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| **Type the title of your abstract:** Assessing the potential of ICESat-2 data to retrieve fuel-related variables |
| **Introduction/Aim:**  Recent studies suggest that fire regimes will be altered in response to climate change, leading to increased frequency and intensity of wildfires in fire-prone areas, as well as expansion into previously unaffected regions. In the Mediterranean region, projected weather conditions, combined with existing vegetation patterns, are expected to contribute to more frequent and severe wildfires. Portugal has already experienced catastrophic consequences of these extreme circumstances in 2003, 2005, and 2017, with large wildfires causing extensive economic, environmental, and human losses.  The characterization and mapping of fuels are recognized as critical factors in wildfire prevention and planning. Fuel management is a direct method for reducing fire risk, and fire behavior simulators (e.g., FARSITE, FlamMap) are valuable tools for supporting fire and fuel management decisions. However, the accuracy of simulation outputs depends heavily on the availability of precise fuel data. High-quality information on variables such as canopy height (CH), canopy cover (CC), canopy base height (CBH), canopy bulk density (CBD), and canopy fuel load (CFL) is essential for accurate wildfire management decisions.  The overarching objective of this study had two main components: i) evaluating the utility of ICESat-2 data for estimating key fuel-related variables, and ii) creating a comprehensive map of these variables at a 25-meter resolution by integrating ICESat-2 data with other remotely sensed datasets such as Sentinel-1, Sentinel-2, ALOS2/PALSAR2, and SRTM.  To achieve the first goal, a three-step approach was implemented: (i) modeling fuel-related variables using field-based vegetation measurements and ALS-derived metrics; (ii) generating ALS-based estimates of key fuel-related variables to provide ground-truth information across the study area; and (iii) assessing the utility of ICESat-2 ATL08 canopy height and cover metrics for estimating key fuel-related variables. An error analysis regarding the ICESat-2 derived estimates for the key fuel-related variables and the ICESat-2 standard CH estimates was performed to understand how different factors (e.g. land cover type, canopy cover, and slope) could affect the performance of the estimates. For the second objective, the Google Earth Engine cloud-computing platform was used to preprocess, mosaic, and retrieve Sentinel-1, Sentinel-2, PALSAR-2, and topographical data. Additionally, it was utilized to compute a suite of vegetation indices and textural metrics (GLCM). The Random Forest machine learning algorithm was then applied to predict each of the fuel-related variables using the aforementioned multisource satellite data.  In this presentation, we will discuss the primary strengths and limitations of ICESat-2 data in providing useful and accurate information about key fuel-related metrics in a semi-arid Mediterranean landscape. |