SAR based change detection for mapping changes in wetlands

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Introduction
The Kerkini Artificial Lake in Greece is subjected to frequent changes due to water dynamics and human actions. Data fusion of hypetemporal SAR-based maps can enhance optical-based land cover maps and provide complementary information to field data.

Methods
- Dataset of 33 Sentinel-1 images from Jan-Dec 2016
- LULC map processed using 3 Sentinel-2 images for 2016.
- The Omnibus change detection algorithm (Conradsen et al 2016) identifies the frequency of change of each pixel across the time series of SAR images

Results
- High rates of change in the wetland (red and yellow colors in the frequency of change map, Fig 1) are produced by multiple oscillations in the water table level. The area though, is classified as permanent water by the optical classification. The white dashed line in Fig. 1 marks the correct boundary between permanent and seasonal waters
- Fig. 2 shows VV backscatter plotted for 4 points labeled by the optical classification as permanent water (‘water1’, ‘water2’ and ‘water3’) and Seasonal water. Only ‘water1’ shows consistent low backscatter throughout the year.
- ‘water2’ and ‘water3’ backscatter patterns correspond to water between April and August and wet soil the rest of the year (Fig 3).

Conclusion & Outlook
-Hypetemporal imagery improves our understanding of wetland dynamics and complements optical-based LULC maps. This is especially important for highly variable areas such as wetlands, where water regimes are different, species composition is also expected to be different.
-Data fusion of Sentinel-1 statistics (Fig 4) with Sentinel-2 imagery has also potential applications for other study areas such as determining the intensity of harvest of crops, or monitoring grass-cutting practices

References:
https://doi.org/10.1109/TGRS.2015.2510160

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Fig 1: Frequency of change map based on Sentinel-1(left) and LULC map based on Sentinel-2(right). The white dashed line in both maps was delineated using the frequency of change map. It shows the actual boundary between permanent and seasonal water, which cannot be detected using only multitemporal Sentinel-2 imagery.

Fig 2: VV backscatter for the points labelled as water and seasonal water in the LULC map. Low values represent periods of inundation, and higher values periods of wet soil.

Fig 3: Water table level. High values correspond to low backscatter for temporarily inundated areas.