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Daily Mapping of 30 m LAI and NDVI for Grape Yield Prediction in California Vineyards

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Abstract: Wine grape quality and quantity are affected by vine growing conditions during critical phenological stages. Field observations of vine growth stages are too sparse to fully capture the spatial variability of vine conditions. In addition, traditional grape yield prediction methods are time consuming and require large amount grape samples. Remote sensing data provide detailed spatial and temporal information regarding vine development that is useful for vineyard management. In this study, Landsat surface reflectance products from 2013 and 2014 were used to map satellite-based Normalized Difference Vegetation Index (NDVI) and leaf area index (LAI) over two *Vitis vinifera* L. cv. Pinot Noir vineyards in California, USA. The spatial correlation between grape yield maps and the interpolated daily time series (LAI and NDVI) was quantified. NDVI and LAI were found to have similar performance as a predictor of spatial yield variability, providing peak correlations of 0.8 at specific times during the growing season, and the timing of this peak correlation differed for the two years of study. In addition, correlations with maximum and seasonal-cumulative vegetation indices were also evaluated, and showed slightly lower correlations with the observed yield maps. Finally, the within-season grape yield predictability was examined using a simple strategy in which the relationship between grape yield and vegetation indices were calibrated with limited ground measurements. This strategy has a strong potential to improve the accuracy and efficiency of yield estimation in comparison with traditional approaches used in the wine grape growing industry.

Keywords: wine grape; satellite remote sensing; NDVI; LAI; yield; field-scale

1. Introduction

Over 99 percent of grapes grown commercially in the United States come from California, which accounts for nearly 90 percent of American wine production valued at approximately $6 billion from 918,000 acres of vineyards in 2015 [1]. The ability to accurately and efficiently monitor vine development and estimate grape yields within season will have significant benefit to the wine industry