Retrieval of Biophysical Parameters for Rice using Polarimetric SAR Data

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JECAM Joint Experiment for Crop Assessment and Monitoring
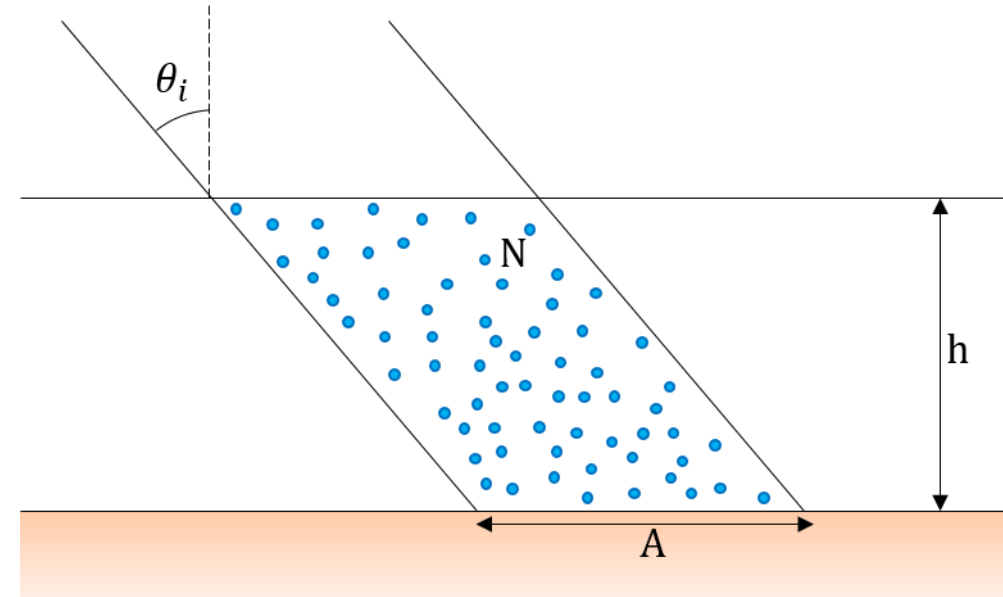
Crop biophysical parameters

o **Crop phenology—Growth stages**

o **Leaf area index (LAI) and/or Plant Area Index (PAI)**

o **Crop geometry**

- Plant height

- Plant density (row and plant spacing)

- Orientation of plant elements (leaf/stem)

- Row direction

o **Vegetation biomass**

- Wet biomass/fresh weight

- Dry biomass

- Vegetation water content

Importance

- Proxy for crop growth monitoring

- Production forecasting

- Agronomic managements

  - Fertilizer

  - Pesticides

- Risk assessment

Vegetation Modeling: Water Cloud Model (WCM)

- First proposed by Attema and Ulaby (1978).

- **Assumptions**:
  - o The vegetation canopy is modeled as a water cloud

  - o The N number of particles to be **identical and uniformly distributed**

  - o A **single scattering** from the particle is considered

$$\sigma^0 = \underbrace{AL^E \cos\theta \left(1 - \boxed{\exp\left(-\frac{2BL^F}{\cos\theta}\right)}\right)}_{} + \underbrace{(CM_v + D) \times \exp\left(-\frac{2BL^F}{\cos\theta}\right)}_{}$$

Vegetation   Two way attenuation factor   Soil contribution attenuated by vegetation

M_v = soil moisture
L = LAI or PAI
θ_i = incidence angle

- Non-linear least-squares regression → **Calibration (Find A, B..D)**

Attema, E., Ulaby, F. T., 1978. Vegetation modeled as a water cloud. Radio Sci. 13 (2), 357–364.

EO-data

Table 1: Specification of C-band quad-pol RADARSAT-2 acquisitions over the test site during the field campaign

Acquisition date	Beam mode	Incidence angle range (.deg)	Orbit	In-situ measurements
05-07-2018	FQ15W	33.7 - 36.7	Ascending	04 Jul., 05 Jul.
29-07-2018	FQ15W	33.7 - 36.7	Ascending	01 Aug., 02 Aug.
22-08-2018	FQ15W	33.7 - 36.7	Ascending	22 Aug., 23 Aug.
15-09-2018	FQ15W	33.7 - 36.7	Ascending	14 Sep., 15 Sep.
09-10-2018	FQ15W	33.7 - 36.7	Ascending	08 Oct., 09 Oct.
02-11-2018	FQ15W	33.7 - 36.7	Ascending	02 Nov., 03 Nov.
26-11-2018	FQ15W	33.7 - 36.7	Ascending	25 Nov., 26 Nov.

Schematic workflow
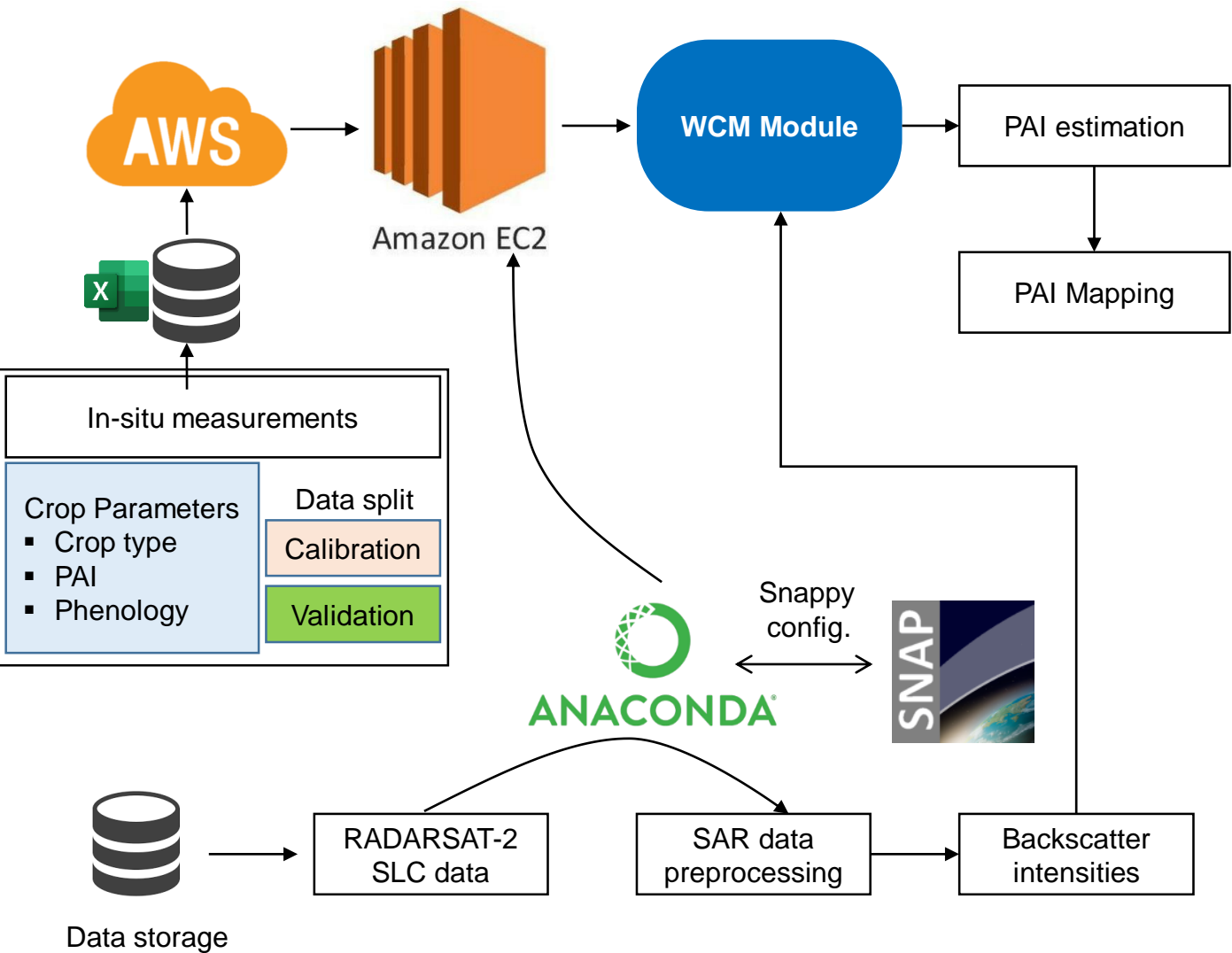
PAI Validation
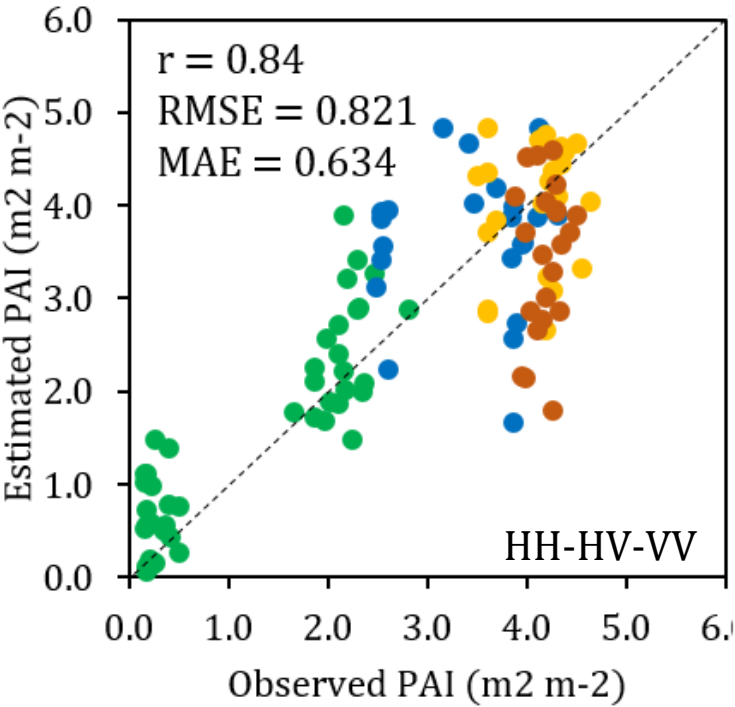
PAI mapping

Thank you

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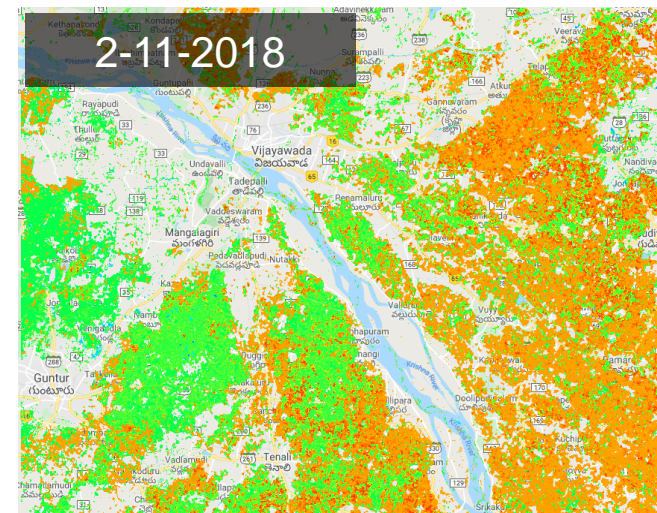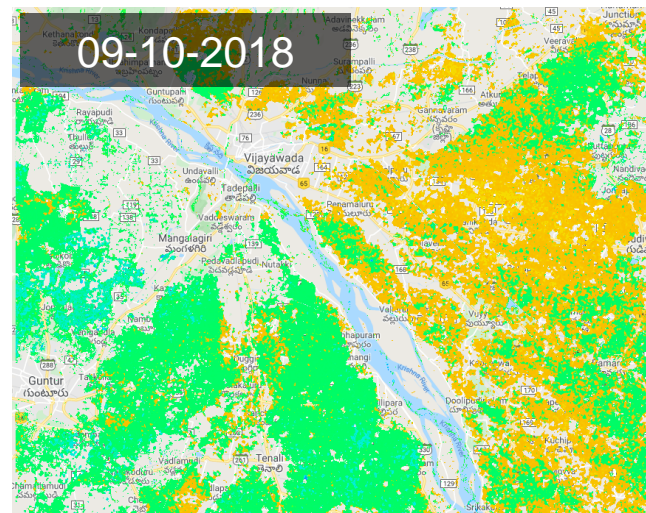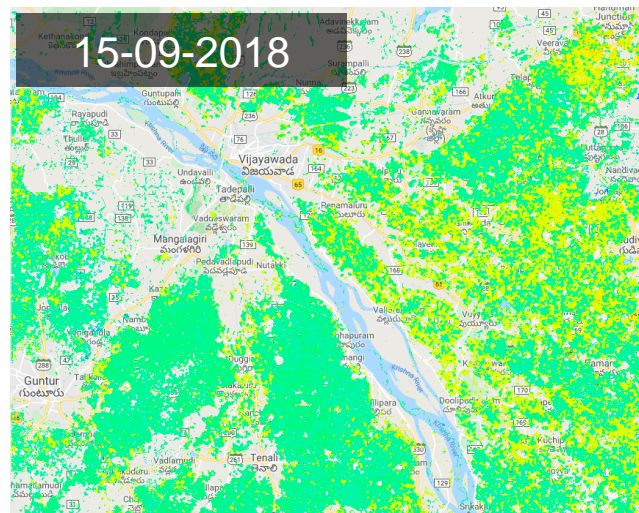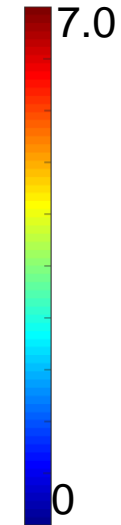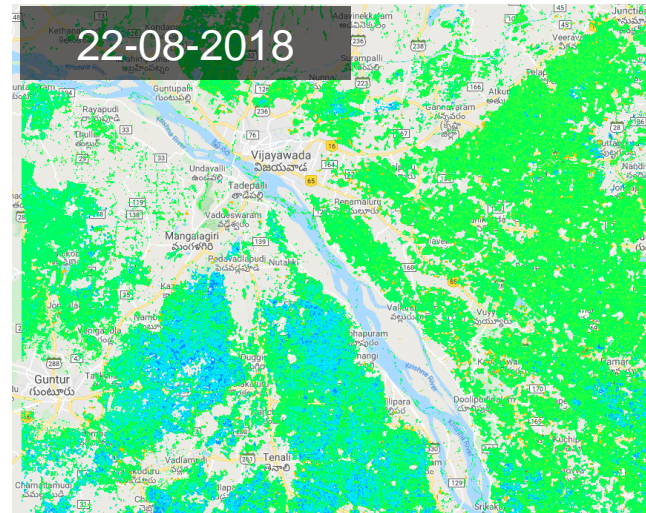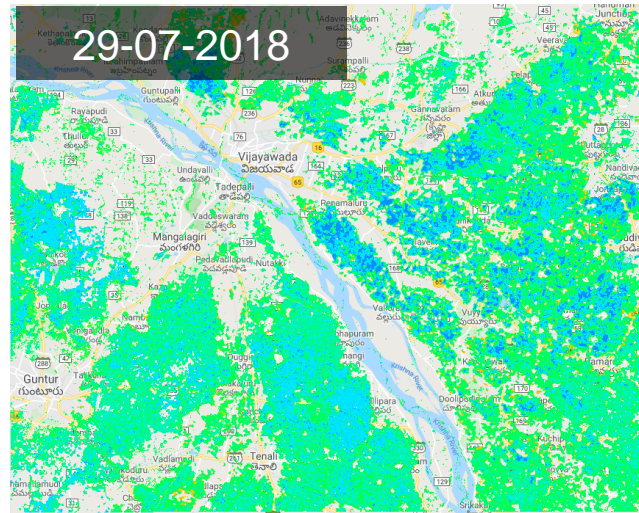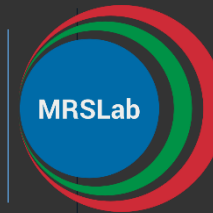
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