An Evapotranspiration Data Product from NOAA GOES-16 and 17

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ABI on GOES-16/17 vs Heritage NESDIS GET-D Product System ET from GET-D Update with GOES-16/17 Summary and Next Steps



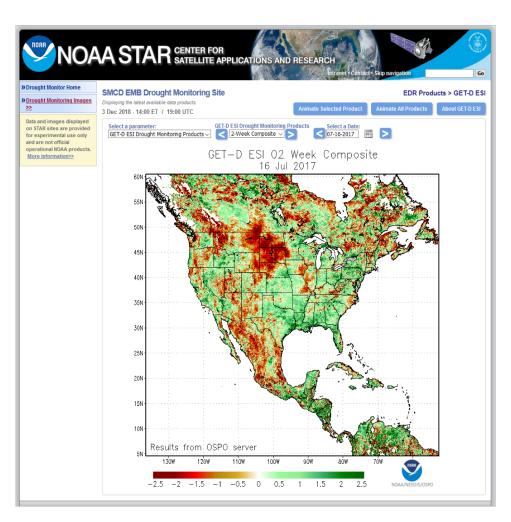
Advanced Baseline Imager (ABI) on GOES-16/17 vs its Heritage

	ABI	IMAGER
Spectral Bands	16	5
Spatial Resolution	0.65 μ m visible - 0.5 km Other visible/NIR - 1 km Bands (> 2 μ m) – 2 km	~1 km NA ~4 km
Temporal Resolution	Full Disk - 15 min. CONUS – 5 min. Mesoscale – 0.5 min.	Scheduled 3 hrs ~15 min. NA



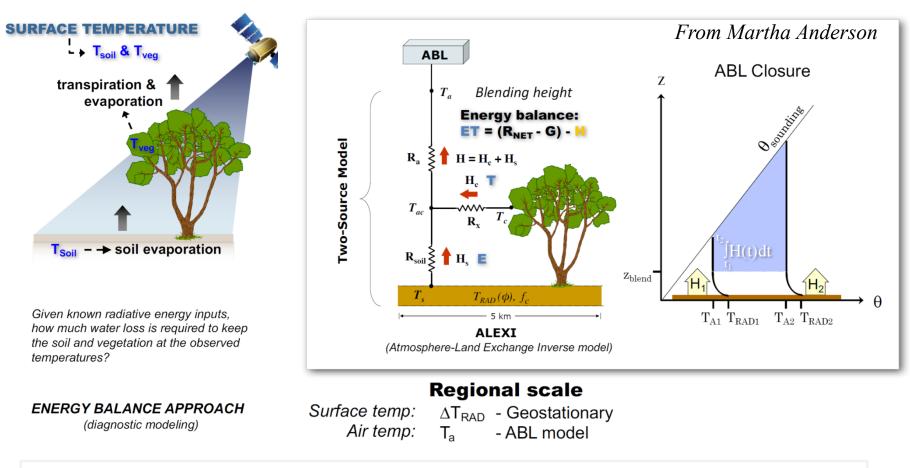
NESDIS GOES Evapotranspiration and Drought Product System (GET-D)

- Regional daily ET at 8km has been generated from GOES-13 and GOES-15 thermal infrared (TIR) data via GET-D using the Atmosphere-Land Exchange Inversion (ALEXI) model
- Daily ET is converted to Evaporative Stress Index (ESI) that represents soil moisture status
- Negative ESI is used to monitor drought early warning and occurrence



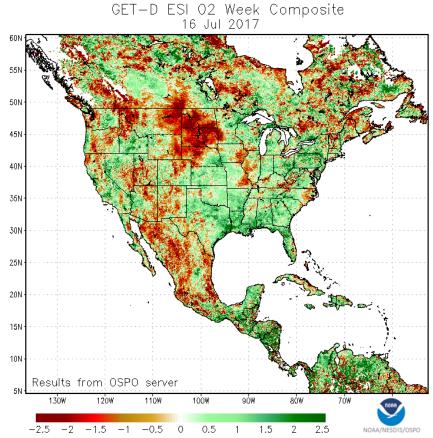


Atmosphere-Land Exchange Inversion model (ALEXI)



- ALEXI model exploits the mid-morning rise in LST from GOES to deduce the land surface fluxes, including evapotranspiration ET
- A simple evaporative stress index (ESI), the ratio of actual-to-potential ET (f_{PET}), can then be computed from ALEXI ET estimates to represent surface soil moisture status; Negative ESI anomaly may indicate drought occurrence

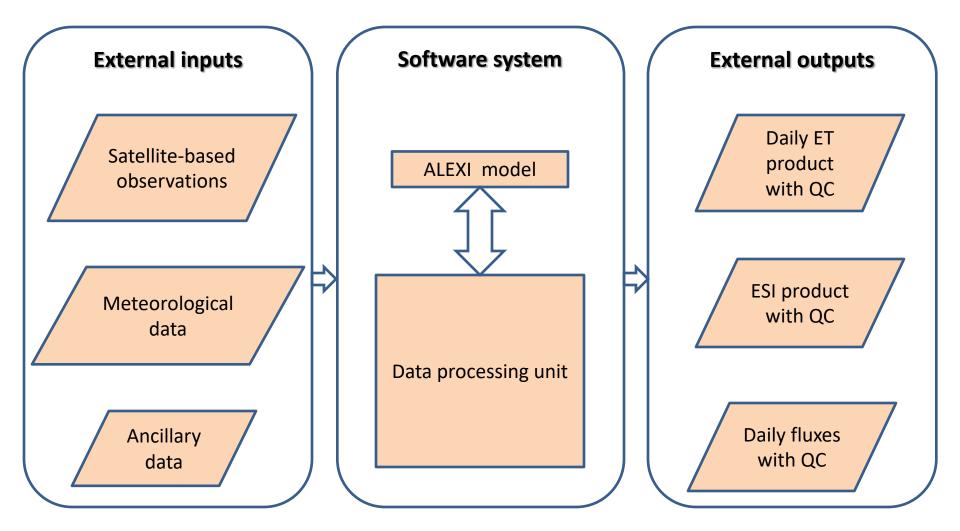
GET-D Product System Characteristics



- ALEXI does not require precipitation data, the current surface moisture state is deduced directly from the remotely sensed LST, therefore it may be more robust in regions with minimal in-situ precipitation monitoring
- Signatures of vegetation stress are manifested in the LST signal before any deterioration of vegetation cover occurs, as indicated by vegetation indices such as NDVI, so TIR-based indices such as ESI can provide an effective early warning signal of impending agricultural drought



GET-D General Architecture





GET-D Input Data

Name	Category	Source	Description
Brightness temperature	Satellite observation	GOES	GOES East/West Imagery; 11micron/3.9 micron brightness temperature
Insolation	Satellite observation	GSIP	GSIP real time insolation
Vegetation Index	Satellite observation	VIIRS	VIIRS EVI
Snow mask	Satellite observation	NOAA IMS	IMS Daily Northern Hemisphere Snow and Ice Analysis
Air temperature	Meteorological data	CFS	Surface and pressure level profiles
Specific humidity	Meteorological data	CFS	Surface and pressure level profiles
Geopotential height	Meteorological data	CFS	Surface and pressure level profiles
Wind speed	Meteorological data	CFS	Surface
Downwelling longwave radiation	Meteorological data	CFS	Surface
Land Cover	Ancillary data	University of Maryland	Land cover classes in 1km resolution (static)
Albedo	Ancillary data	MODIS	Surface Albedo from MODIS (static)
Clear day insolation	Ancillary data	GSIP	Clear day insolation (static)



GET-D Output Products

Variables	Description
ET product with QC	Daily ET map
ESI products with QC	2,4,8, 12-week composite drought map
Flux products with QC	Daily sensible heat, soil heat, downward short wave radiation, long wave down/up ward radiation and net radiation
Coverage	North America
Spatial Resolution	8km



GET-D Websites

NESDIS-STAR:

https://www.star.nesdis.noaa.gov/smcd/emb/droug htMon/products droughtMon.php

NOAA STAR CENTER FOR SATELLITE APPLICATIONS AND RESEARCH OFFICE OF SATELLITE AND PRODUCT OPERATIONS rought Monitor Home Drought Monitoring GOES Evapotranspiration and Drought (GET-D) Data and images displayed on STAR sites are provided for experimental use only GOES Evapotranspiration and Drought (GET-D) products are derived from the Atmosphere-Land and are not official Exchange Inversion model (ALEXI), ALEXI computes principle surface energy fluxes, including perational NOAA products Evapotranspiration (ET), which is a critical boundary condition to weather and hydrologic modeling, and More Information>> a quantity required for regional water resource management. ALEXI ET estimates have been rigorously evaluated in comparison with ground-based data, and perform well over a range in climatic and vegetation conditions. SMCD EMB Drought Monitoring Site EDR Products > GET-D ESI The GET-D system is designed to generate ET and drought maps operationally. ALEXI ET is retrieved Displaying the latest available data products over clear-sky pixels daily and ALEXI drought product is generated over 1 to 6 month compositing ate All Products About GET-D ES 29 Nov 2016 - 21:14 FT / 02:14 UTC periods each day GET-D ESI Drought Monitoring Products Select a parameter Select a Date: GET-D ESI Drought Manitoring Products 4-Week Composite 🔻 为 Current 2 Week Current 4 Week GET-D ESI 04 Week Composite 28 Nov 2016 Current 8 Week Current 12 Weel 401 351 An archive of 2 week images can be found here, 4 week images can be found here, 8 week images can be found here, and an archive of 12 week images can be found here. The ET and drought monitoring maps generated from GET-D are converted to the required formats (GRIB and others) and sent to OSPO for QC monitoring, to ESPC distribution server for distribution and to NCEI/CLASS for archMing. The satellite derived ET data are critical to improving land surface model simulations and the improvement of the numerical weather/climate forecasts. More accurate and complete ET and drought products are critical for global and US agricultural management and forecasts Results from OSPO server -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 on | Webmaster: 0 EPOWebmaster@nosa.pov te | NDAA | NESDIS | Website owner: STAR | Link & product disclaimers | Accessibility | Search | Customer Surv WSC HTML WSC MAI-A Page updated on April 14, 2016. e | Privacy | Information quality | Webmaster | Modified: October 21, 2016



Due to the switch of primary GOES-East from GOES-13 to GOES-16, GET-D stopped operation since Jan 2018.

NESDIS-OSPO: http://www.ospo.noaa.gov/Products/land/getd/

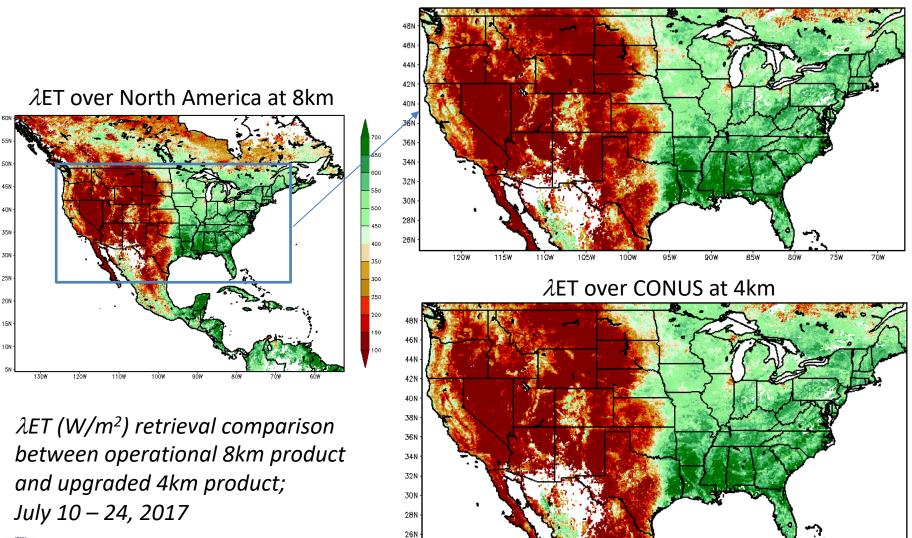
Summary Listing 30ES Evapotranspiration and Drought station index (GV/I) Global Vegetation Processing System MetOp Global Vegetation Index (MGVI) Vegetation Health Product (VHP) **IIRS Green Vegetation Fraction** IIRS Vegetat Documents

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λET from GET-D using GOES 16 Observations





95W

1009

90w

85W

7ŚW

700

7ÓW



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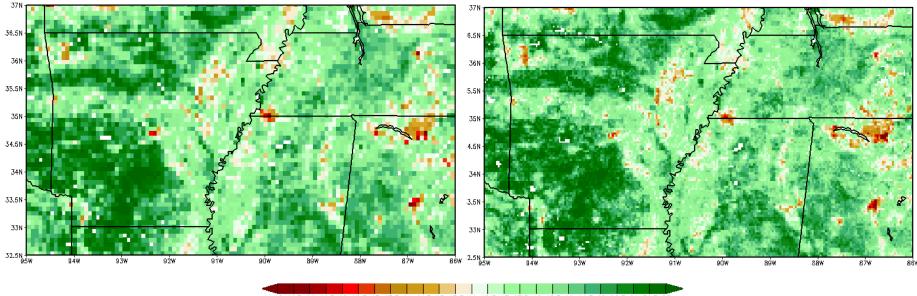
115%

120%

Middle Mississippi River Basin (weekly: July 10-16, 2018)

8 km





10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5 18 18.5 19 19.5 20 20.5 21 21.5 22

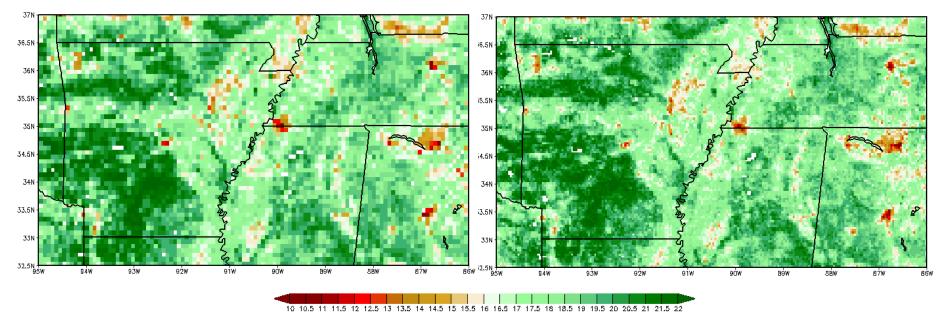
Higher resolution map provides more spatial details Week 2 may have lower ET



Middle Mississippi River Basin (2 weeks: July 10-24, 2018)

8 km





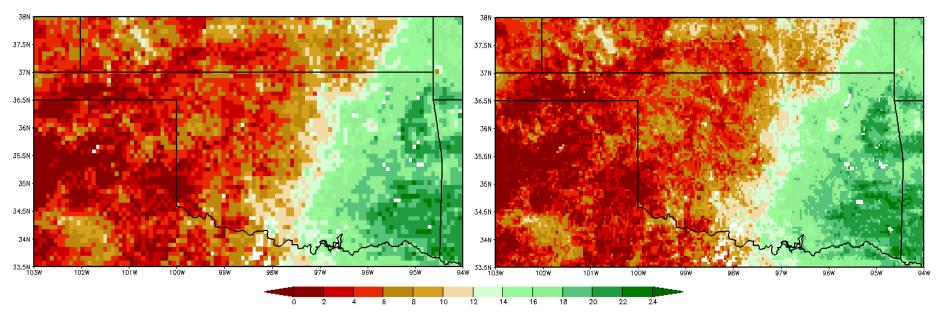
Higher resolution map provides more spatial details



Oklahoma Region (weekly: July 10-16, 2018)

8 km





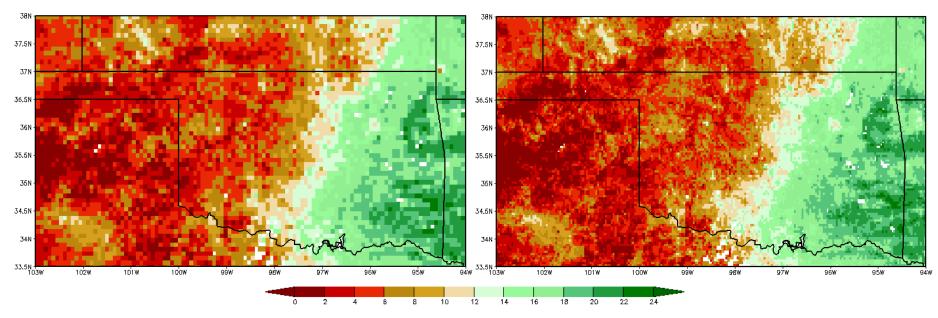
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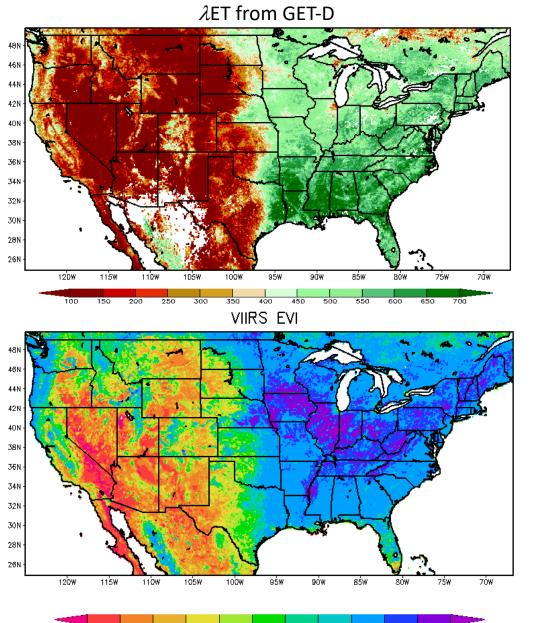




Higher resolution map provides more spatial details Week 2 may have slightly higher ET



Correlation between *AET* **from GET-D and VIIRS EVI**



0,15

0.2

0.25

0.35

July 10 – 24, 2017

July 17 – 24, 2017



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0.5

0.65

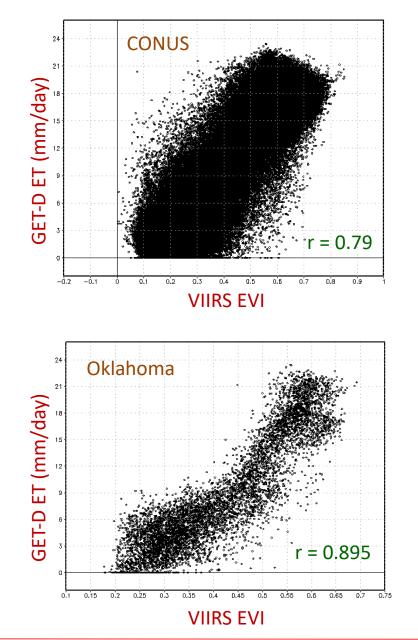
0.7

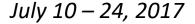
0.75

0.45

0.4

Correlation between ET from GET-D and VIIRS EVI







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Summary and Next Steps

- NESDIS GET-D has been generating ET and ESI data products at 8km resolution for NCEP NWP model validation and Drought Monitoring since 2016
- GET-D is updated successfully to generate ET at 4km spatial resolution using GOES-16 observations
- Validation against independent data sets (e.g. AmeriFlux sites) is on-going
- GET-D is being upgraded to 1km spatial resolution using the high spatial resolution observations from both GOES-16/17



Back up Slides



GET-D Product System Characteristics

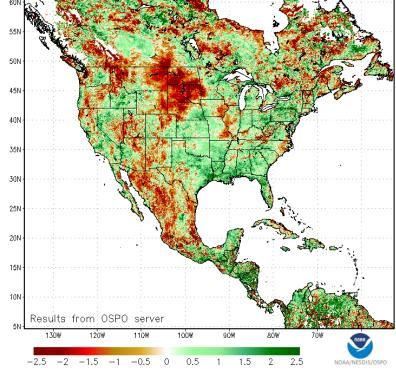
System major inputs

- Satellite-based observations
 - GOES East and West
 - GSIP insolation
 - VIIRS EVI
 - IMS snow
- Meteorological forcing
 - NCEP Climate Forecast System (CFS)
- Ancillary data
 - Land cover
 - GOES view angle
 - Soil reflectance and surface parameters

System outputs

- Daily ET and other energy fluxes
- drought maps (2, 4, 8, 12 weekly composite)



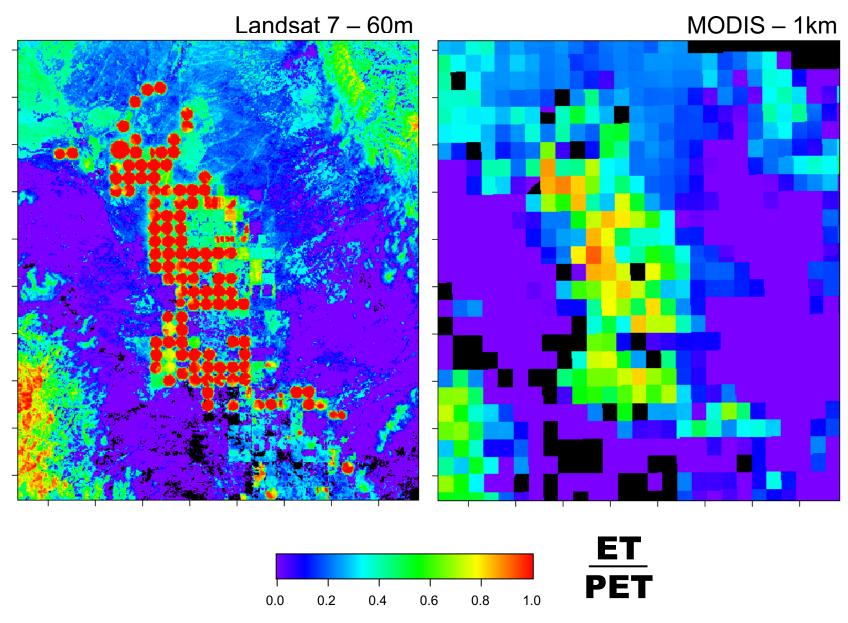


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From Martha Anderson

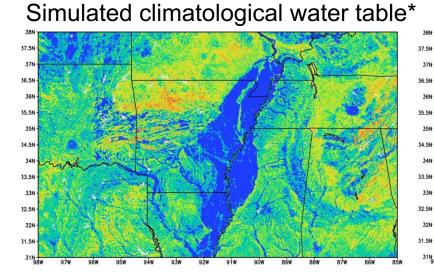
Sensitivity to irrigation

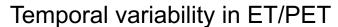


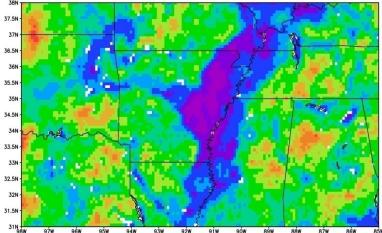
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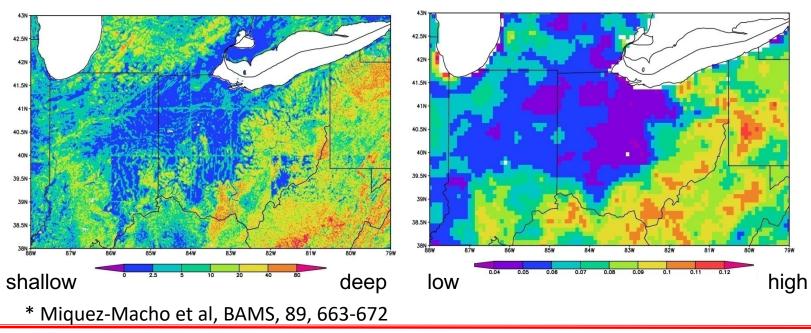
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Sensitivity to shallow water tables









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