

What is Evapotranspiration?



INTRODUCTION

- GOES Evapotranspiration (ET) and Drought (GET-D) has been operationally generating ET and Evaporative Stress Index (ESI) data products at 8km resolution for NCEP NWP model validation and drought monitoring
- Continuation of GET-D operation using the current high-resolution thermal observations of the Advanced Baseline Imagers (ABI) from GOES-R series is in high demand
- This study introduces the architecture of the upgraded GET-D system, the core model (Atmosphere-Land Exchange Inversion model; ALEXI) and preliminary validation results of ET product

ALEXI MODEL

- Atmosphere-Land Exchange Inversion (ALEXI) model exploits the mid-morning rise in LST from GOES to deduce the land surface fluxes, including evapotranspiration
- Implementation of the two-source energy balance (TSEB) model which balances components of energy budgets for the soil and canopy components separately

SYSTEM OUTPUTS

Variables	Spatial Resolution	Unit	Format	Description
ET	2km	mm day ⁻¹	NetCDF, GRIB2, PNG	Daily ET
ET QC	2km	--	NetCDF, GRIB2	Quality control flag for retrieved ET
Fluxes	2km	W m ⁻² day ⁻¹	NetCDF, GRIB2, PNG	Daily short wave down, long wave down, long wave up and net radiation
Flux QC	2km	--	NetCDF, GRIB2	Quality control flag for retrieved fluxes

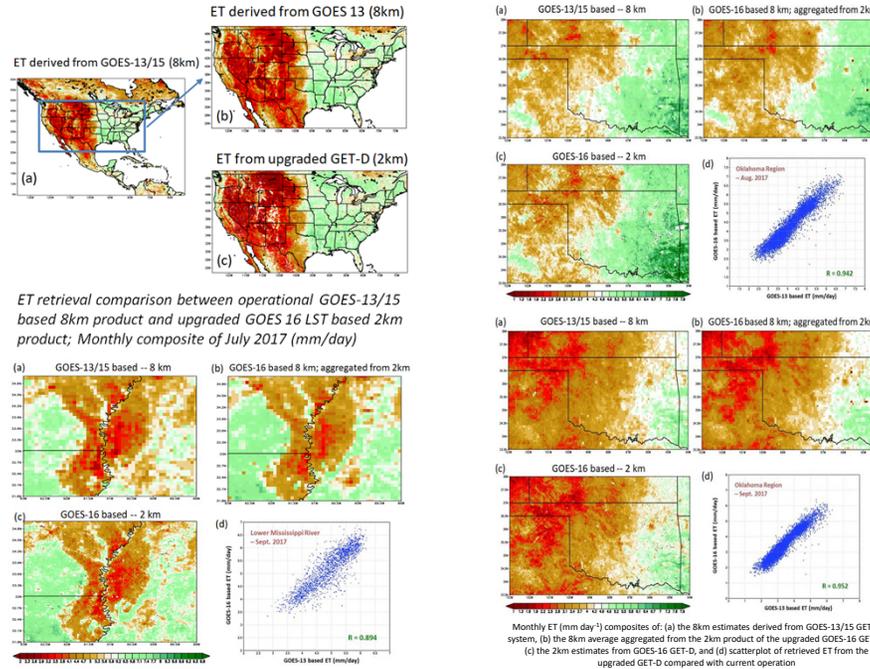
An Evapotranspiration Data Product at 2km resolution from NOAA GOES-16

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PRODUCT



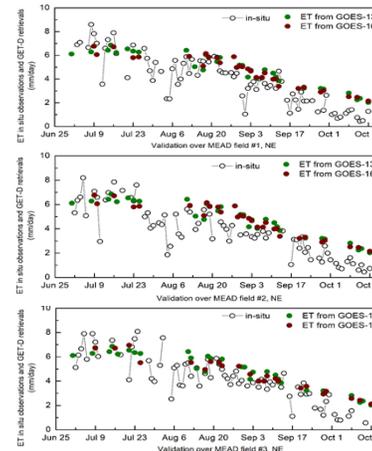
RESULTS



MEAD, NE Ameriflux site [S. Verma, 2010]
Rainfed and irrigation corn and soybean

Field #1: 41°09'54.2"N, 96°28'35.9"W
Field #2: 41°09'53.5"N, 96°28'12.3"W
Field #3: 41°10'46.8"N, 96°26'22.7"W

Error Statistics	Bias		RMSE		Correlation		N
	GOES-13 based	GOES-16 based	GOES-13 based	GOES-16 based	GOES-13 based	GOES-16 based	
Satellites							
MEADsite1	0.555	0.601	1.318	1.215	0.887	0.885	26
MEADsite2	0.561	0.546	1.094	0.906	0.860	0.885	23
MEADsite3	0.754	0.617	1.132	1.023	0.949	0.974	21
Average	0.623	0.588	1.181	1.048	0.899	0.914	



OBSERVATIONS

Name	Data Source	Resolution	Spatial Coverage	Description
GOES thermal observations	GOES-R	2km	Full Disk CONUS	Primary option: Channel 13 of GOES-16 and GOES-17 ABI L1b Radiance product (ABI-L1b-RadF) Second option: GOES LST product (OR_ABI-L2-LS1C)
Clear Sky Mask	GOES-R	2km	Full Disk	GOES-R Clear Sky Mask product (OR_ABI-L2-ACMF)
Insolation	GSIP GOES16 insso	0.125° 2km	North America	GSIP L2 real time insolation; Insolation product from GOES16
Vegetation Index	VIIRS	0.036°	Global	NESDIS GVF (Inverted to LAI)
Air temperature	NARR/CFS	0.3°/0.5°	NA/Global	Surface and pressure level profiles
Specific Humidity	NARR/CFS	0.3°/0.5°	NA/Global	Surface and pressure level profiles
Geopotential height	NARR/CFS	0.3°/0.5°	NA/Global	Surface and pressure level profiles
Wind speed	NARR/CFS	0.3°/0.5°	NA/Global	Surface
Downwelling longwave radiation	NARR/CFS	0.3°/0.5°	NA/Global	Surface
Solar zenith	GOES-R	2km	Full Disk	GOES-R solar zenith angles
View zenith	GOES-R	2km	Full Disk	GOES-R view zenith angle
Snow Mask	IMS	24 km	Northern Hemisphere	NOAA IMS Daily Northern Hemisphere Snow and Ice Analysis

CONCLUSIONS

- The GET-D system has been upgraded successfully to generate ET at much improved spatial resolution of 2km over CONUS using GOES-16 observations
- The comparison proves ET estimates from the upgraded GET-D system to be very consistent with the current operational products
- The spatial correlation between the two products reaches 0.946 averaged over CONUS domain for the studying period
- Upgraded GET-D is validated against MEAD in situ observations
- Accuracy of the new GET-D ET product is satisfactory with the bias of 0.588 mm/day and the correlation of 0.914 averaged from three Mead sites

Fang, L.; Zhan, X.; Schull, M.; Kalluri, S.; Laszlo, I.; Yu, P.; Carter, C.; Hain, C.; Anderson, M. Evapotranspiration Data Product from NESDIS GET-D System Upgraded for GOES-16 ABI Observations. *Remote Sens.* **2019**, *11*, 2639.