AN INTEGRATED APPROACH ON RICE PADDY IRRIGATION PATTERN MONITORING OVER ASIA WITH MODIS AND AMSR-E

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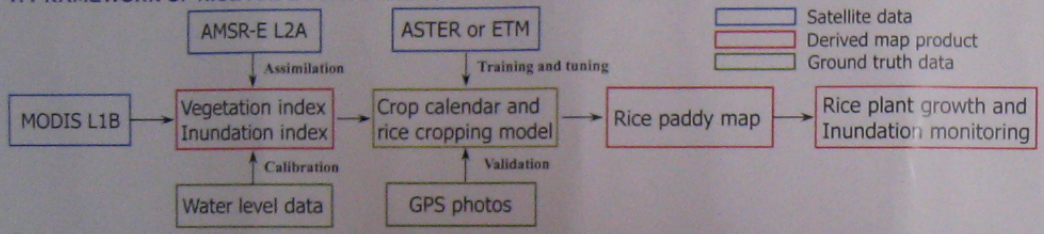
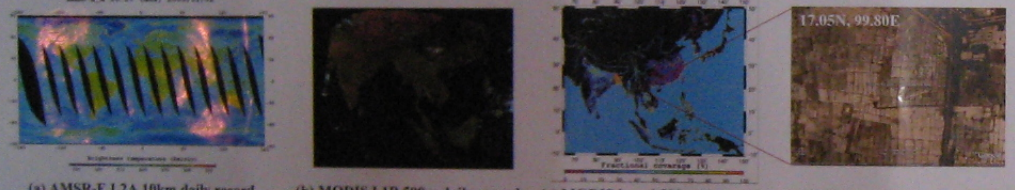
ABSTRACT: *This research focuses on an integrated monitoring of rice paddy cultivation with MODIS and AMSR-E data. A time series of analysis on single cropping rice cultivation was conducted on vegetation and inundation condition with MODIS derived indices and those of AMSR-E. It was found that AMSR-E captures a salient points on rice cropping phenology more precisely than MODIS because it is not affected by cloud contamination. A all-weather type monitoring with high frequency can be effective especially on inundation condition in wet season along with MODIS data with high spatial resolution.*

KEYWORDS: *Inundation, normalized vegetation and water indices, data fusion of optical and microwave sensors*

1. FRAMEWORK OF RICE PADDY MONITORING WITH REMOTE SENSING



2. INTEGRATED MONITORING SYSTEM OF RICE PADDY CULTIVATION FROM PIXEL TO CONTINENTAL

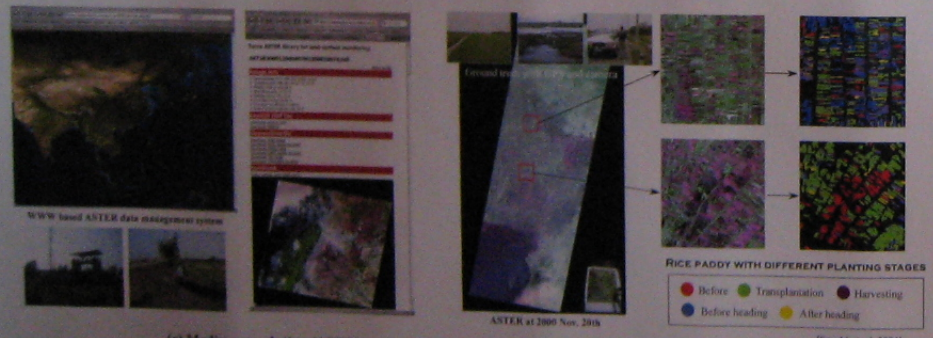


(a) AMSR-E L2A 10km daily record provided by NSIDC, USA

(b) MODIS L1B 500m daily record received at AIT, Thailand

(c) MODIS based 500m rice paddy fractional cover map [3]

(d) Ground based water level monitoring in Chaophraya river



(e) Medium-resolution (ASTER or ETM) based paddy mapping supplemented by GPS photos

3. REMOTELY SENSED INDICES FOR RICE PADDY MONITORING

MODIS: Normalized vegetation, soil and water indices [2]

$$NDVI = (Ch.2 - Ch.1) / (Ch.2 + Ch.1) \quad (1)$$

$$NDSI = (Ch.6 - Ch.2) / (Ch.6 + Ch.2) \quad (2)$$

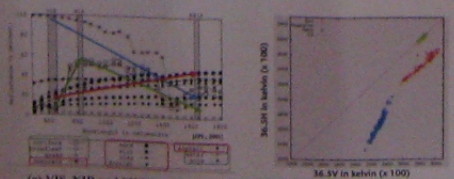
$$NDWI = (Ch.1 - Ch.6) / (Ch.1 + Ch.6) \quad (3)$$

AMSR-E: Normalized polarization index [Sippel, 1994] and minimum brightness temperature index

$$NDPI(\Delta T) = (36.5V - 36.5H) / (36.5V + 36.5H) \quad (4)$$

$$36.5HN = (36.5H_{max} - 36.5H) / (36.5H_{max} - 36.5H_{min}) \quad (5)$$

* Maximum and minimum values are derived from annual spectral changes

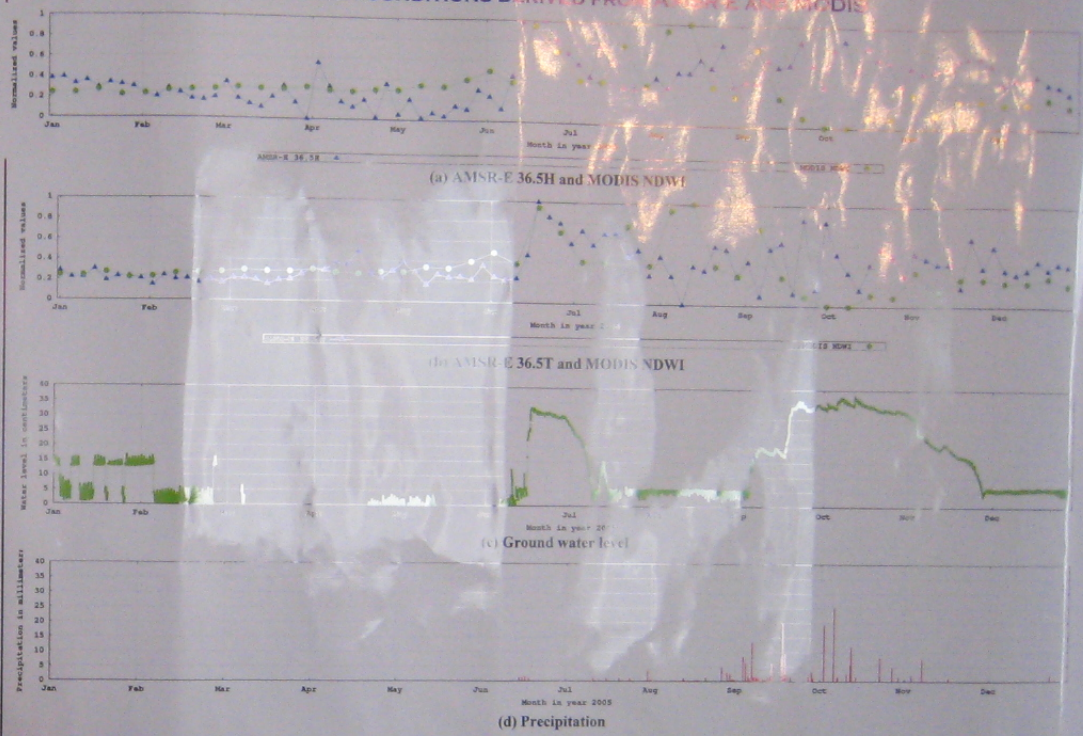


(a) VIS, NIR and SWIR wavelength

(b) 36.5GHz polarization

Fig. 2 Comparison of spectral characteristics on vegetation, soil and water

4-1 TIME SERIES OF INUNDATION CONDITIONS DERIVED FROM AMSR-E AND MODIS



4-2 COMPARING SPATIAL CONTEXT ON INUNDATION CONDITIONS DERIVED FROM AMSR-E AND MODIS

(a) 36.5ΔT on Jan. 25 (b) NDWI on Jan. 25 (c) 36.5ΔT on Jun. 14 (d) NDWI on Jun. 14

(a) Dry season (soil) (b) Rainy season (inundated) (c) Landsat (Google earth)

5. CONCLUDING REMARKS

1. Time series of inundation conditions observed from MODIS is basically consistent with AMSR-E and ground based water level.
2. MODIS normalized water index (NDWI) has an anomaly value due to cloud contamination in August (rainy season).
3. Minimum brightness temperature index (36.5H) represents an inundation condition better than normalized polarization index (NDPI) compared with ground based water level.
4. A visual interpretation found that a spatial context on inundation conditions derived from AMSR-E and MODIS are similar although they have much difference in spatial resolutions (500m v.s. 10km)
5. More efforts must be conducted in geometric correction errors, polarization difference and frequency selection in AMSR-E.

KEY PUBLICATIONS

[1] Takeuchi, W. and Yasuoka , Y., 2004. Estinating spatio-temporal patterns of paddy fields over Southeast Asia using MODIS time series. *25th Asian conference on Remote Sensing (ACRS)*, 835-840.

[2] Takeuchi, W., *et al.* 2005. Mapping of fractional coverage of paddy fields over Asia using MODIS time series. *5th International Scientific Conference on the Global Energy and Water Cycle (GEWEX)*.

[3] Takeuchi, W., *et al.* 2005. Development of a complete rice paddy map data set over Asia using MODIS data. *AGU 2005 fall meeting*

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