Utilizing Automated Feature Extraction of Irrigation Indicators to Estimate Methane Emissions from Rice Paddies in Vietnam [1]

Submitted by Lindsay.Barbieri on Mon, 2015-06-29 00:17

Abstract:
This study utilizes automated feature extraction techniques to examine Landsat 8 satellite imagery of rice paddies in the Mekong Delta, Vietnam from four time steps over two growing seasons. Landscape features corresponding to irrigation practices, such as irrigation channels and field flooding, were identified in all four time steps to observe changes in patterns which could indicate different methane emission rates from rice paddies. Rice is the main staple food of an increasing global population, and most of the world's rice production is from flooded fields, which contain bacteria that produce methane under anaerobic conditions. Mitigation of methane emissions in rice paddies is relatively well understood. Emissions can be reduced by 30-40% without compromising yields if one or more drying period is introduced, though the amount of methane reduced depends on environmental conditions and especially on water crop management. This information, along with greenhouse gas emissions data, is often poor or lacking - especially in the developing world. Accurately quantifying and monitoring emissions is crucial to develop and implement optimal emissions mitigation strategies, which is challenging as rice farmers' irrigation management practices are highly spatially variable. Monitoring this kind of complexity on farmer's fields especially for large areas is difficult, as current quantification techniques are localized, point specific and costly. Remote sensing provides an opportunity to monitor landscape scale features more efficiently and cost effectively, and may provide opportunities to more accurately estimate methane emission rates based on water management. While Landsat 8 imagery is not ideal in either spatial or temporal resolution for monitoring irrigation practices on individual rice paddies in Vietnam, this analysis could allow for a more accurate estimate of methane over a large area, and could serve as a baseline for comparison with unmanned aerial vehicle (UAV) imagery which will be monitored for a specific study site over a complete rice-growing season.

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Keywords: rice paddies [5]
methane [6]
remote sensing [7]
automated feature extraction [8]
irrigation [9]
agriculture [10]
greenhouse gas emissions [11]

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