Developing a Rice Mapping and Monitoring System: Integration of PALSAR, MODIS and Biogeochemical Modeling for Quantification of Methane Emissions

LOS

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# **Talk Outline**

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- Overall objectives brief review
- Motivation: Work supported by the PALSAR and MODIS mapping and monitoring of rice.
- Validation efforts Assessment of initial rice products
- Phase II products
- Next steps

# **Developing Rice Monitoring Tools**

#### Summary

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- Objectives
  - Map the extent of rice paddies in Pan Asian region
  - Map rice cropping systems in Pan Asian region
  - Map inundation period of rice agriculture in Pan Asian region
  - Map and monitor rice biophysical characteristics (biomass, LAI, age, height) in Pan Asian region.
  - Use PALSAR derived products to drive a biogeochemical model to estimate net GHG emissions.



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# **Completion of work from Phase 1**

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#### Task: Algorithm Development

- Algorithms & methodology for rice products (i.e., subtask 1.1.1)
- Completed using fine-beam, AUIG ScanSAR, & K&C Strips



# **Phase 1 Summary Conclusions**

- Multi-temporal FBS/FBD and ScanSAR are promising for routine mapping and monitoring of rice at regional scale.
- Decision tree classification and segmentation can be implemented in an automated system.
- ScanSAR radiometry is suitable for mapping and monitoring, but issues of scale in regions with smaller rice paddies.
- Ideal system combines FBD/FBS mapping of rice extent with ScanSAR monitoring for refining cropping intensity, cropping dates and inundation dynamics.
- Summary of Updated Activities since Phase 1 Report.
  - Assessment of Products

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- Field work completed for Jiangxi Province China & Sacramento Valley, USA
- DNDC simulations and sensitivity analyses for USA



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# **Motivation: Regional Rice GHG Budget**

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### **Motivation: Support HPAI Risk Assessment**

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### **Motivation: Development of Rice MRV Offset Protocol**

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- CA AB32: State legislation for GHG reductions looking at Cap and Trade system, with major role for ag offsets in the near term
- Working with California Rice Commission and Environmental Defense Fund to examine
  - Baseline GHG emissions from rice

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- Opportunities for GHG reductions
  - > Water, straw and fertilizer management
- > Development of offset protocols (in collaboration with ARB) that
  - A. rely on process models (too expensive for measurement of CH4 and N2O) and
  - B. rely on remote sensing for setting baseline management and for verification of management changes
- Important demonstration in US for use of process models and remote sensing in development of climate policies and offset protocols: small step in an important direction...

# **Assessment of Rice Products Completed**

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- Automated FBS/D & K&C Rice Map Products
- Very high overall FB accuracy 95% (449/469) using NAIP true-color sub meter reference
- Using to drive biogeochemical model parameters to assess GHG emissions
  and agricultural management decisions



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# Assessment of Rice Products Completed

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• Automated K&C Rice Map Products for Poyang Lake, Jiangxi Province, China

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 Ground-truth, GPS photos show strong overall accuracies for regional / continental scale products (330 points)



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### **Assessment of Hydroperiod Products**

ScanSAR Hydroperiod Maps

- Strong agreement (84-95%) between ScanSAR and MODIS Flood Products
- ScanSAR WB1 Threshold integrated with. MODIS 8-day MCD43A4 LSWI+0.05>EVI = Flood
- Ground truth, GPS-photos: 95% PALSAR inundation product for 1/20/2009
- DOY comparison for 4 times periods. 2006339: 85%, 2007066: 94%, 2007107: 89%, 2009020: 84%







### **Validation: Methane Emissions from Rice**

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# **Sensitivity Analyses of Hydroperiod Products and GHG Emisions**

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# **Phase II Processing**

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- Phase I: We developed customized open source GDAL and python scripts for pre-processing ORT Strip products.
- Phase II: Working with SLT products

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- Reduce processing requirements on EORC so multiple products do not need to be created for wetlands work in same regions (as discussed in January)
- Required new software. Met with SARMAP and will be using SARSCAPE
- In process of revising our processing stream with new software

# **Next Steps**

- Operational processing & mapping underway for large-regions
- Integration with optical observations at development sites to improve algorithms; drive GHG offsets policy

Figure. MODIS 8-day LSWI (blue line) and EVI (red dashed line) rescaled and plotted over time for rice paddy #574 (83 hectares) for one year starting November 1, 2006 (DOY 305). Orange line on graph marks flooded periods for winter flood (DOY 2006337 - 2007033: 72days) and summer flood/planting (DOY 2007121 - 2007145: 32 days).

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Unique rice field hydroperiods



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# Next Steps cont...

Finish new processing stream.

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- Field work in Java and Thailand planned (June through August)
  - Coordinated with AIT and LAPAN
  - Collection of reference data based on stratified random sample (region based – cost limitations)
- Final China products and initial Mainland SE Asia products by fall.
- Assessing DNDC biogeochemical model results: MRV protocol that incorporates both model uncertainty (derived from validation) and model sensitivity to precision of inputs (costs for data collection)



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# An international science collaboration led by JAXA Next Steps: Point and Click Web Model System

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**Digital Orthophoto** 

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**DWR** Cropland



