Detecting Soil Moisture by Combining MODIS/Landsat and In-situ Measurements Over Cropland of Iowa State, USA

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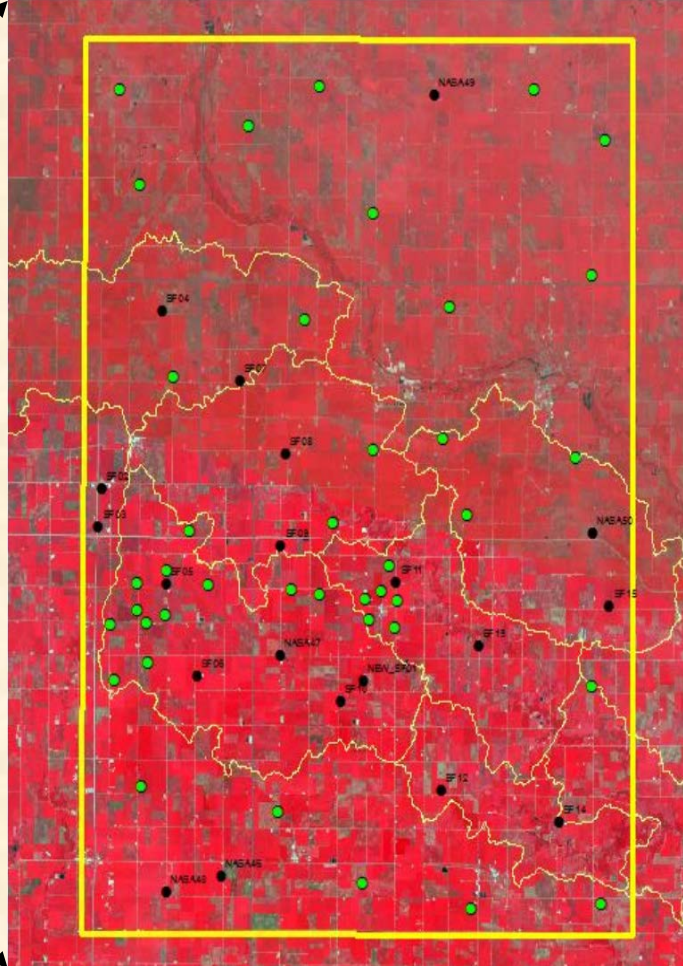
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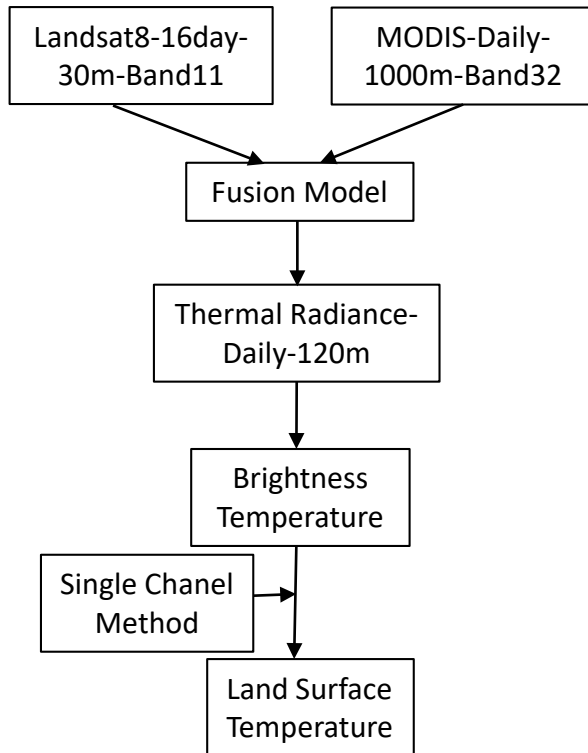Email: *cxu8@masonlive.gmu.edu

Supporting SMAP Validation Tasks

Study Area

Methods

LST retrieval method

$$T_s = \gamma[\varepsilon_i^{-1}(\psi_1 B_i + \psi_2) + \psi_3] + \delta$$

$$\gamma = \left\{ \frac{C_1 B_i}{T_i^2} \left[\frac{\lambda_i^4}{C_2} B_i + \lambda_i^{-1} \right] \right\}^{-1}$$

$$\delta = -\gamma * B_i + T_i$$

SSM retrieval method

Thermal inertia method

$$ATI = \frac{1 - \alpha}{\Delta T}$$

$$SM = a_0 ATI + a_1$$

$$SM' = SM * f(LST, NDVI)$$

α- Surface Albedo

ΔT- Diurnal Temperature Range

$$NDVI^* = \frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

Universal triangle method

$$LST^* = \frac{LST - LST_{min}}{LST_{max} - LST_{min}}$$

$$NDVI^* = \frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

$$SM = a_{00} + a_{10}NDVI^* + a_{20}NDVI^{*2}$$
$$+ a_{01}T^* + a_{02}T^{*2}$$
$$+ a_{11}NAVI^*T^* + a_{22}NDVI^{*2}T^{*2}$$
$$+ a_{12}NDVI^*T^{*2} + a_{21}NDVI^{*2}T^*$$

$$SM' = SM * f(LST)$$

Conclusions

- The improved data fusion method can effectively generate remote sensing data at both fine spatial and temporal resolution, and for future LST retrieval. LST and NDVI can be combined for SSM monitoring during growing seasons through thermal method.

- Surface soil moisture can be retrieved at both fine spatial and temporal resolutions through the fusion method.

Merits and Limitations

- But study area includes agriculture type only, whether this method will be applied to other land cover type is not clear yet.

- Thermal methods can only measure the surface soil moisture, don't have penetration.

- Thermal methods will be influenced by weather conditions a lot, (eg. Clouds, rain).