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A Joint Data Assimilation Method for Improving Soil Moisture Estimates

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Assimilation of Soil Moisture Data

- Data assimilation
- Assimilation of satellite soil moisture
- Analysis tool: Genetic algorithms

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Joint Data Assimilation Framework

Designed a joint data assimilation (DA) framework for brightness temperature (TB) and soil moisture

- Merge two soil moisture estimates:
  - Satellite soil moisture (LPRM)
  - Land surface scheme (CLASS)
- Validation with in-situ dataset

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Joint Data Assimilation Framework

Assimilate satellite TB into LPRM: Output = satellite soil moisture

Assimilate satellite soil moisture into CLASS

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Data Assimilation Objectives

$$Bias = \frac{\sum_{i=1}^{k}(x_i - x_{o,i})}{k}$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^{k}(x_i - x_{o,i})^2}{k}}$$

$$J(x_i) = \sum_{i=1}^{k}\left\{\frac{(x_i - x_{b,i})^2}{\sigma_{b,i}^2} + \frac{(x_i - x_{o,i})^2}{\sigma_{o,i}^2}\right\}$$

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Assimilation of Satellite TB Into LPRM

- Observed TB from satellite (AMSR-E)
- Simulated TB from LPRM
- Merge observed and simulated TBs
  - Incorporate errors from both TB estimates

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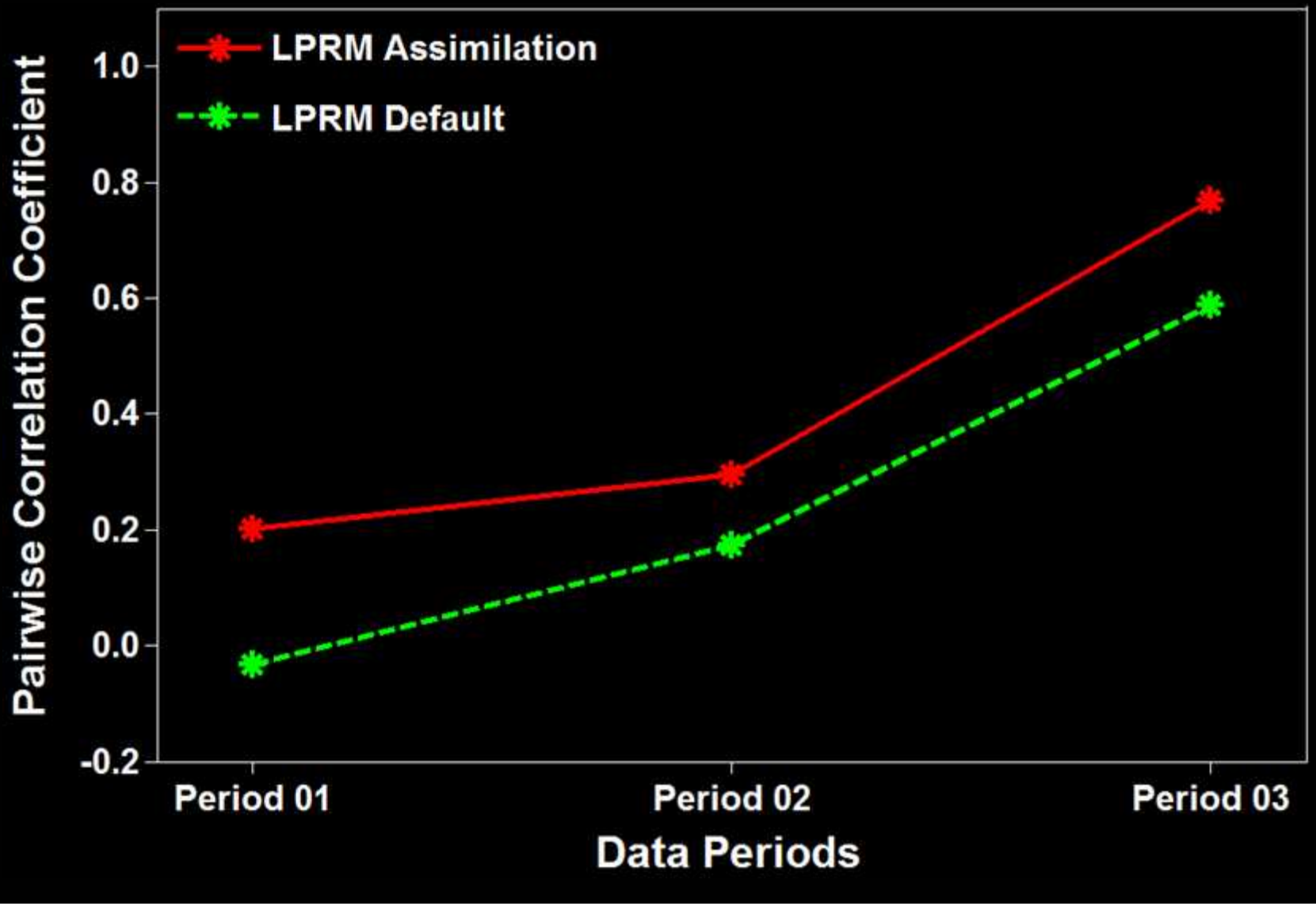
Comparison Between Assimilation and LPRM Default



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Assimilation of Satellite Soil Moisture Into CLASS

- Satellite soil moisture from LPRM
- Simulated soil moisture from CLASS
- Merge two soil moisture estimates:
  - Incorporate errors from both estimates

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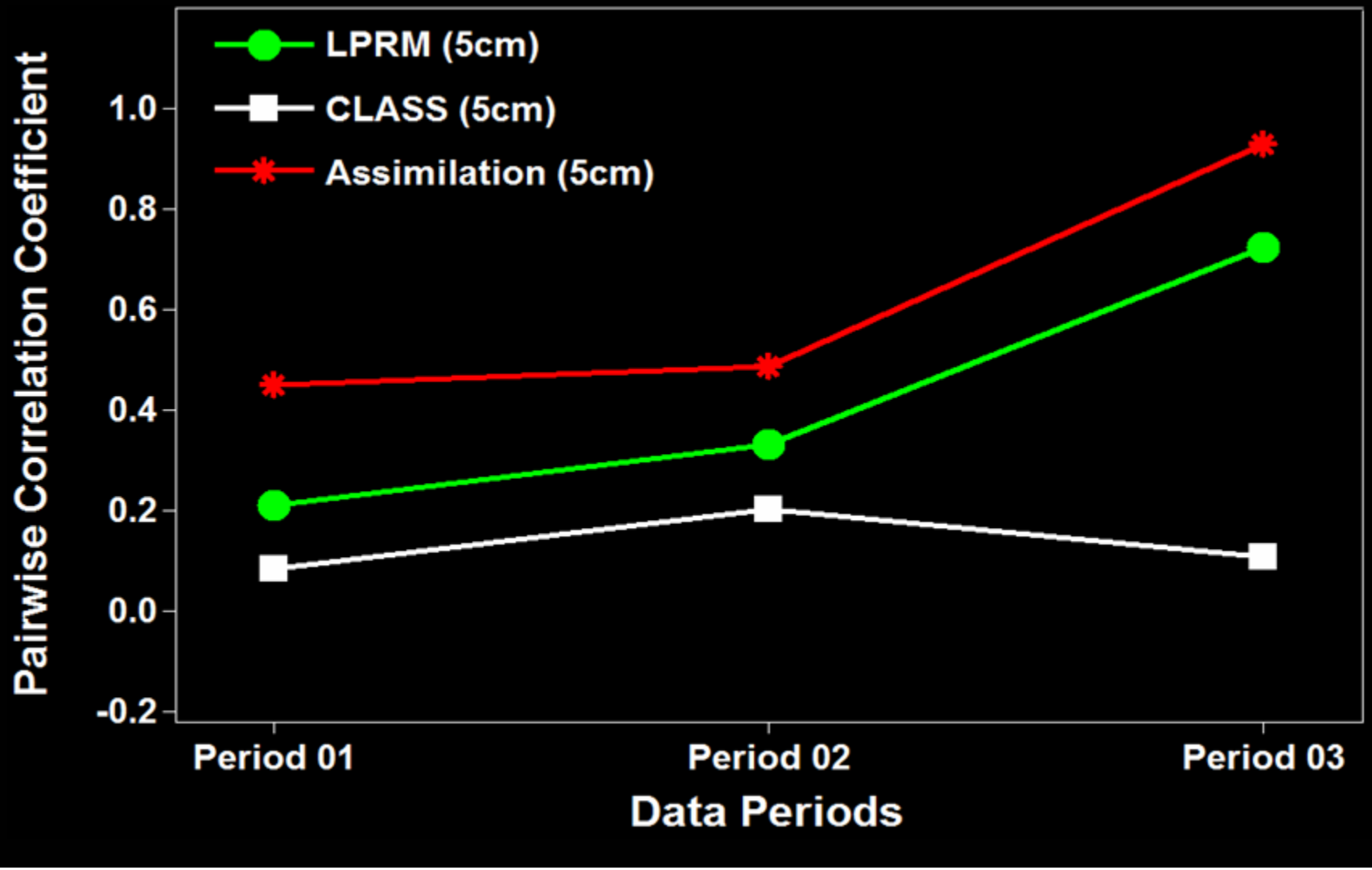
Comparison Between Soil Moisture Estimates



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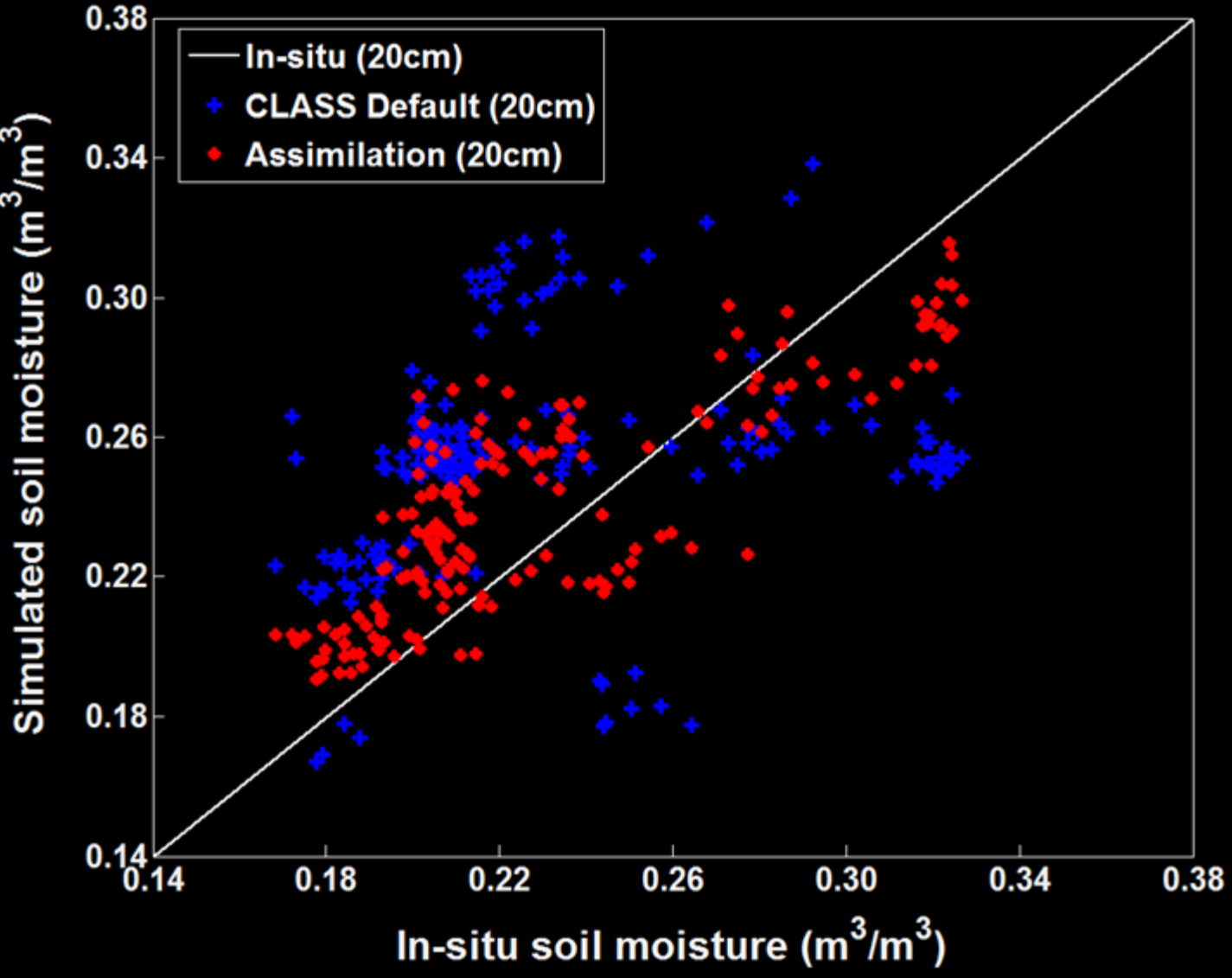
Validation for Soil Moisture @ 20cm Depth



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Summary & Conclusion

- Improve soil moisture estimate by assimilating satellite TB into LPRM
- Generate an improved soil moisture through a merger between satellite soil moisture and CLASS
- Continuous updating for real-time soil moisture assimilation