



Evaluation of High Resolution Data for LCLUC Science

PI Name: S. Skakun

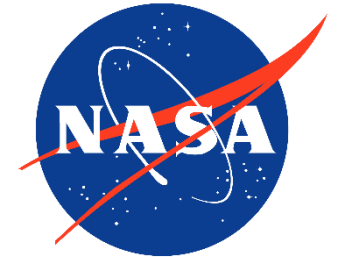
Affiliation: University of Maryland, College Park

Co-I Name: J.-C. Roger

Affiliation: University of Maryland, College Park

Co-I Name: E. Vermote

Affiliation: NASA GSFC



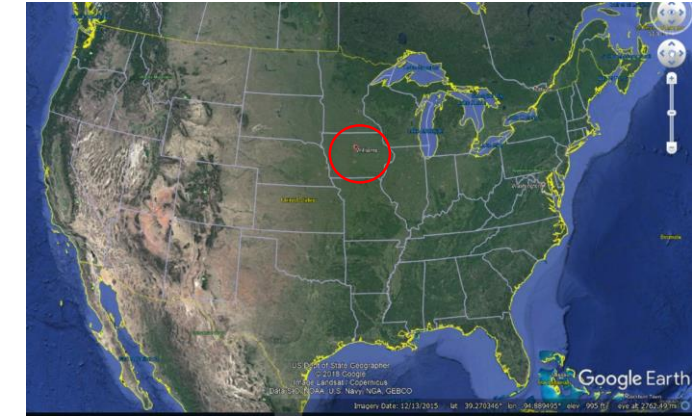
Project Title: Combined use of VHR WorldView-2/3 and Planet datasets for MuSLI agricultural monitoring

Objectives

- To evaluate VHR data (1-3 m) on capturing a **field level yield variability**
- To explore the benefits of VHR data (1-3m) on **crop mapping**:
 - **small fields** with large diversity of summer crops in Ukraine, and
 - **mixed** and **small fields** in Africa
- Expected data usefulness and benefits

Data Requested and Status

- **Study Region:**
 - US (Iowa), Ukraine (Western Part) and Tanzania
- **Data download status and plans:**
 - US, Iowa
 - **WorldView-3 (WV-3)** – 2 images
 - **Planet** – 270 unique scenes, ~84,000 km²
 - Plans:
 - Getting data for Ukraine and Tanzania
- **No issues or challenges** in downloading the data



**WV-3, 21 July 2018,
1.2 m, Red-Green-Blue**

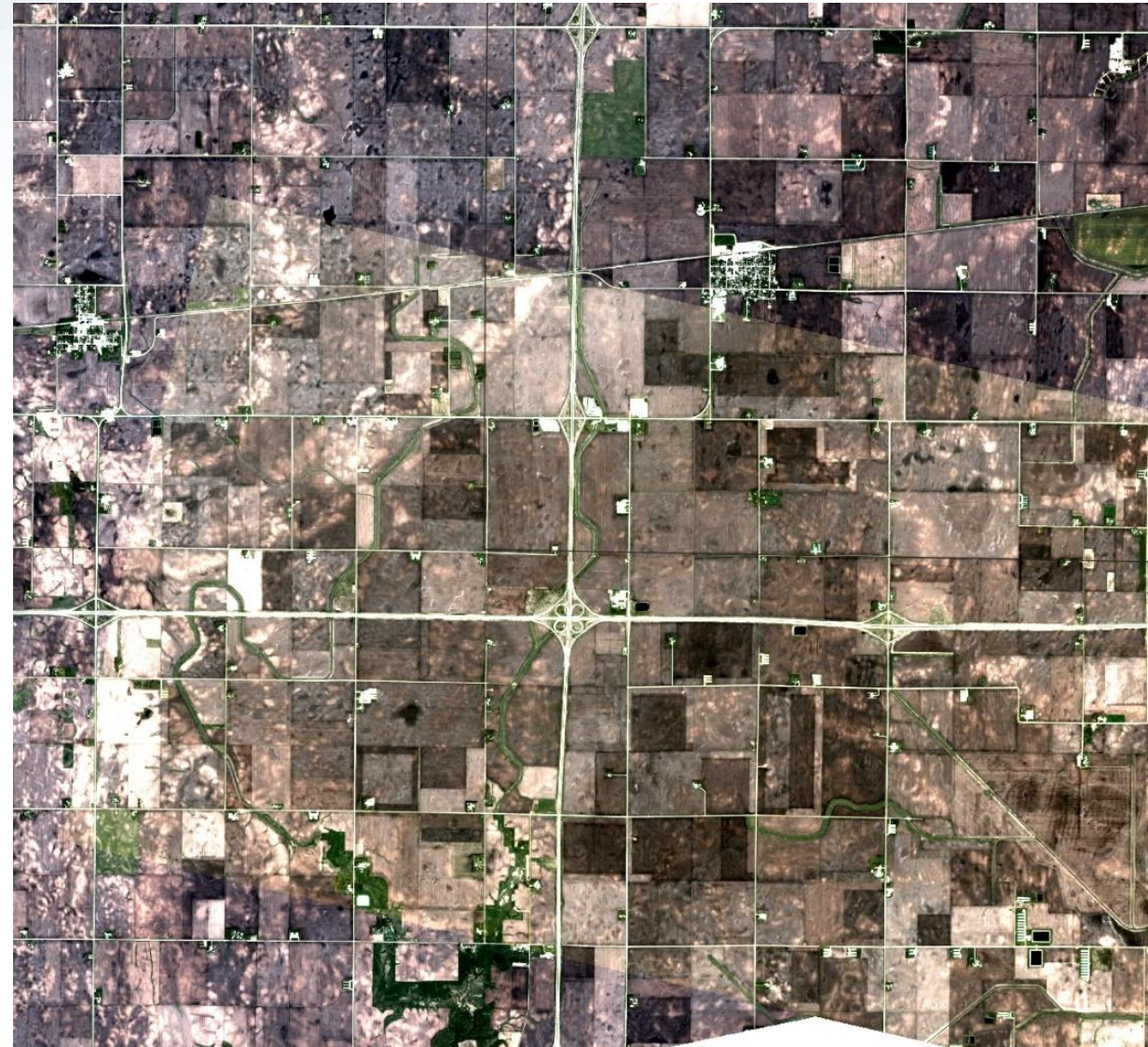
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**Planet, 30 August 2018,
3 m, Red-Green-Blue**

Preliminary results

- **Calibration**
 - Issues with **Planet**
- **Geo-referencing**
 - **Planet**: Good (visually) co-registration
 - **WV-3**: Delivered as Level-1B – without ortho-rectification
 - Ortho-rectification with 30 m SRTM DEM (using GDAL routines): Still ~10 px registration error
 - Manual GCPs selection to enable subpixel accuracy (RMSE<1px)
- **Atmospheric correction**
 - **LaSRC** – adaptation from Landsat 8 and Sentinel-2 (Vermote et al. 2016)



Planet, True color TOA

R: 0.09-0.14

G: 0.1-0.15

B: 0.12-0.16

20180515_163100_101c_3B_AnalyticMS_TOA

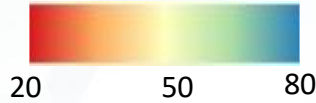
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20180515_163111_100e_3B_AnalyticMS_TOA

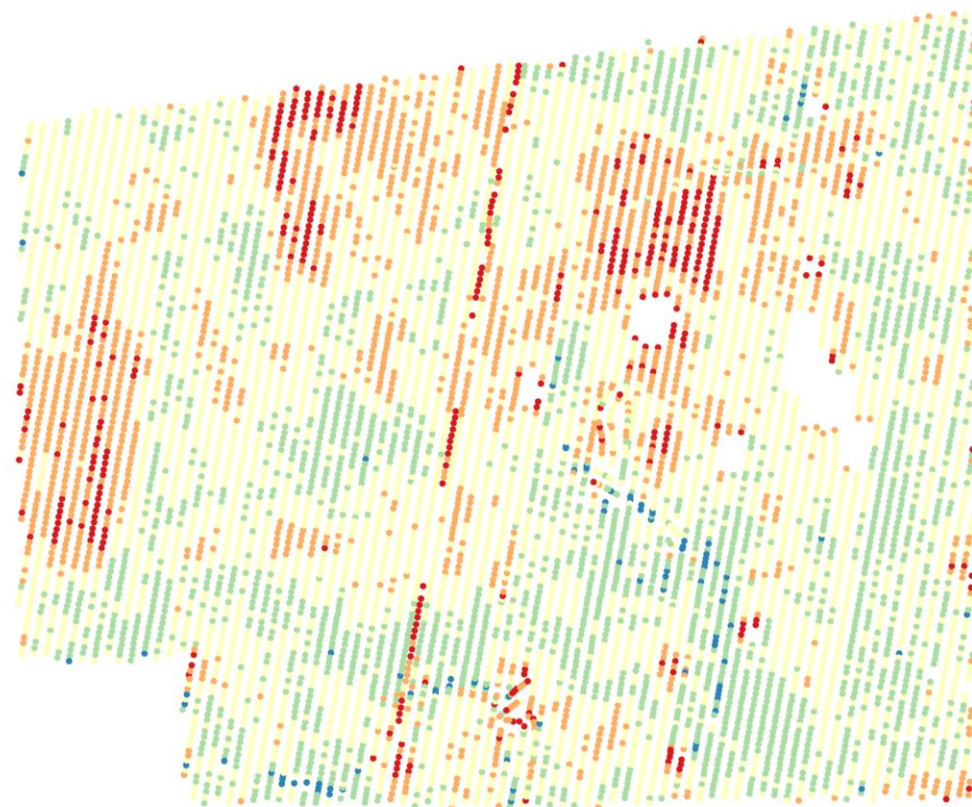
Preliminary results

Soybean

Yield, bu/ac



Field scale yield:
 52 ± 9 bu/ac (16%)
(3.5 t/ha)



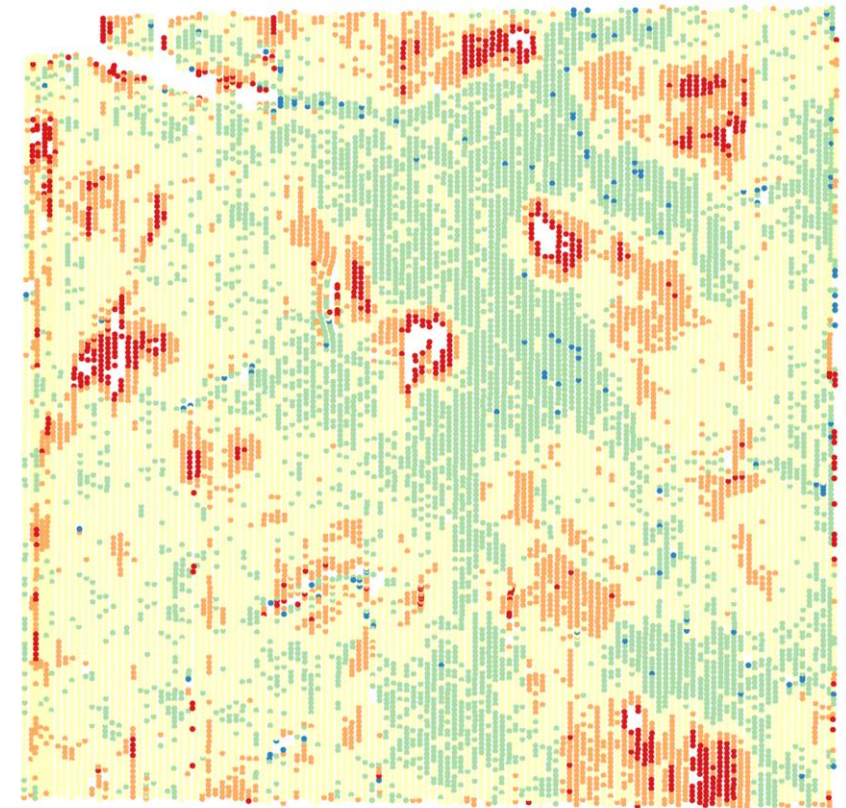
720 m

Corn

Yield, bu/ac



Field scale yield:
 186 ± 24 bu/ac (13%)
(11.7 t/ha)



720 m

Field scale yields for
corn and soybean
(Hamilton County, IA,
USA). Provided by Iowa
State University

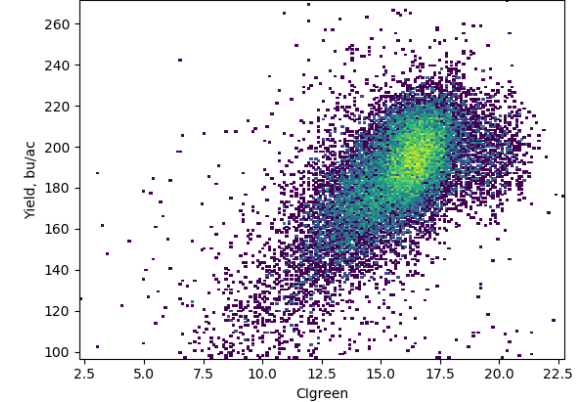
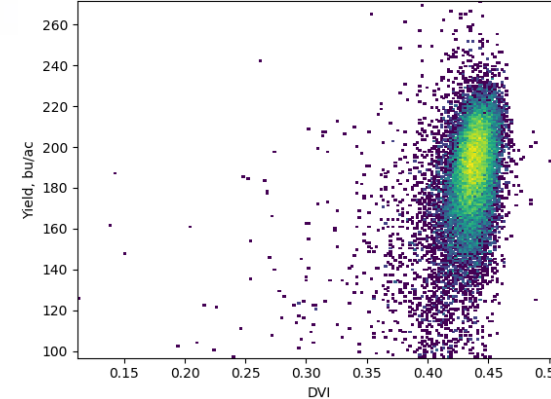
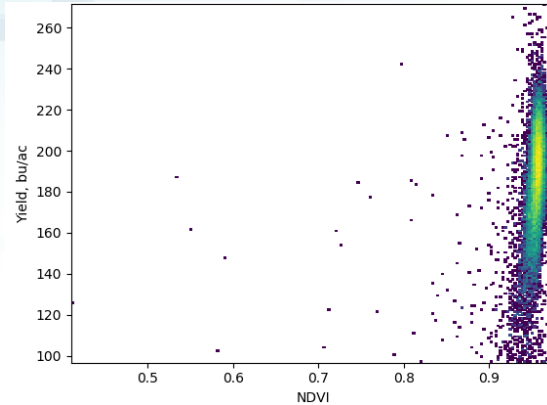
Preliminary results: WV-3

NDVI, $R^2=0.119$

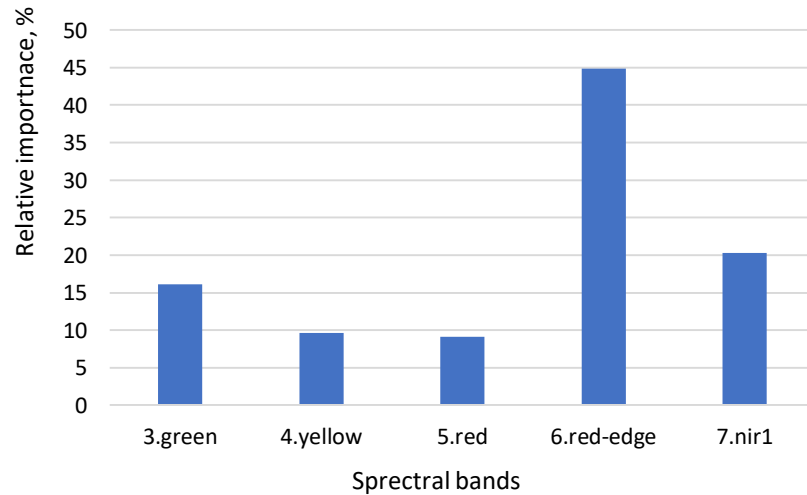
DVI = NIR-Red, $R^2=0.147$

Cgreen = NIR/Green-1, $R^2=0.371$

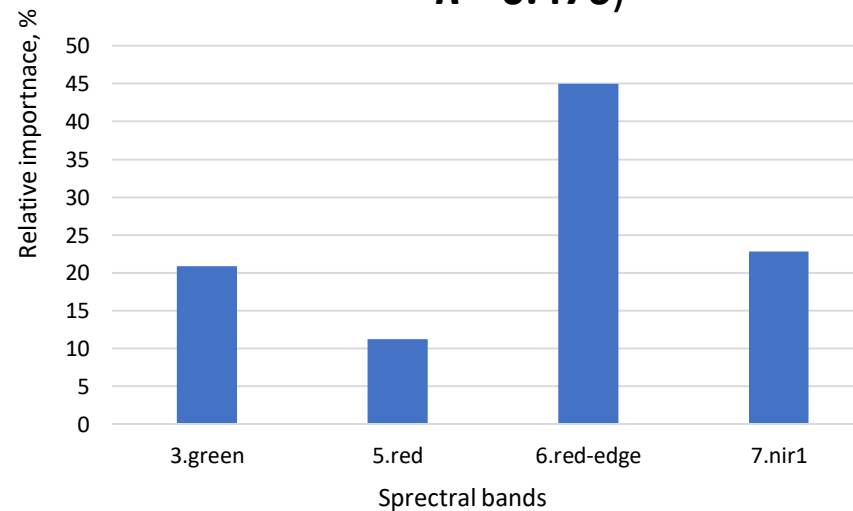
**WV-3
Corn
21 July 2018, DOY=202**



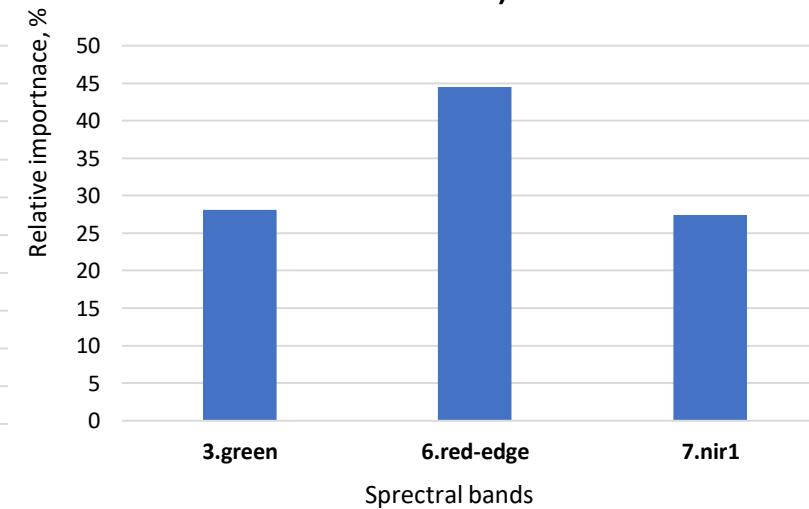
Relative importance
(corn, WV-3 2018-202, 5 bands
 $R^2=0.477$)



Relative importance
(corn, WV-3 2018-202, 4 bands
 $R^2=0.476$)



Relative importance
(corn, WV-3 2018-202, 3 bands
 $R^2=0.476$)



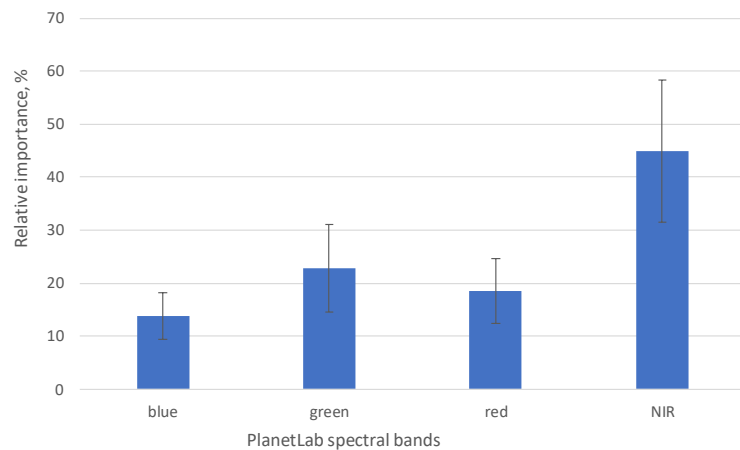
Preliminary results: Planet

Planet, soybean, R^2 over time

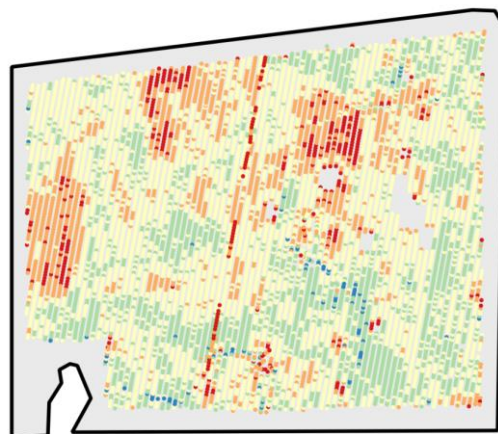
Planet, soybean



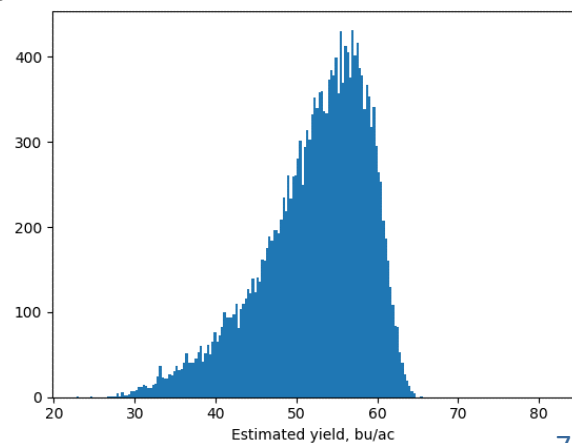
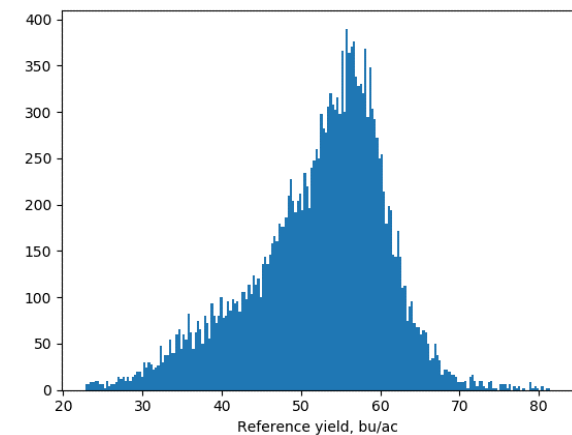
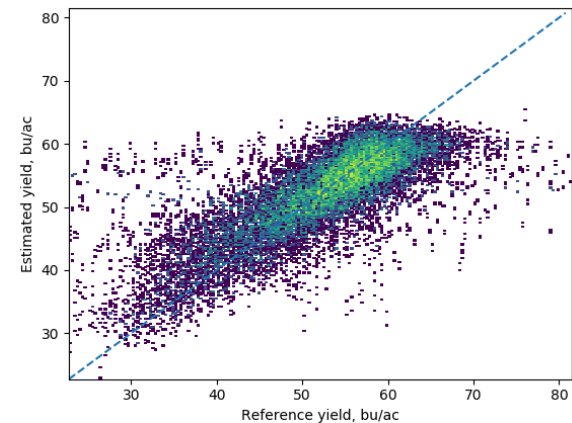
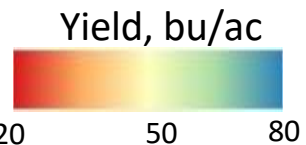
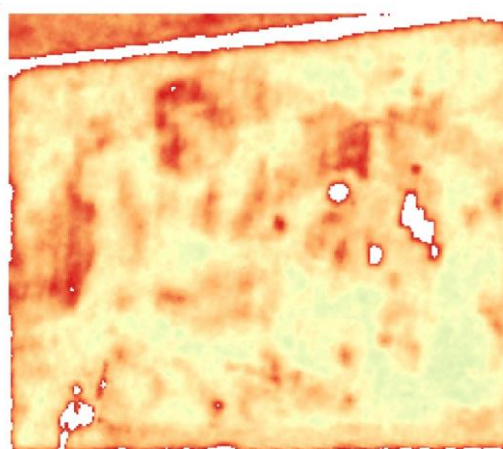
Year and DOY
Relative importance



Yield (from machinery)



Yield (from satellite, 3m)



Conclusions & Next Steps

- **Calibration** issues on Planet
- **Green/Yellow, Red Edge and NIR**: most important explaining corn/soybean yield variability
- **High temporal frequency** of **Planet** allows identification of best suitable date for yield assessment
- **Next steps**
 - Planet co-registration analysis (Skakun et al. 2017 IJDE)
 - Expanding crop yield mapping for multiple fields
 - Crop type mapping with Planet (small fields in Ukraine and Tanzania)

Acknowledgments

- **NASA**

- “Crop Yield Assessment and Mapping by a Combined Use of Landsat-8, Sentinel-2 and Sentinel-1 Images” (#80NSSC18K0336)

- **Digital Globe**

- "DigitalGlobe data were provided by NASA's Commercial Archive Data for NASA investigators (cad4nasa.gsfc.nasa.gov) under the National Geospatial-Intelligence Agency's NextView license agreement."

- **Planet**

- Planet Team (2017). Planet Application Program Interface: In Space for Life on Earth. San Francisco, CA. <https://api.planet.com>