Coupling Radiative Transfer Observation Operator with Land Surface Model for Assimilating Microwave Tb over India

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Outline

- Motivation and Research objective
- Methodology
- Results from previous DA
- Plan for proposed Alternative
- Future work

Motivation and research objective

- INDIA:- varied topographic distribution involving deserts along the Northwest (Thar Desert), snow clad mountains in the North (Himalaya), High Plateau region (Tibetan Plateau) in east.
- Land Surface: Boundary conditions for near surface atmosphere (Lowest atmospheric conditions).
- Can we improve the land surface initial states using Remote Sensing Data.
- Research Objective :- To improve Land surface initial state using Microwave Remote sensing data products.

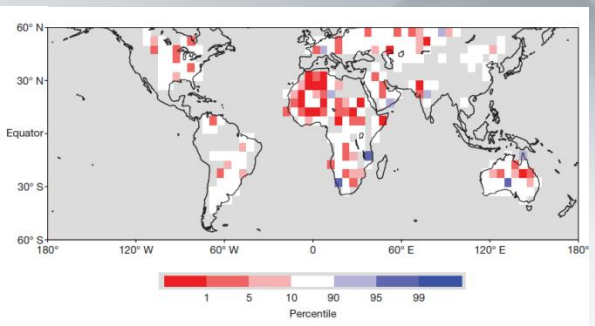
Why Soil Moisture ?

LETTER

doi:10.1038/nature11377

Afternoon rain more likely over drier soils

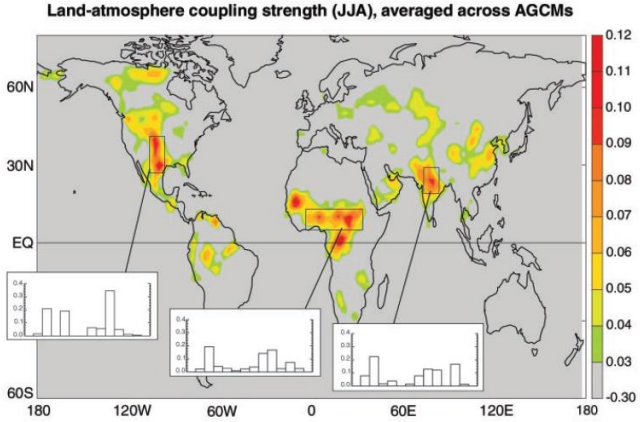
Christopher M. Taylor[1], Richard A. M. de Jeu[2], Françoise Guichard[3], Phil P. Harris[1] & Wouter A. Dorigo[4]

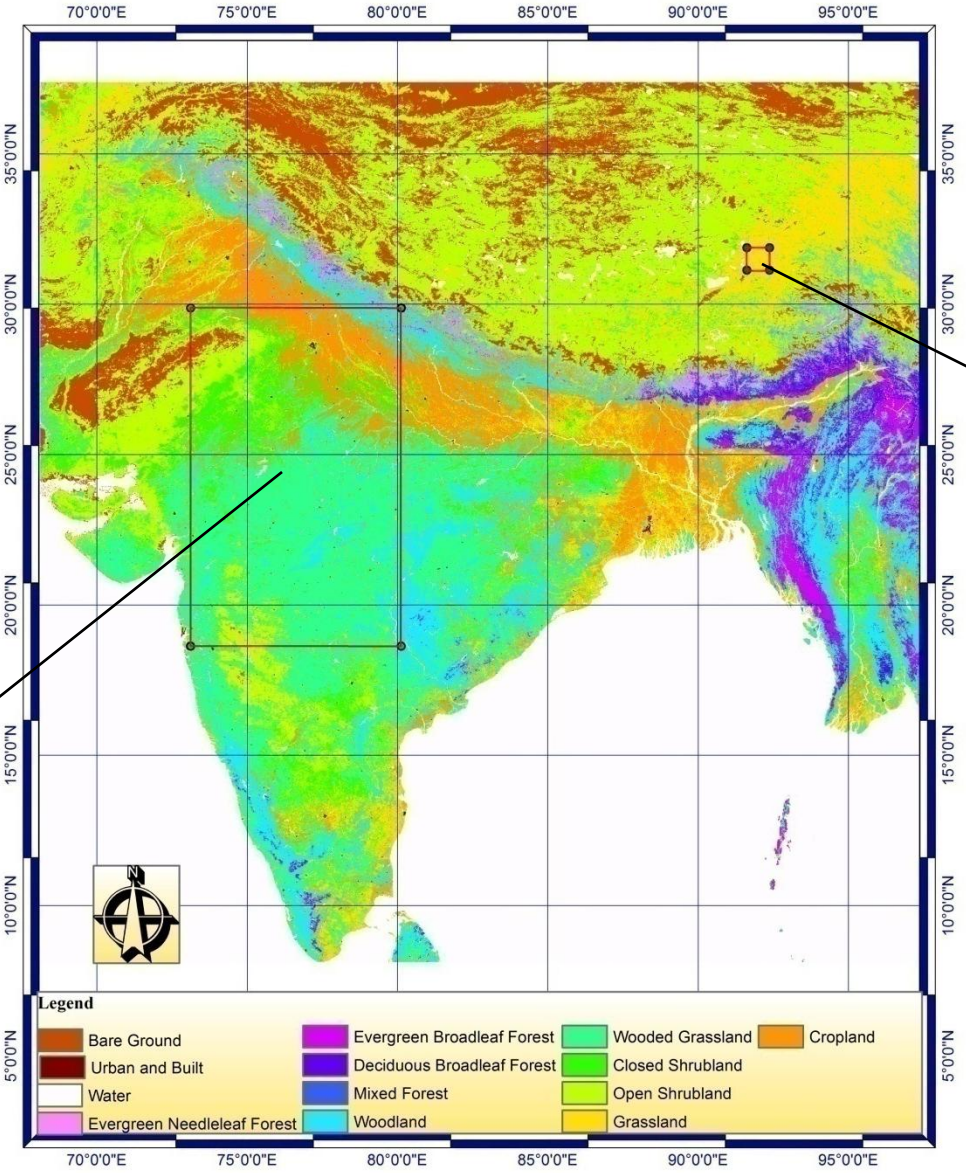


REPORTS

Regions of Strong Coupling Between Soil Moisture and Precipitation

The GLACE Team: Randal D. Koster,[1]* Paul A. Dirmeyer,[2] Zhichang Guo,[2] Gordon Bonan,[3] Edmond Chan,[4] Peter Cox,[5] C. T. Gordon,[6] Shinjiro Kanae,[7] Eva Kowalczyk,[8] David Lawrence,[9] Ping Liu,[10] Cheng-Hsuan Lu,[11] Sergey Malyshev,[12] Bryant McAvaney,[13] Ken Mitchell,[11] David Mocko,[10] Taikan Oki,[14] Keith Oleson,[3] Andrew Pitman,[15] Y. C. Sud,[1] Christopher M. Taylor,[16] Diana Verseghy,[4] Ratko Vasic,[17] Yongkang Xue,[17] Tomohito Yamada[14]





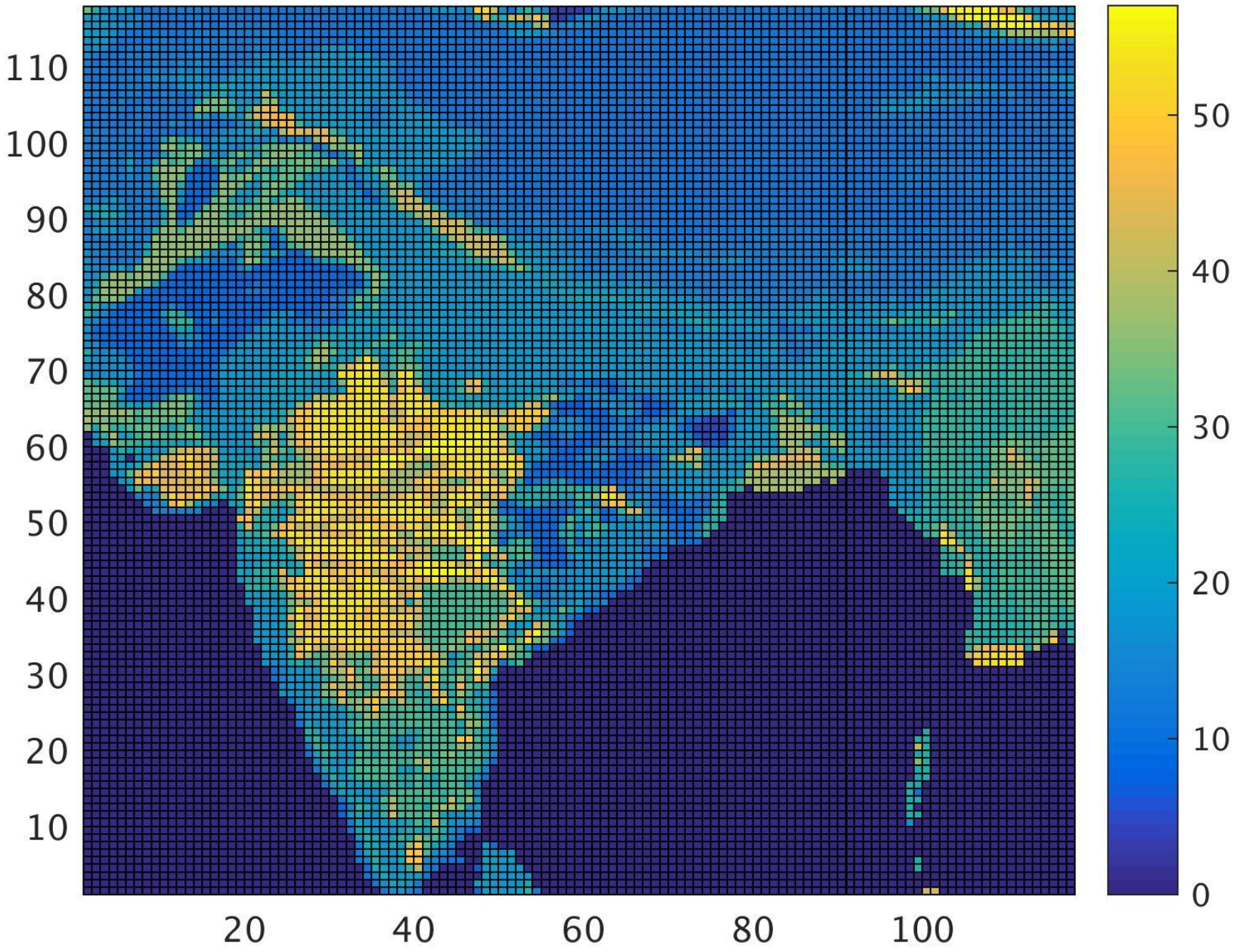
Domain 1

Domain 2

Study Region, with illustration of the UMD landcover classification and location of two sub-domain. (AVHRR 1981-1994)

RESULTS

[The results being shown are from the manuscript (which is under review) being submitted to an international journal.]


CLAY FRACTION*100
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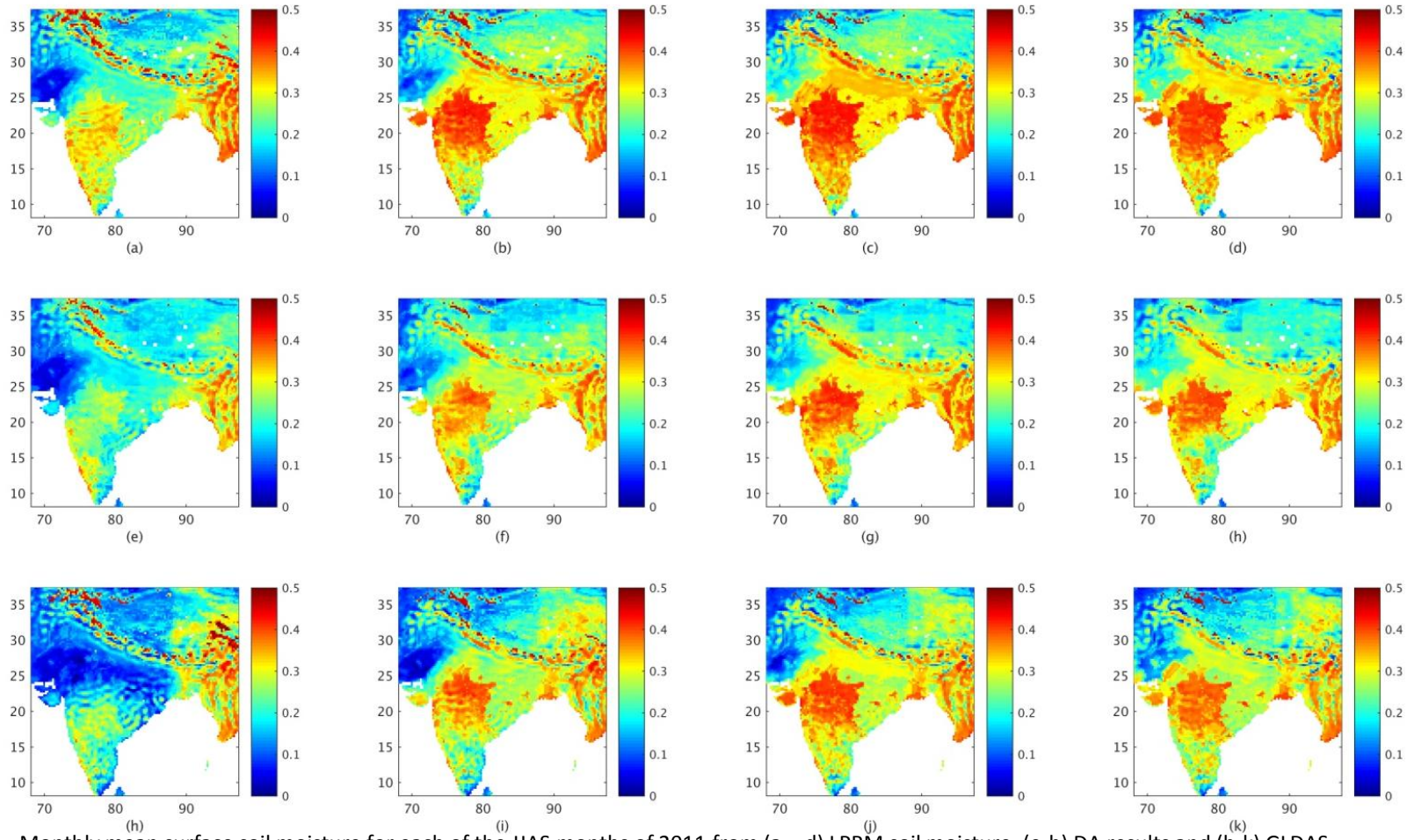
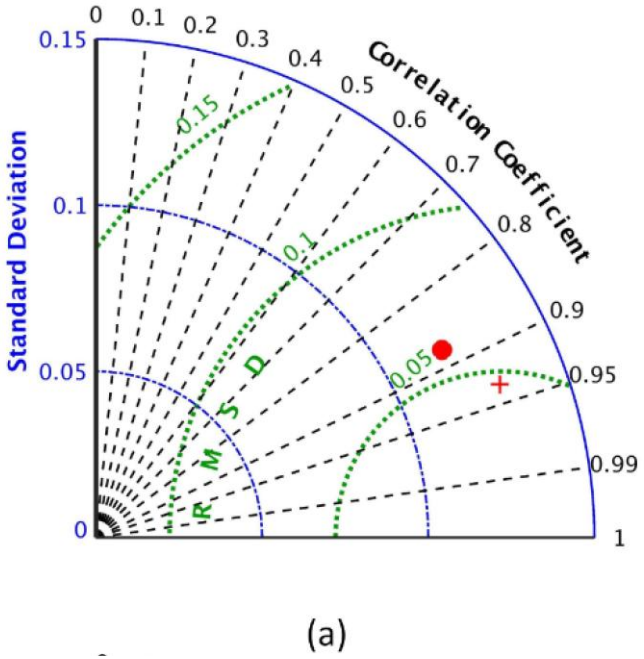
Monthly Mean SSM (JJAS, 2011)

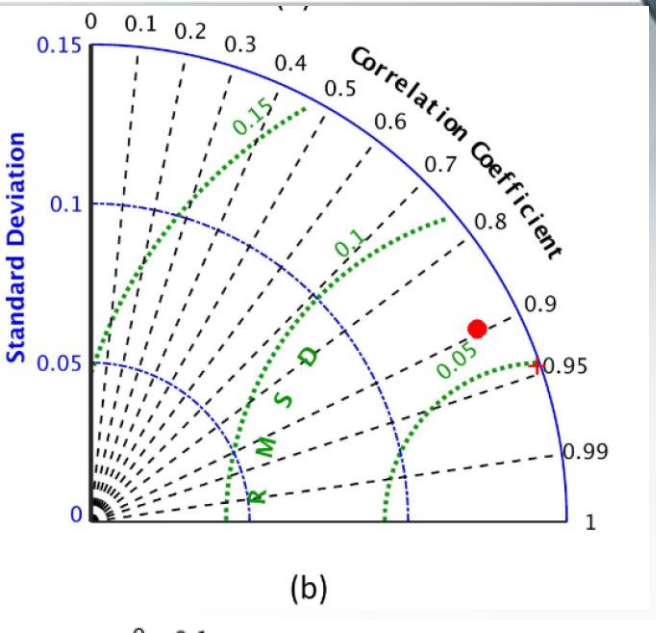


Monthly mean surface soil moisture for each of the JJAS months of 2011 from (a – d) LPRM soil moisture, (e-h) DA results and (h-k) GLDAS

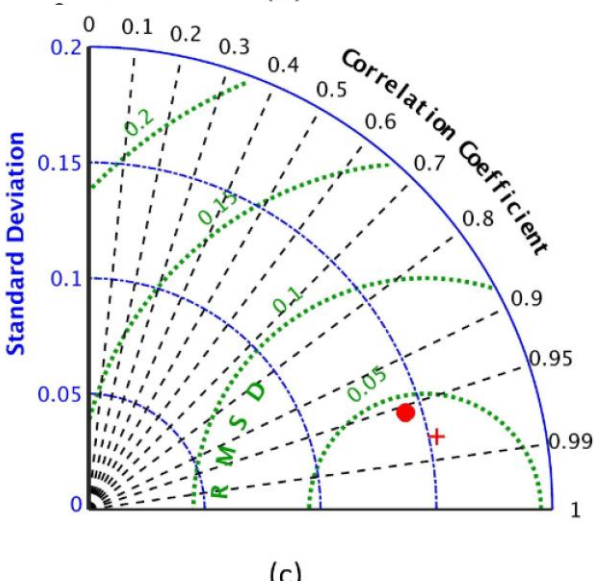
Taylor Plots



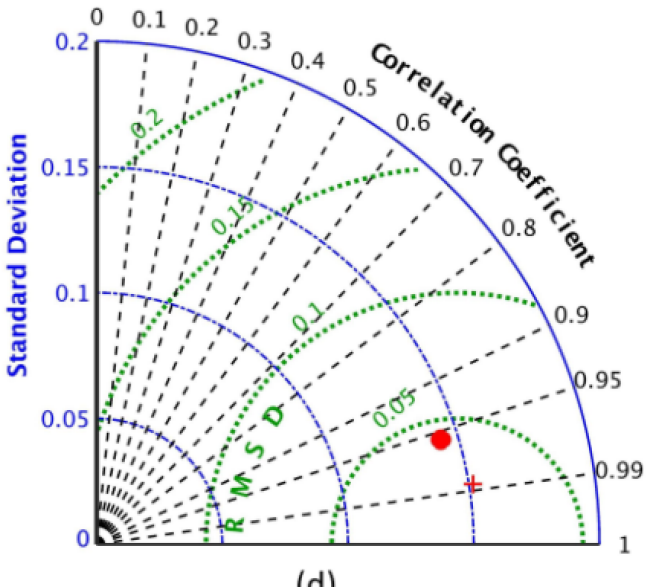
(a)



(b)

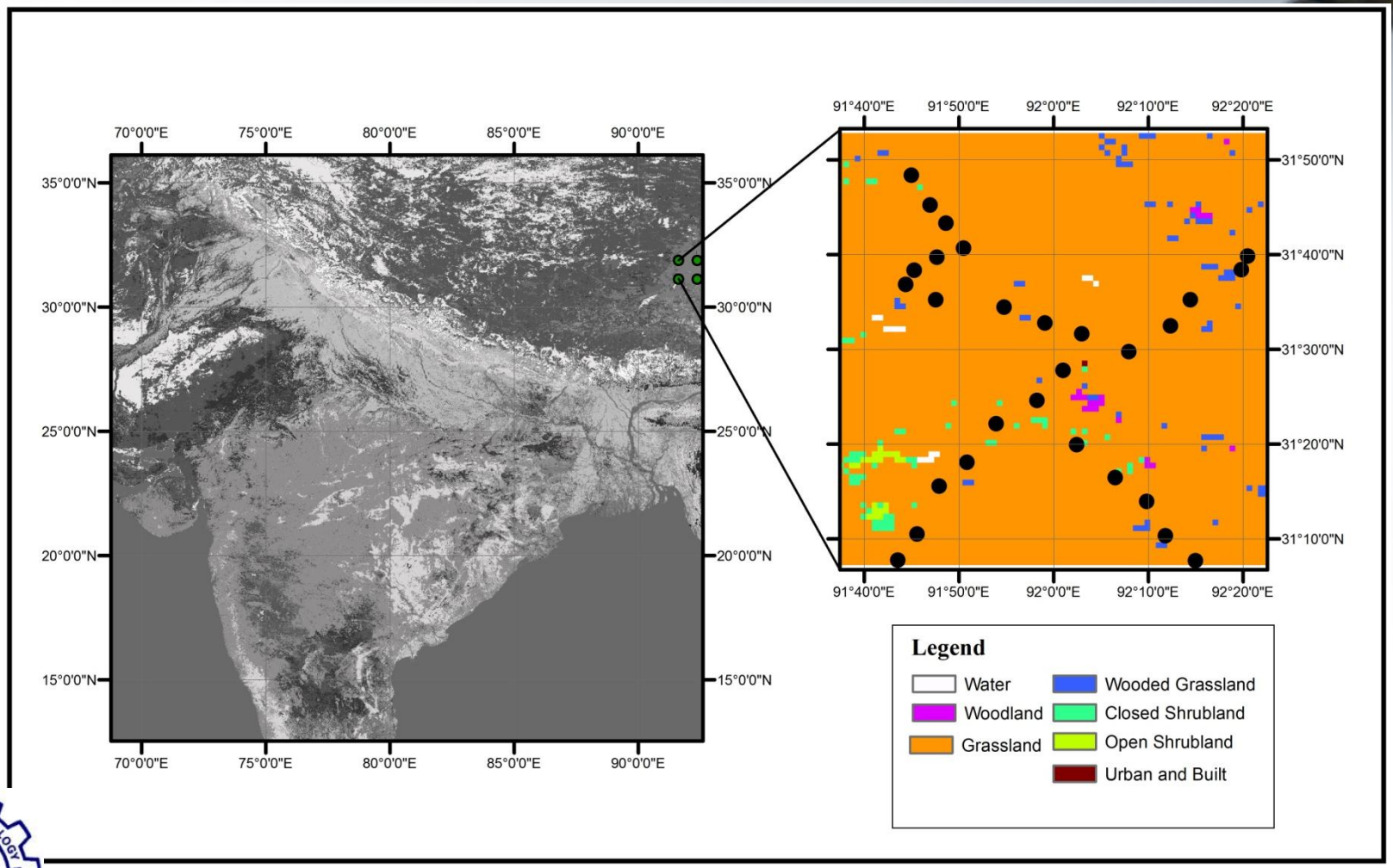


(c)



(d)

Domain 2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15°0'0"N
91°40'0"E
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92°0'0"E
92°10'0"E
92°20'0"E
31°50'0"N
31°40'0"N
31°30'0"N
31°20'0"N
31°10'0"N
Legend
Water
Woodland
Grassland
Wooded Grassland
Closed Shrubland
Open Shrubland
Urban and Built

Why Microwave Brightness Temperature (Tb)

- Passive Microwave (PMW) remote sensing at lower frequency are particularly sensitive to soil moisture than its physical temp.
- The low frequency channels are also well known for low interference from vegetation , atmosphere and clouds.
- Current global remote sensing soil moisture products have considerable biases in many regions, due to uncertainties in specified parameters .
- CHALLENGES !!!

Optimization…

- **Parameters to be Opimized**:-

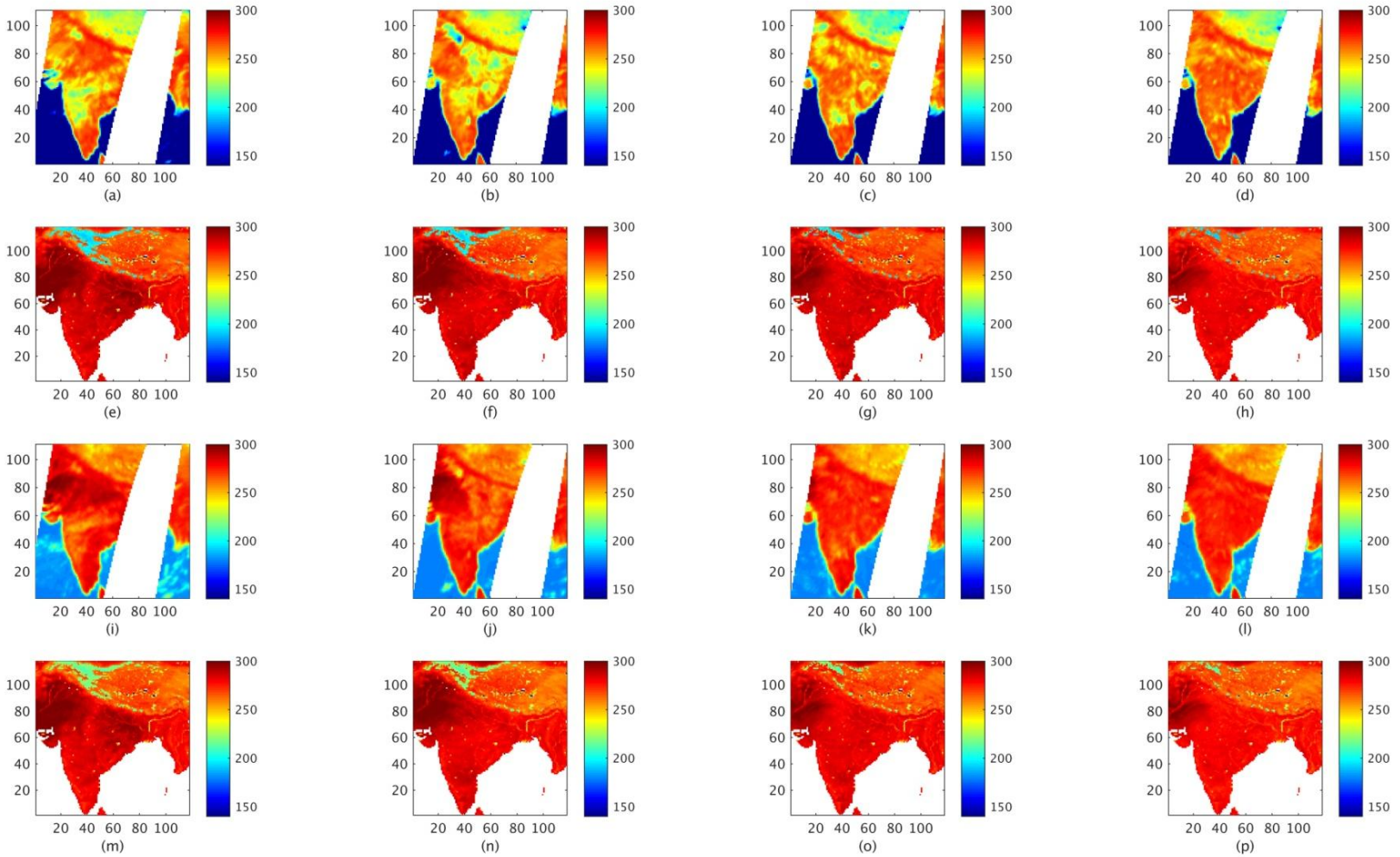
Five Parameters:-

1. Parameters describing vegetation scattering of microwaves.
2. Parameter describing surface roughness and its angular dependence.

- **Particle Swath Optimization (PSO; Kennedy and Eberhart 1995)**

- It iteratively minimizes predefined objective function.
- Algorithm modifies the parameter sets within the predefined range.

Simulation Results



Future work

- To couple this land data assimilation system to a numerical weather forecast system .
- To utilize the improved soil moisture estimation from DA for drought /flood risk estimation.
- To investigate the impact of the error characterization on assimilation efficiency.


THANK
YOU