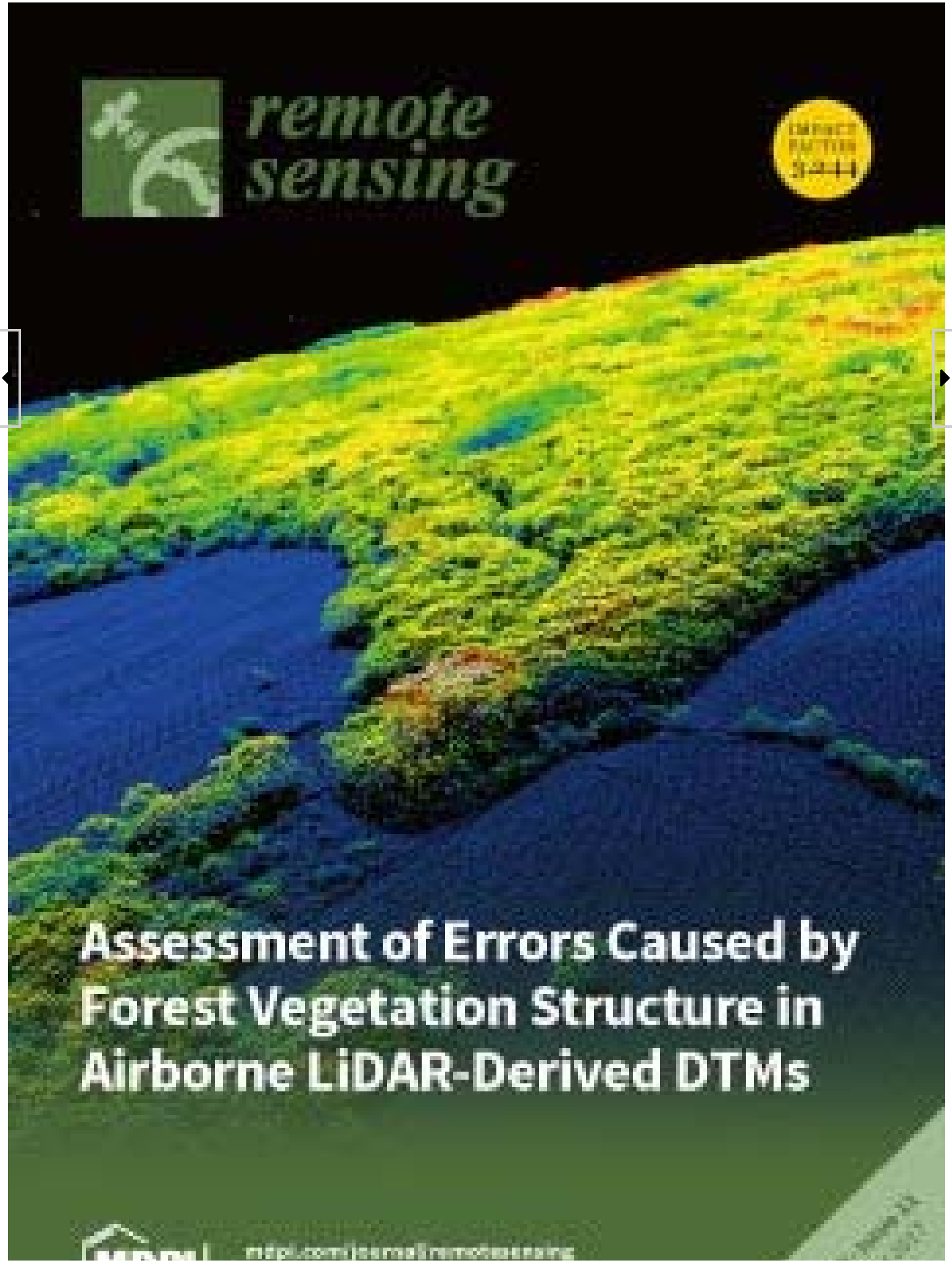
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Data Assimilation to Extract Soil Moisture Information from SMAP Observations

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Received: 3 October 2017 / Revised: 3 November 2017 / Accepted: 9 November 2017 / Published: 17 November 2017

(This article belongs to the Special Issue Retrieval, Validation and Application of Satellite Soil Moisture Data (/journal/remotesensing/special_issues/soilmoisture))

Abstract

This study compares different methods to extract soil moisture information through the assimilation of Soil Moisture Active Passive (SMAP) observations. Neural network (NN) and physically-based SMAP soil moisture retrievals were assimilated into the National Aeronautics and Space Administration (NASA) Catchment model over the contiguous United States for April 2015 to March 2017. By construction, the NN retrievals are consistent with the global climatology of the Catchment model soil moisture. Assimilating the NN retrievals without further bias correction improved the surface and root zone correlations against in situ measurements from 14 SMAP core validation sites (CVS) by 0.12 and 0.16, respectively, over the model-only skill, and reduced the surface and root zone unbiased root-mean-square error (ubRMSE) by 0.005 $m^3 m^{-3}$ and 0.001 $m^3 m^{-3}$, respectively. The assimilation reduced the average absolute surface bias against the CVS measurements by 0.009 $m^3 m^{-3}$, but increased the root zone bias by 0.014 $m^3 m^{-3}$. Assimilating the NN retrievals after a localized bias correction yielded slightly lower surface correlation and ubRMSE improvements, but generally the skill differences were small. The assimilation of the physically-based SMAP Level-2 passive soil moisture retrievals using a global bias correction yielded similar skill improvements, as did the direct assimilation of locally bias-corrected SMAP brightness temperatures within the SMAP Level-4 soil moisture algorithm. The results show that global bias correction methods may be able to extract more independent information from SMAP observations compared to local bias correction methods, but without accurate quality control and observation error characterization they are also more vulnerable to adverse effects from retrieval errors related to uncertainties in the retrieval inputs and algorithm. Furthermore, the results show that using global bias correction approaches without a simultaneous re-calibration of the land model processes can lead to skill degradation in other land surface variables. View Full-Text (/2072-4292/9/11/1179/htm)

Keywords: data assimilation (/search?q=data assimilation); SMAP soil moisture (/search?q=SMAP soil moisture); neural networks (/search?q=neural networks); bias correction (/search?q=bias correction)

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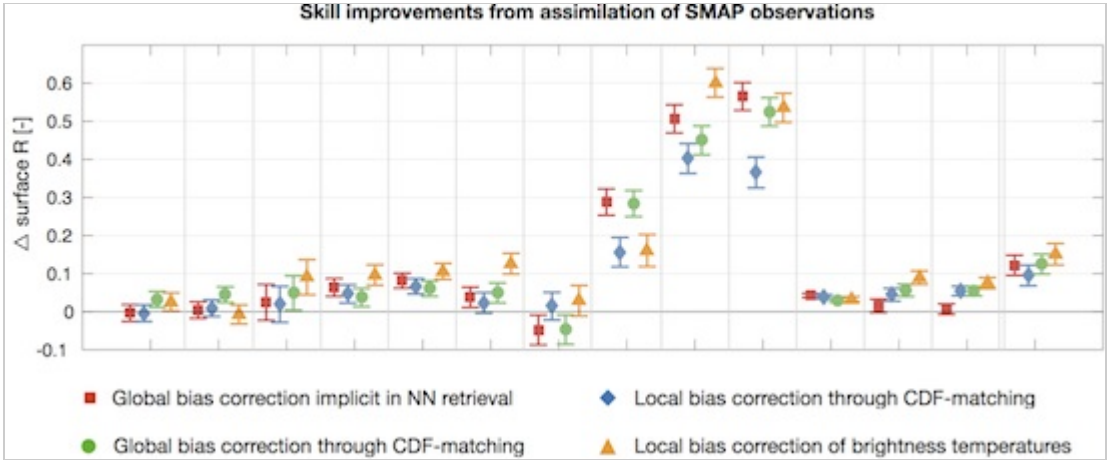

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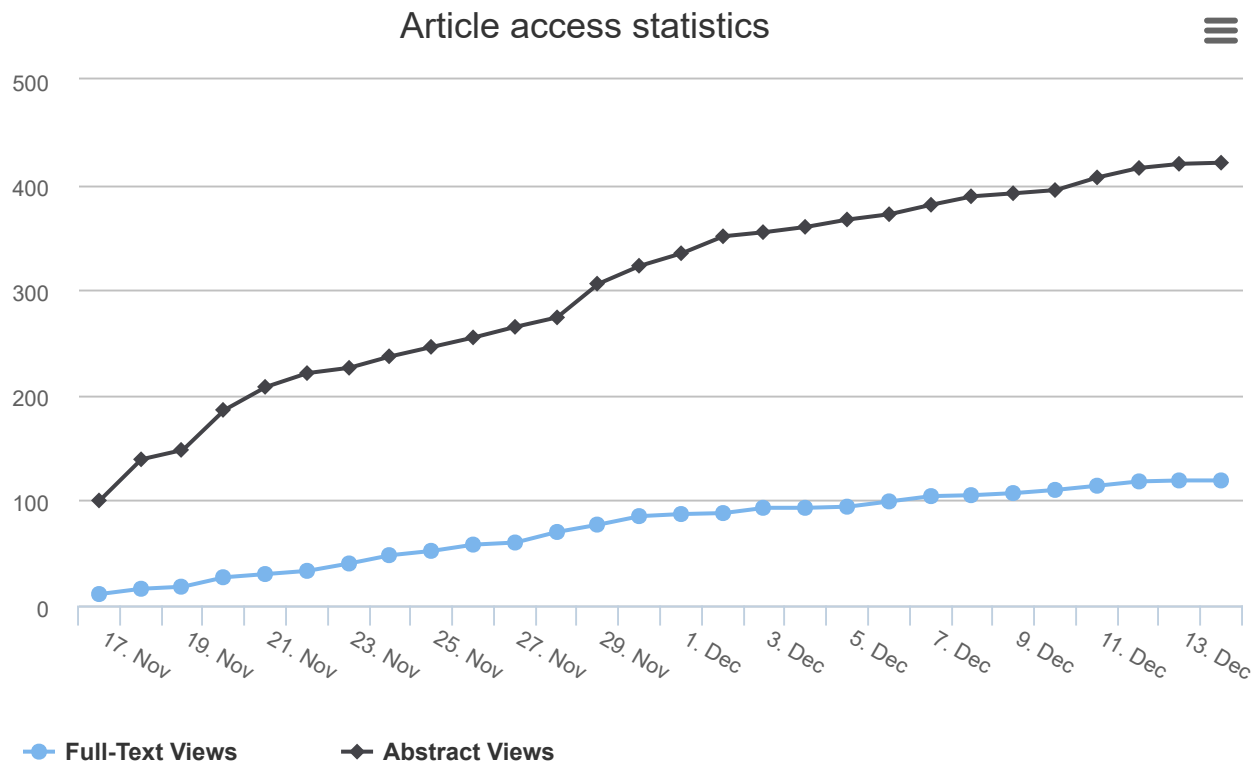

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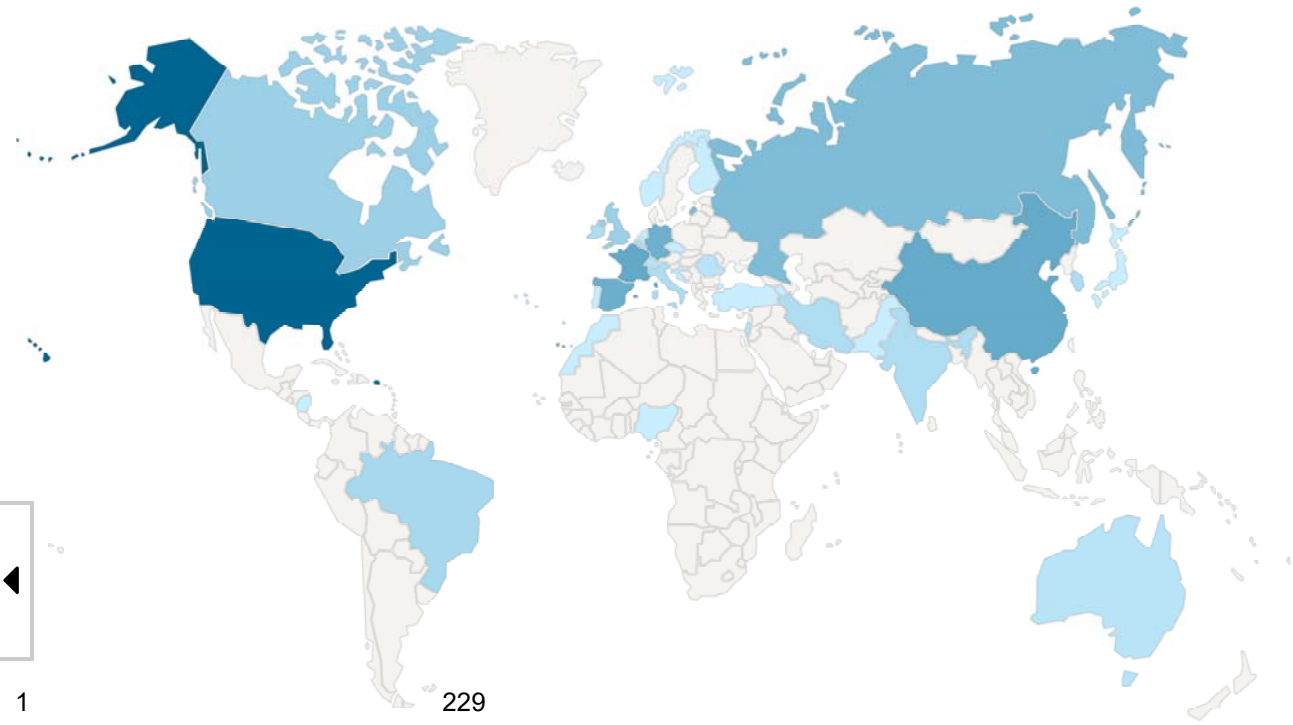

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