Assessment of the JULES model surface soil moisture using in situ observations over the Brazilian North East semiarid region

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May 2020



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Conclusions



Site and measurements	Jules	Results	Conclusions
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Outline			





3 Results

- Jules evaluation
- Modeled in situ soil moisture data

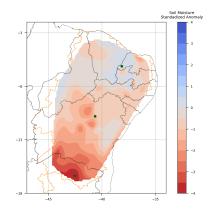
4 Conclusions





Site and measurements	Jules	Results	Conclusions
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Objectives			

- Compare superficial soil water from observations with Jules land surface model
- Derive relationships between model and measurements for applications on:
 - Generate modeled soil moisture data
 - Characterize long-term trends of soil water and drough events



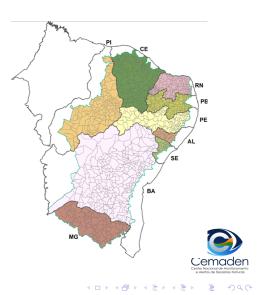
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Site and measurements	Jules	Results	Conclusions
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Brazilian Semiarid			

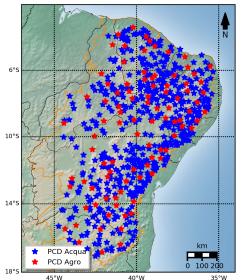
- Covering 10 states
- 800,000 km² (10% Brazilian territory)
- 23 million inhabitants
- Caatinga (unique ecosystem with great biodiversity)





Site and measurements	Jules	Results	Conclusions
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Cemaden's network			

- Monitoring of rainfall and soil moisture at 595 stations (PCD Acqua, 10 and 20 cm)
- Four depths in 95 stations +
- Air temperature, relative humidity, wind speed, solar radiation (PCD Agro)
- Hourly data via cellular network
- "Rural network"





Site and measurements	Jules	Results	Conclusions
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Database			

- 360 stations
- Data coverage from 2015 to 2019
- 2 months to 4 years of data
- Physical consistency (other depths and rainfall)

Find Research Data My Datasets 1	New Dataset FAQ					_
This is your published dataset.						
A soil moisture da	ataset over th	ne Brazil	ian sen	niarid re	egion	
Published 20 Sep 2019 Version 1 DOI:1					0	
Contributor(s): Marcelo Zeri, José Maria G	losta, Domingos Urbano, Lue	Adriana Cuartas, A	ndré Ivo, Jase M	arengo, Regina C.	S. Alvalá	
Description of this data				Latest versi	on	
This dataset cantains soil maistare measured o retwork of 575 automatic around stations was				Version 1	2029-08-20	-
Natural Disasters (CEMMDEN) with the aim of affected Brazilian region - the Brazilian Semiar	supporting monitoring activities o	wer the driest and rea	st draught-	Published: 2319-0	9-20	
agriculture. Soil volumetric water content is obtained by me				Create	new vestige	
minimizes salinity and textural effects (model if calibration, resulting in a precision of approxim	ately 20.03 m3 m-3. The network	stations collected me	destruction	This will create a d	raft of Version 2	
hourly at 0.1 m and 0.2 m depths; a subset of s measurements at 0.1 m, 0.2 m, 0.3 m, and 0.4	n depths.			DOI: 10.17632/wik	Sirkpivg.1	
A quality control process was applied and select August 2015 to April 2019. Data availability is a some stations. Gaps caused by instrument mail	pproximately 2-year-long on aver-	ige, reaching up to 4-	rear-long in	Ote this dataset		
tome tracover. Gapt caused by intraneet man Validation and consistency were assessed by on collected by each station (not available in this d.	riparing trends in solivertical nei	ghbor data and rainfa	I records		Costa, José Maria;	
level, were kept on the database. Each file available here contains the time series				Adriana; No, A	ingos; Cuartas, Luz Indré; Marengo,	
geographic coordinates, and the soil texture (Is distarbed samples collected at each site. Data 6	etion of sand, silt and elay). Sell i	effernation was derive	d from 1 kg		egina C. S. (2019), re dataset over the	
summarising stations information is found in t on methodology and site can be found in Zeri s	he file Stations.xlox. First applicati	ons of this dataset an		Brazilian semi Mendeley Dat		
					L1N33/MASHavg.3	
Experiment data files		Dewn	load all files (2)			
m				Statistics	Downloads: 6	
Defa.cly		74 MB 🕥		Viewe 68	LOWING B	
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https://doi.org/10.3390/w10101421		article is derived	From this dataset 🕕	CC BY 4.0	Loss ner	
doi:10.3390/w18101421						4

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¹Zeri, Marcelo; Costa, José Maria; Urbano, Domingos; Cuartas, Luz Adriana; Ivo, André; Marengo, José Maria; Urbano, Domingos; Cuartas, Luz Adriana; Ivo, André; Marengo, José Maria; de Banka Materia Maria (Regina C. S. (2020), "A soil moisture dataset over the Brazilian semiarid region", Mendeley Data, v2 Maria (Marcelo; 10.17632/xrk5rfcpvg.2

Site and measurements	Jules	Results	Conclusions
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Jules Land Surfa	ace Model		

• JULES Land Surface Model (the Joint UK Land Environment Simulator)

"Skillful seasonal prediction of key carbon cycle components: NPP and fire risk"

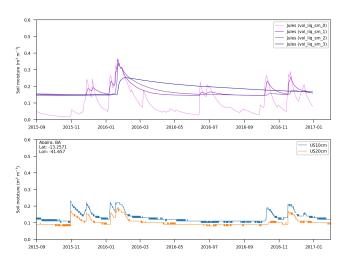
Philip Bett, Karina Williams, Chantelle Burton, Adam Scaife, Andrew Wiltshire, Richard Gilham https://eartharxiv.org/29ve5/

- Runs from 1979 to 2016
- Overlap with first full year of measurements





Site and measurements	Jules	Results	Conclusions
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Original data			

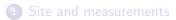




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Site and measurements	Jules	Results	Conclusions
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Jules evaluation

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4 Conclusions





Jules

Index of agreement (d)

Iournal

Physical Geography >

Volume 2, 1981 - Issue 2

454 82 Views CrossRef citations to date Altmetric

Original Articles

ON THE VALIDATION OF MODELS

Cort I. Willmott

Pages 184-194 | Published online: 15 May 2013

G Download citation Attps://doi.org/10.1080/02723646.1981.10642213



Cort J. Willmott @, Scott M. Robeson, Kenji Matsuura

First published: 09 September 2011 | https://doi.org/10.1002/joc.2419 | Citations: 353

Brief history of the index of agreement 3.

The original form of Willmott's index of agreement (Willmott and Wicks, 1980; Willmott, 1981) was a specification of Equation (1). Willmott and Wicks used d to represent the index (rather than o) and we will follow their convention here. It (d) was a sums-of-squares-based measure, within which δ was the sum of the squared errors while μ was the overall sum of the squares of sums of the absolute values of two partial differences from the observed mean, $|P_i - \bar{O}|$ and $|O_i - \bar{O}|$. Thus, the form of the original index was

$$d = 1 - \frac{\sum_{i=1}^{n} [(P_i - \overline{O}) - (O_i - \overline{O})]^2}{\sum_{i=1}^{n} (|P_i - \overline{O}| + |O_i - \overline{O}|)^2}$$
(2a)

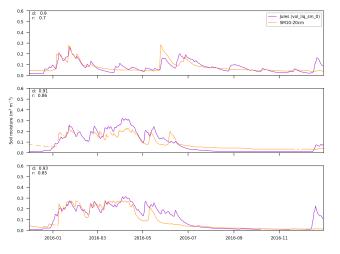
which simplifies to and is commonly written as

$$d = 1 - \frac{\sum_{i=1}^{n} (P_i - O_i)^2}{\sum_{i=1}^{n} (|P_i - \overline{O}| + |O_i - \overline{O}|)^2}$$
(2b)





Site and measurements	Jules	Results	Conclusions
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Jules and stations			

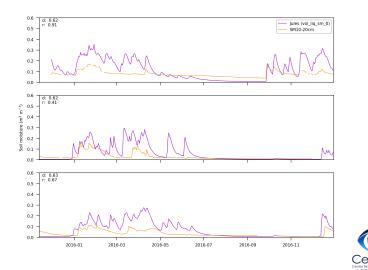






Site and mea	asurements	Jules 00	Results 000€0000000000	Conclusions 00



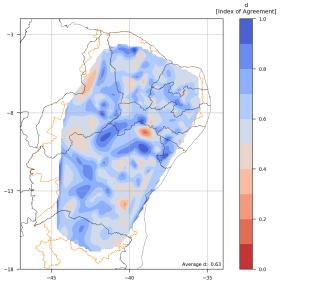




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Site and measurements	Jules	Results	Conclusions





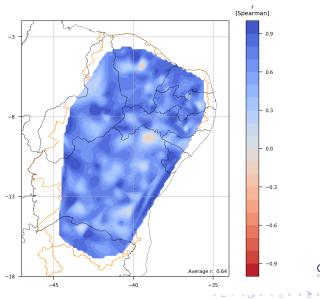


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Site and measurements	Jules	Results	Conclusions
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Correlation coefficient (r)



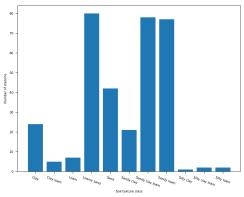


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Site and measurements	Jules	Results	Conclusions
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Statistics and soil texture class

- Fractions of sand, silt and clay
- USDA soil classification

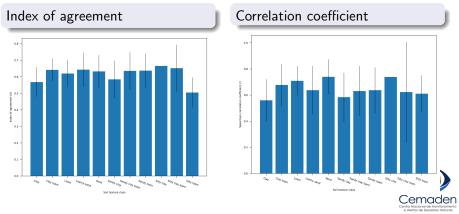








Good agreement and correlation between measurements and model for different soil texture classes



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Site and measurements	Jules	Results	Conclusions
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Outline			









Jules evaluation

Modeled in situ soil moisture data

4 Conclusions

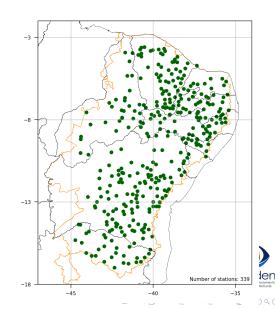




Site and measurements Jules Results Conclusions

Modeled in situ soil moisture data

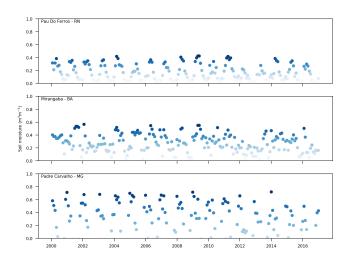
- Generate 1979-2016 soil moisture data
- Locations criteria:
 - Significant correlation (p-value)
 - Correlation higher than 0.6





Site and measurements	Jules	Results	Conclusions
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Soil moisture 2000-2016

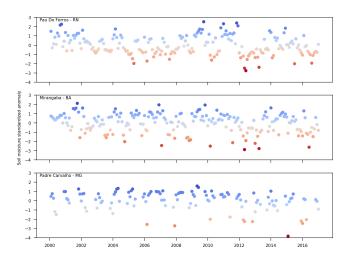






Site and measurements	Jules	Results	Conc
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Soil moisture 2000-2016 - Standardized anomaly



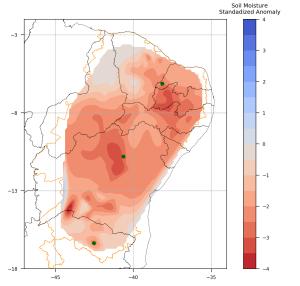


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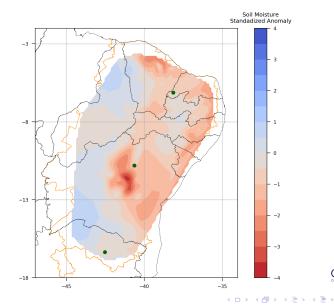
Standardized anomaly - April 2012





Site and measurements	Jules	Results	Conclusions
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Standardized anomaly - April 2013

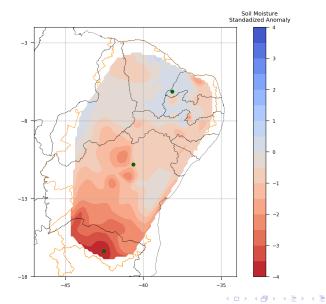




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Standardized anomaly - January 2015





Site and measurements	Jules	Results	Conclusions
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Conclusions			

- Good correlation between Jules superficial soil water and measurements
- Modeling of in situ data from 1979 to 2016
- Standardized soil moisture anomaly
 - Correct identification of drought events

Future steps

- Comparison with other metrics (SPI, NDVI)
- Integration with other metrics in a combined drought index



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and	measurements

Jules

Conclusions

Obrigado!





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²Umbuzeiro tree (*Spondias tuberosa L.*)



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