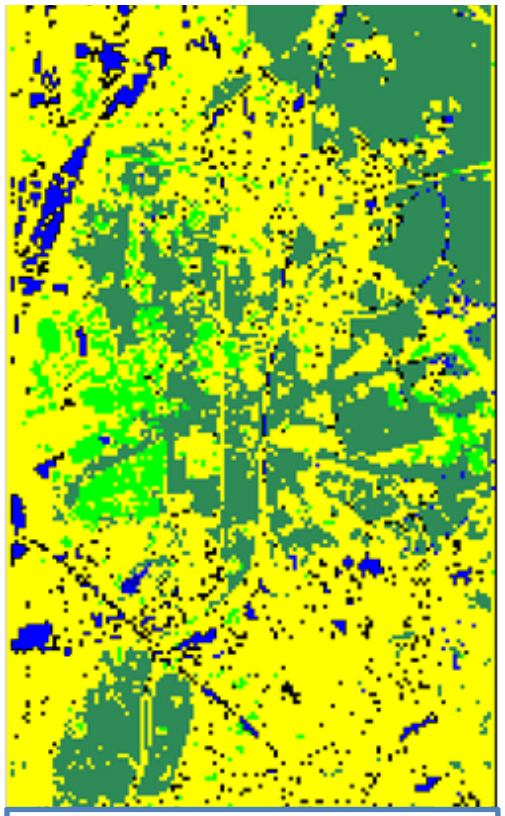
- Initiate the process: apply what we have learned in the field to a greater scale
- **Simulate HyspIRI imagery from EO-1 Hyperion & demonstrate integration of PRI and fAPARchl**

- Spatial resolution → take advantage of the fine spectral and spatial resolution of HyspIRI
- A question need to ask for any product whether to use it directly or input to models
- Changes in average values due to aggregation
- **PRI & spatial resolution**

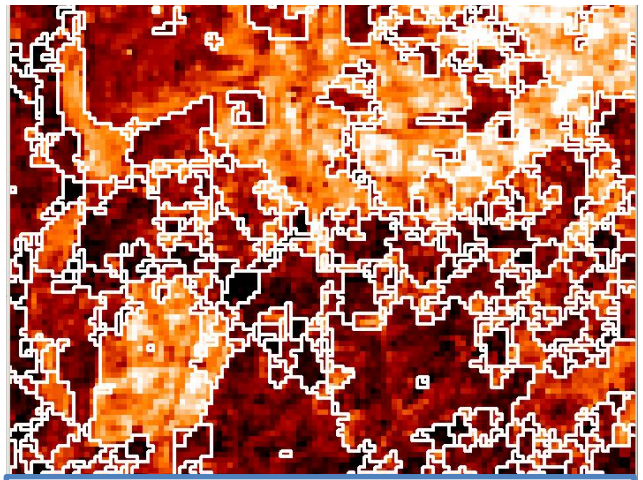
Continue What We Have Started



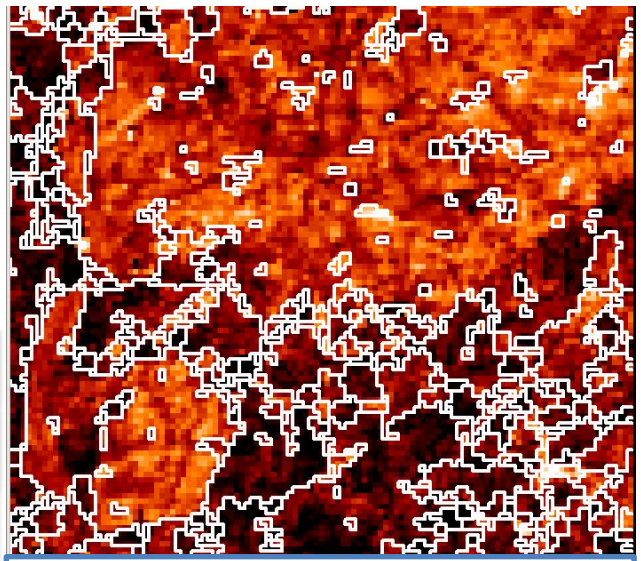
EO-1 Hyperion VSWIR



Greenbelt, MD



ASTER TIR 04/18/2009



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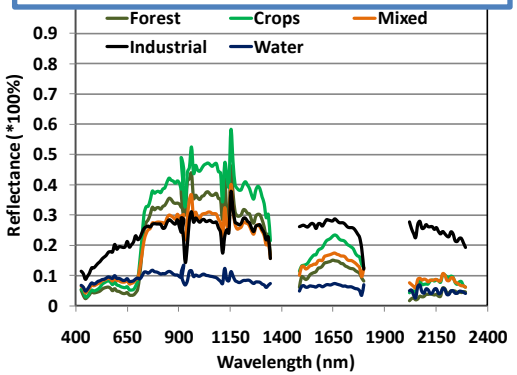


Mixed Forest

Crops

Residential / Grassland

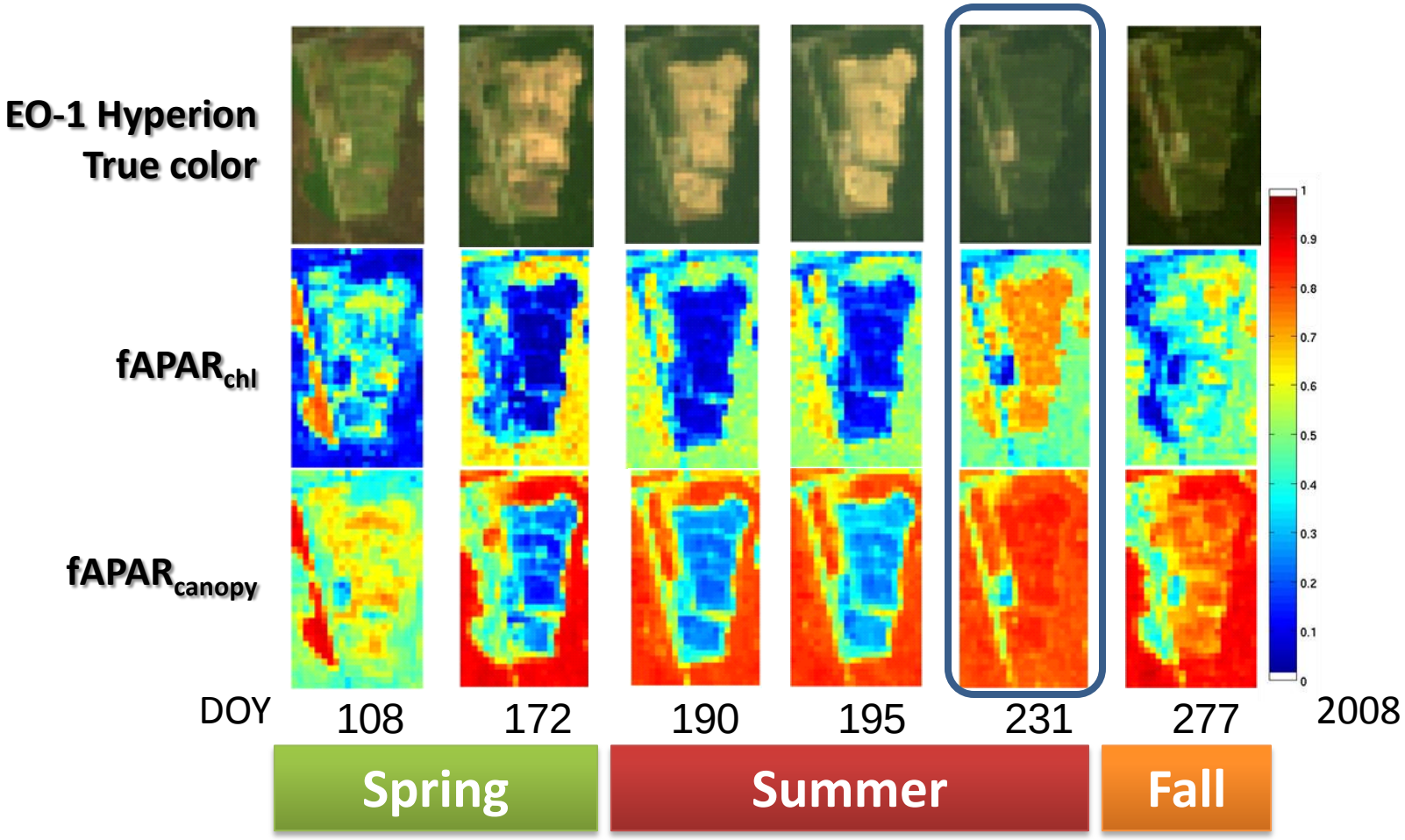
Business / Industrial

NASA Goddard SPACE FLIGHT CENTER

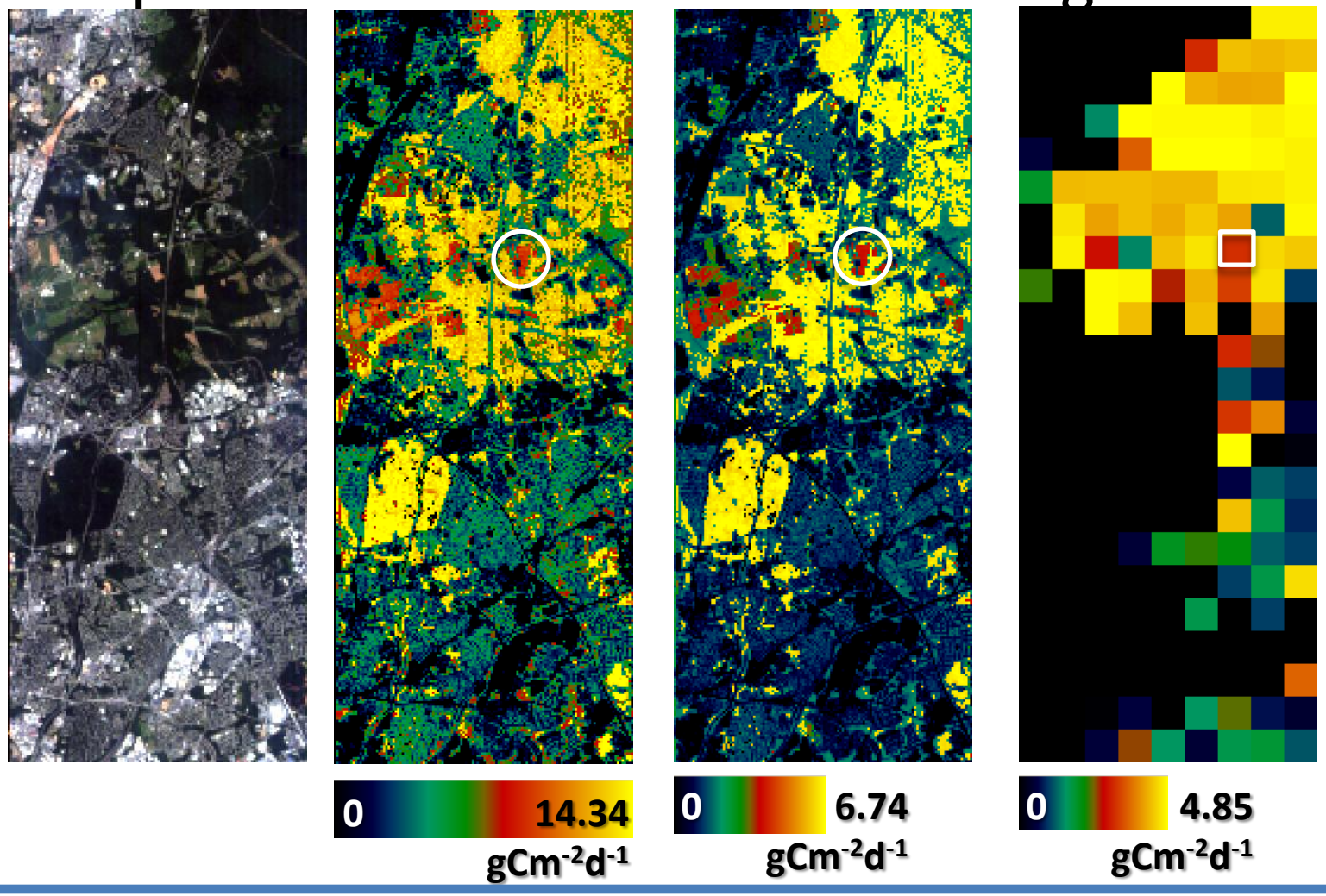
USDA United States Department Of Agriculture Agricultural Research Service

USDA-ARS HRSL Hydrology & Remote Sensing Lab Beltsville, Maryland, USA

OPE3 Optimizing Production Inputs for Economic and Environmental Enhancement (OPE3)



Comparisons of GEP from various algorithms



60m Hyperion RGB	60m Hyperion PRI & fAPARchl	60m simulated MOD17	MOD17 1km GPP

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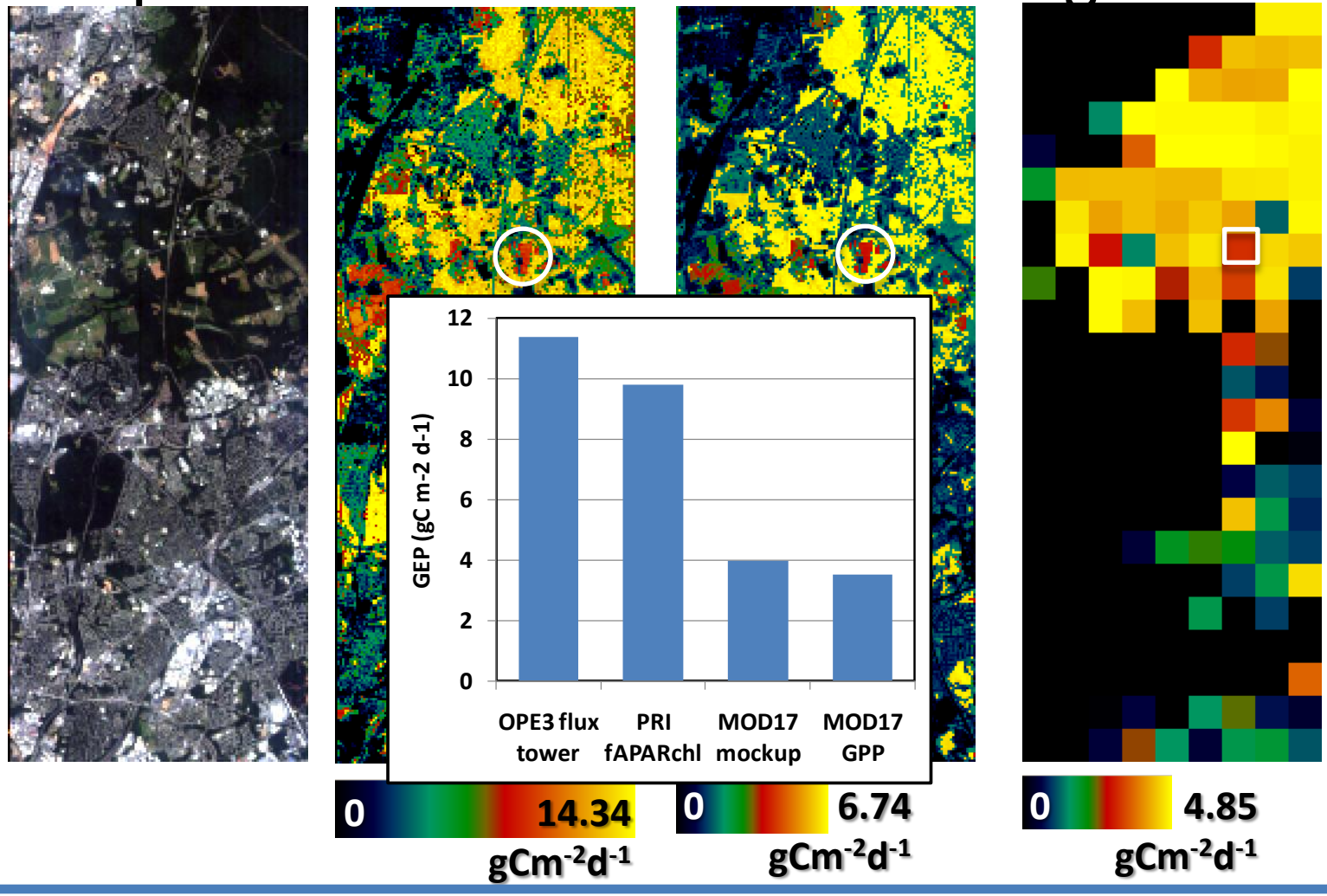

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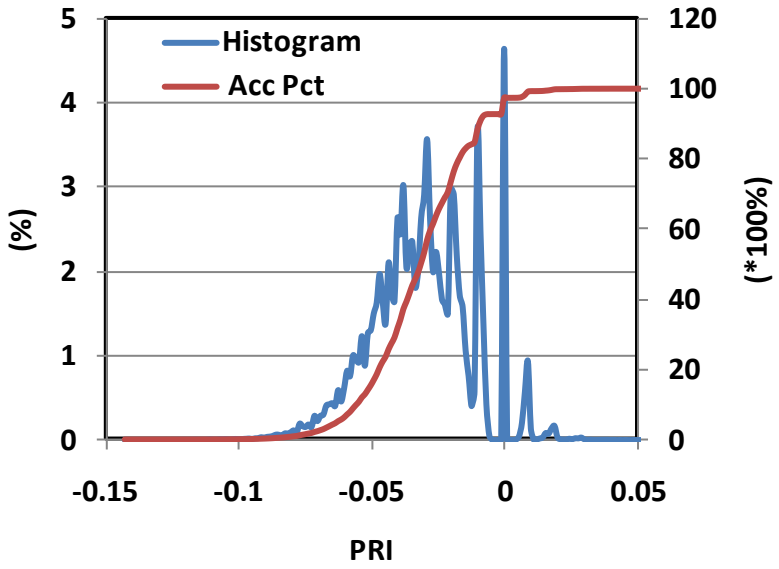
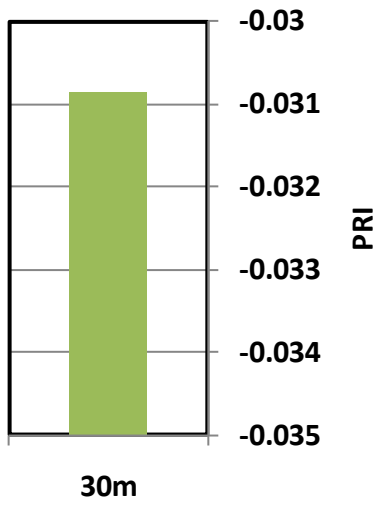
Hyperion imagery, August 18, 2008
Histogram and average of PRI derived @ various scales





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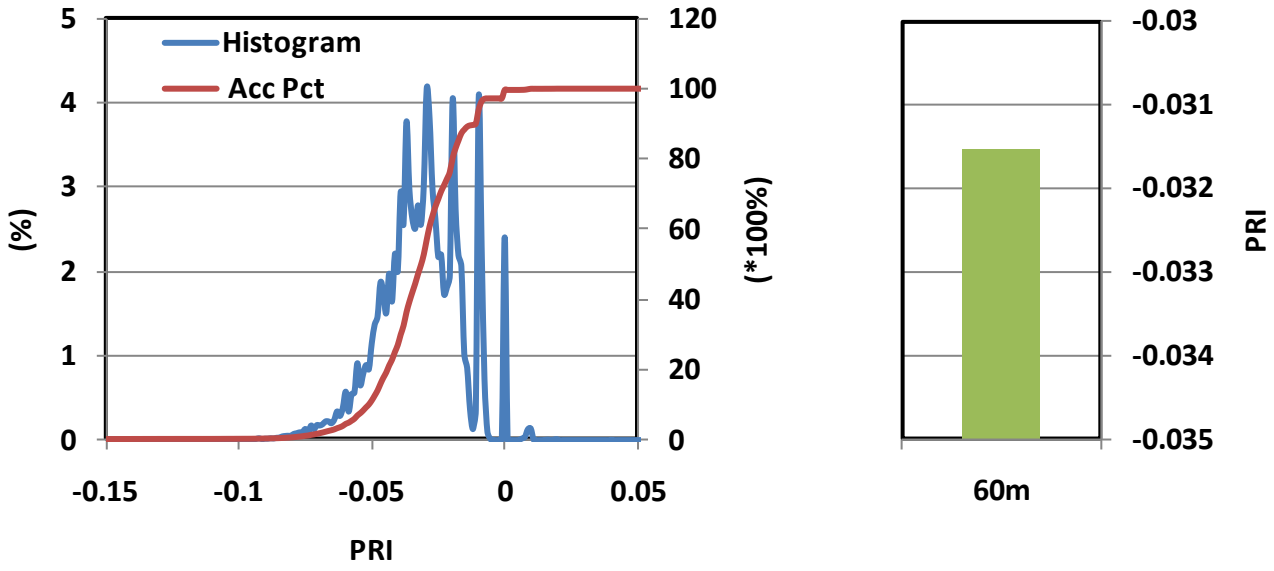

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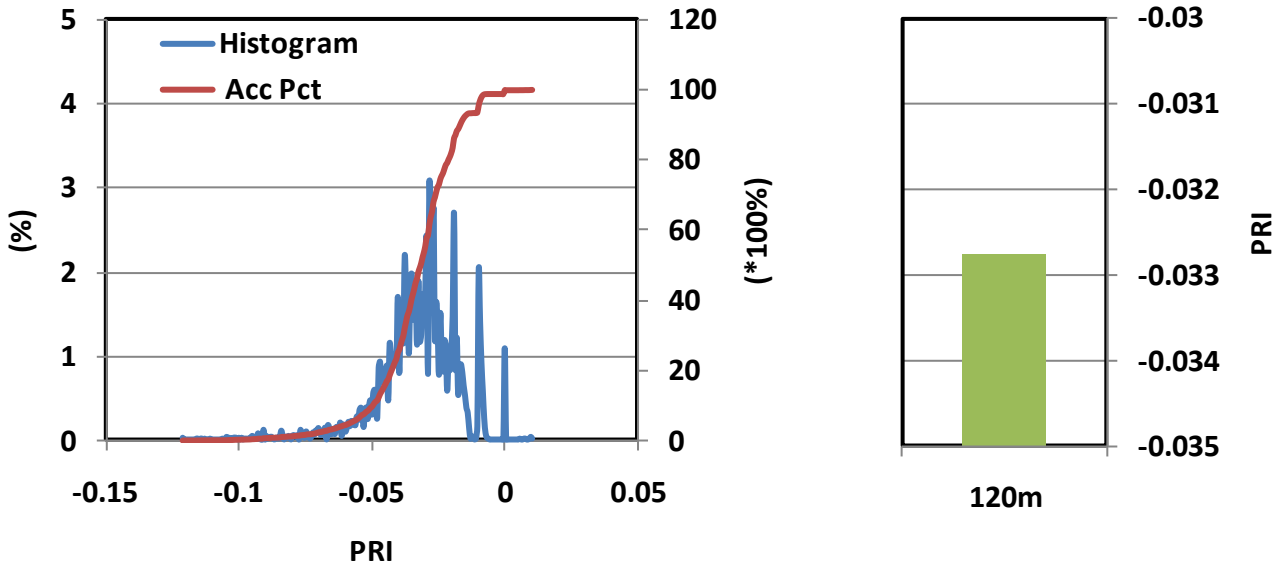

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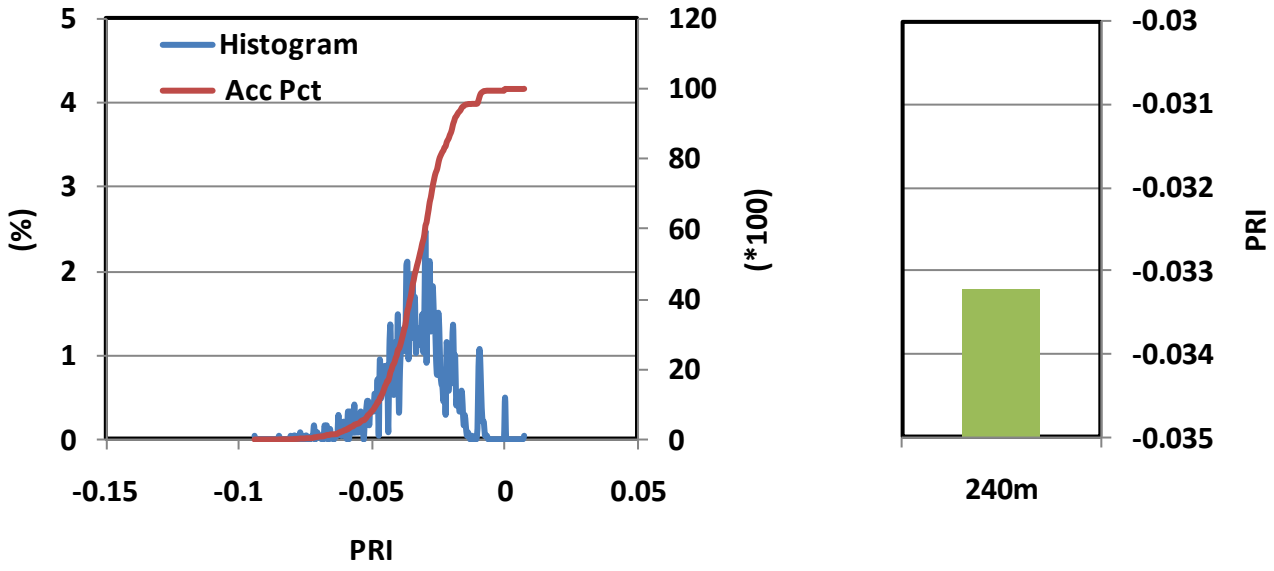

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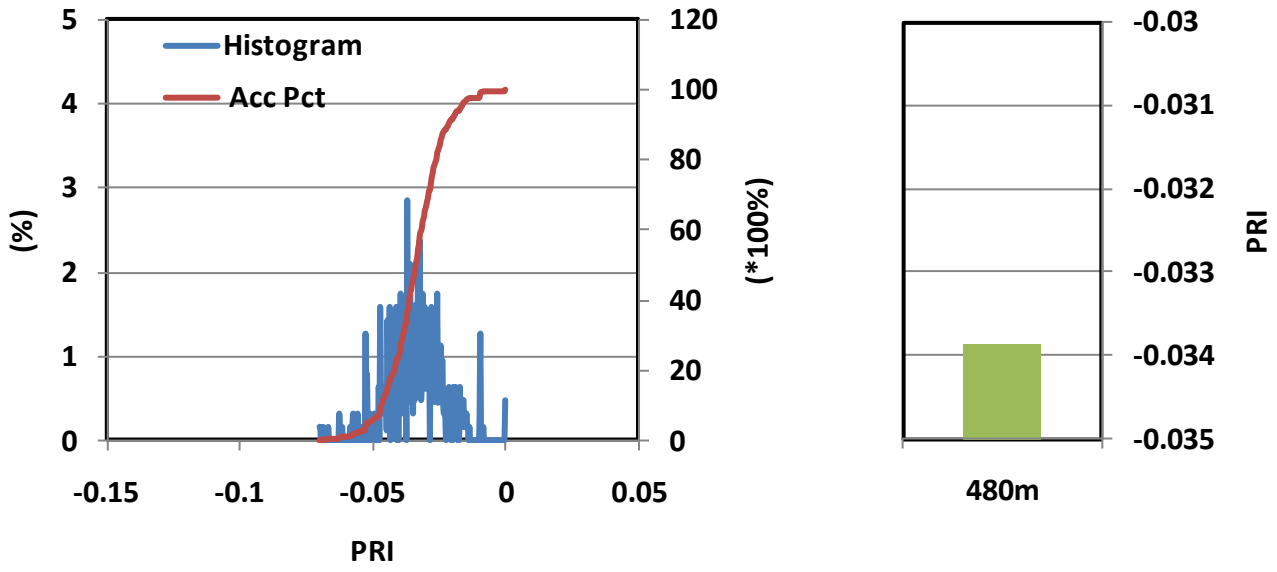

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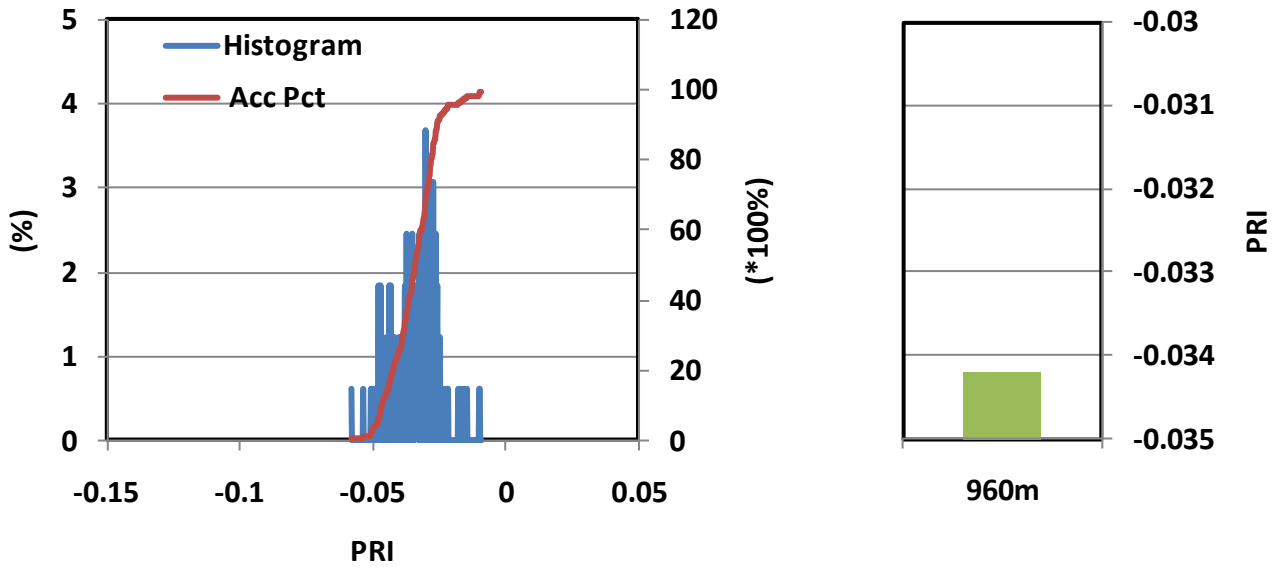
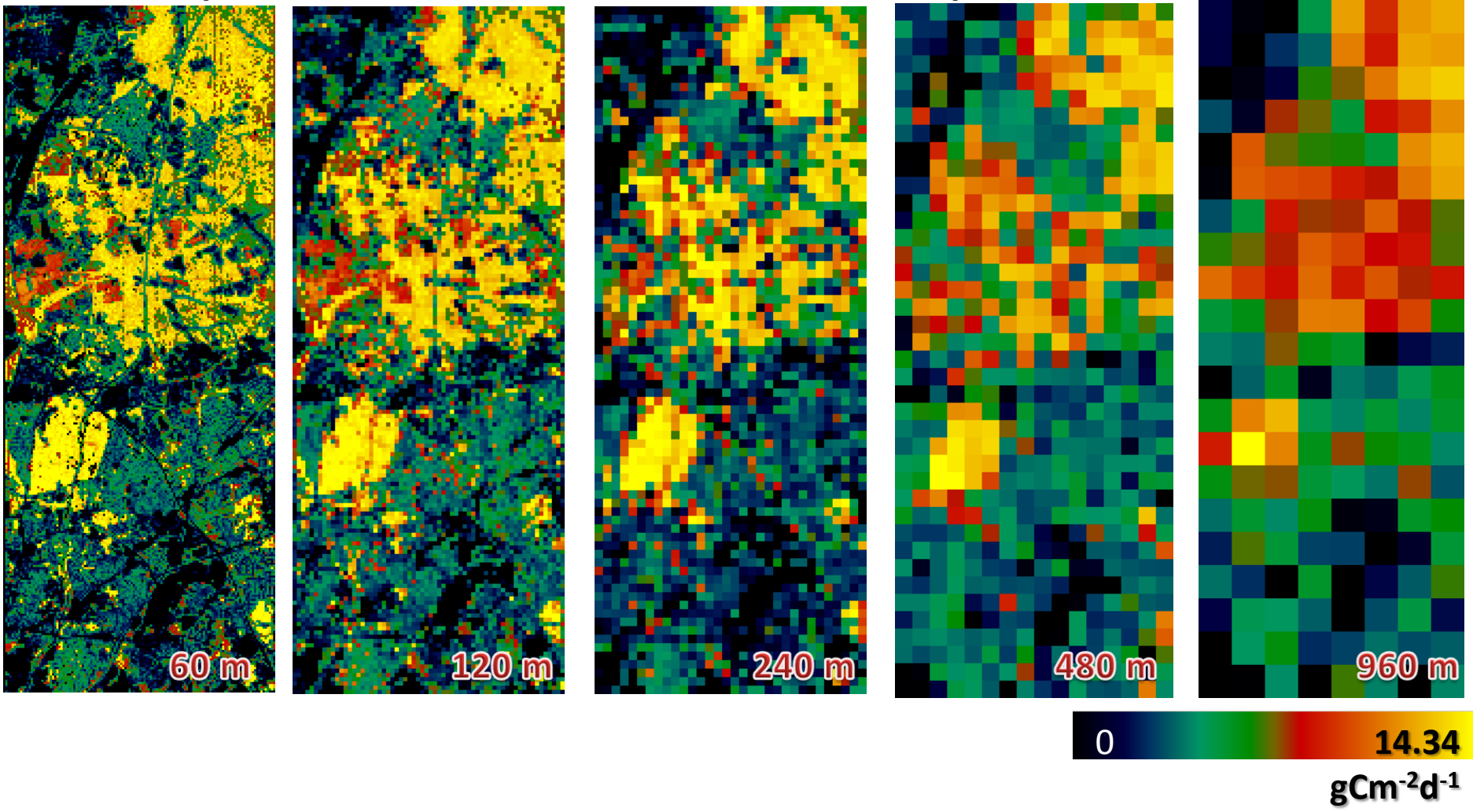


Changes in both the mean value and distribution histogram of PRI due to the increase of pixel size

Regional mean derived from 30-m PRI was 10% more compared to that derived from 960-m PRI

Comparisons of GEP at various spatial resolution



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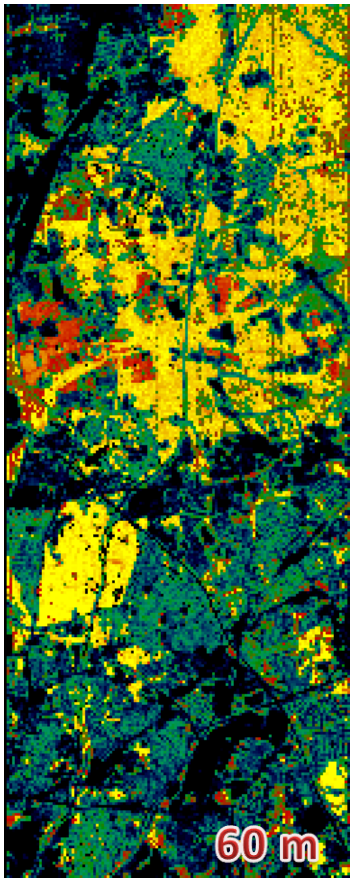

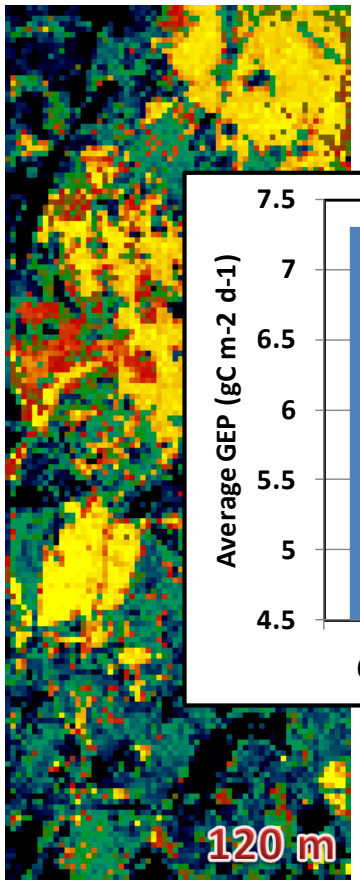

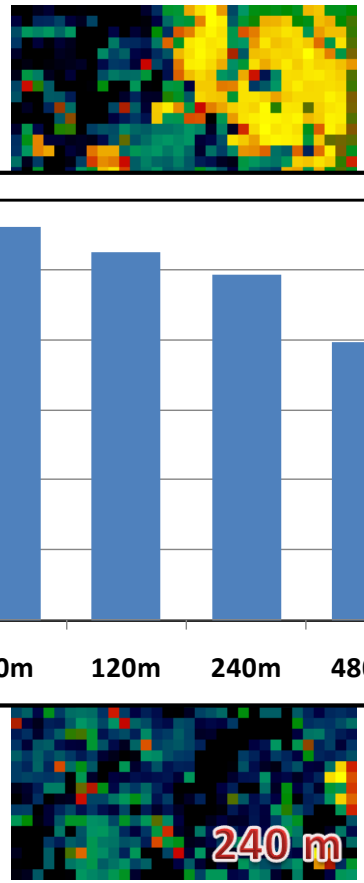

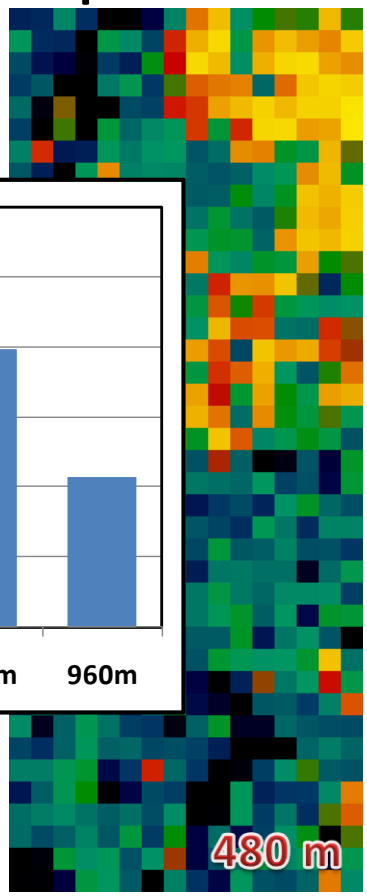

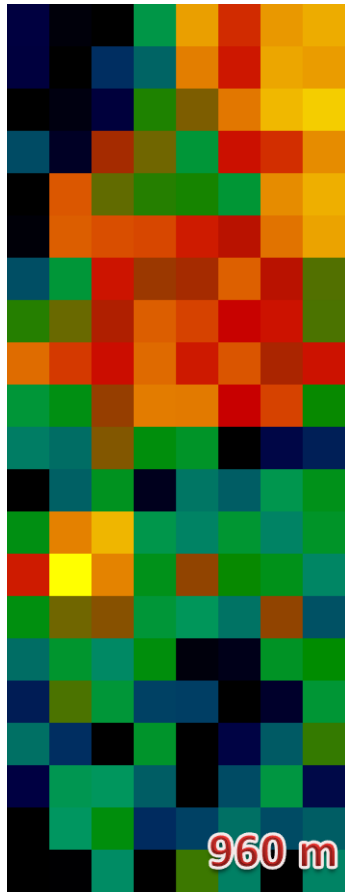

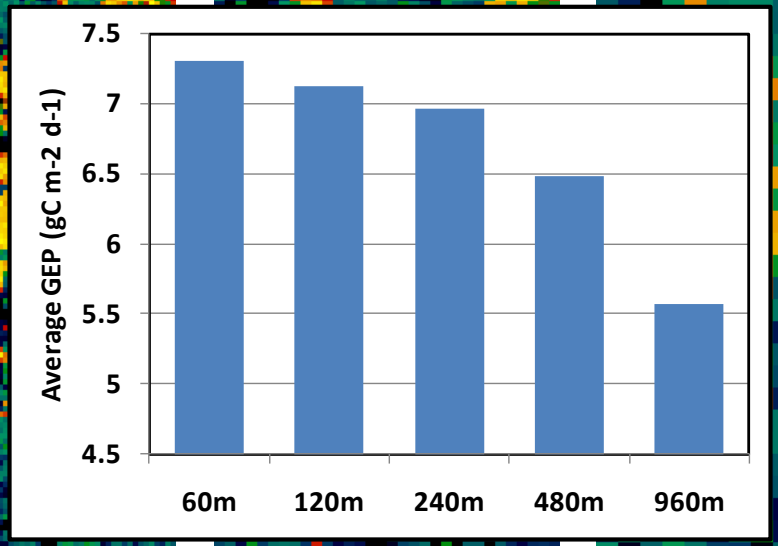

Summary

- Demonstration of using both the PRI and fAPARchl products for carbon monitoring and effects of spatial resolution

- Continue testing the robustness of the algorithm
- Confounding effects on PRI / PRI:LUE
- Uncertainty assessment in LUE and GEP estimates
- Various case study

- Use PRI and/or fAPARchl as model inputs
- Comparisons among various models (Cal/Val)

Thank you!!