Using multispectral imagery to estimate tornado-induced tree fall patterns identified via UAS

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Background:

- Analyzing tree fall patterns can be an informative way to estimate tornado wind intensity and dynamics

- Imagery obtained from UASs can be used to identify where trees fell, but this requires having resources for UAS flight

- High resolution satellite imagery is a possible alternative to identify tornado-induced tree falls without UASs

- EF-3 tornado hit Jacksonville, AL on 18 March 2018

Motivation:

- Determine how tree fall frequency and location can be estimated with satellite imagery by using UAS imagery as a reference

Method:

- Tree fall data obtained from colleagues at Jacksonville State University (AL) who identified and delineated tree fall locations from UAS imagery

- Multispectral (RGBN) imagery obtained from Planet, 3-m resolution (approximate size of small/medium tree canopy)
  - 08 May 2017, 15 March 2018, 22 March 2018, 08 May 2018

- Calculated Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) for Planet imagery and differences between pairs of images: one before tornado and the other after

- Determine changes in NDVI and EVI at locations of 4871 tree fall locations (base) and 5023 control points located >4.24 m (one pixel) from tree fall locations

Conclusions and next steps:

- Tree fall locations and control points exhibit greatest differences in EVI and NDVI change post-green-up (May)

- EVI and NDVI change in March (immediately before/after tornado, pre-green-up) exhibits least variance WRT number of tree falls at a distance d from tornado path center

- In the future, we will test use of unsupervised classification algorithms to differentiate between tree fall locations and control points using NDVI and EVI

Tree fall points

March 15 to March 22nd 2018 ΔNDVI

March 15 to March 22nd 2018 ΔEVI

May 2017 to May 2018 ΔNDVI

May 2017 to May 2018 ΔEVI

March 15 to May 8 2018 ΔNDVI

March 15 to May 8 2018 ΔEVI