



EGU2020-5421 Session BG2.7

Twelve years of SIFTER

Sun-Induced Fluorescence retrievals from GOME-2 as an independent constraint on photosynthesis across continents and biomes

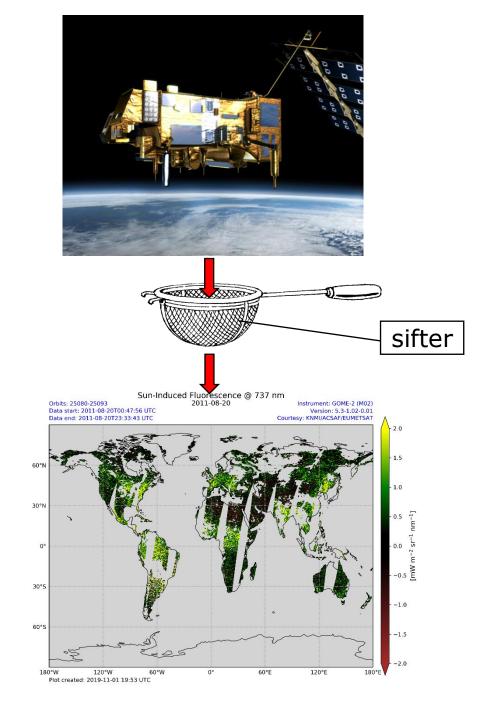
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The SIFTER retrieval

What is the SIFTER product?

Sun-Induced Fluorescence of Terrestrial Ecosystem Retrieval

- Based on Joiner et al. (2013)
- Developed by Sanders et al. (2016)
- Improved by van Schaik et al. (2020)
- Validated by Mengistu et al. (2020)



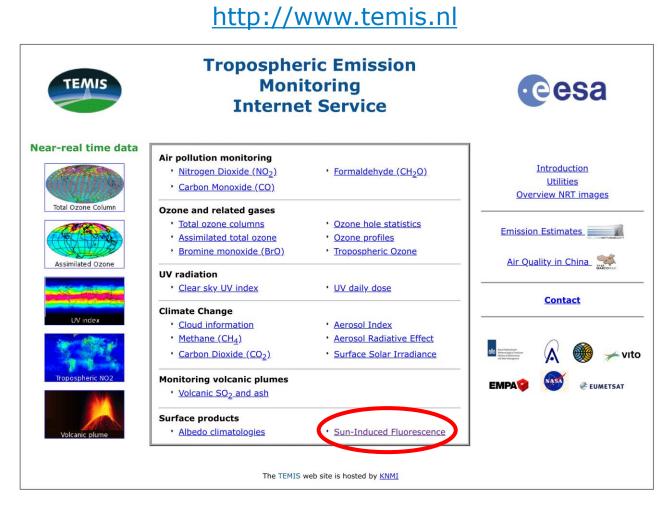




SIF daily GOME-2 dataset 2007-2018

- 12 years of data available
- Daily measurements on GOME-2 grid
- The dataset and detailed information is available at

www.temis.nl/surface/sif.html



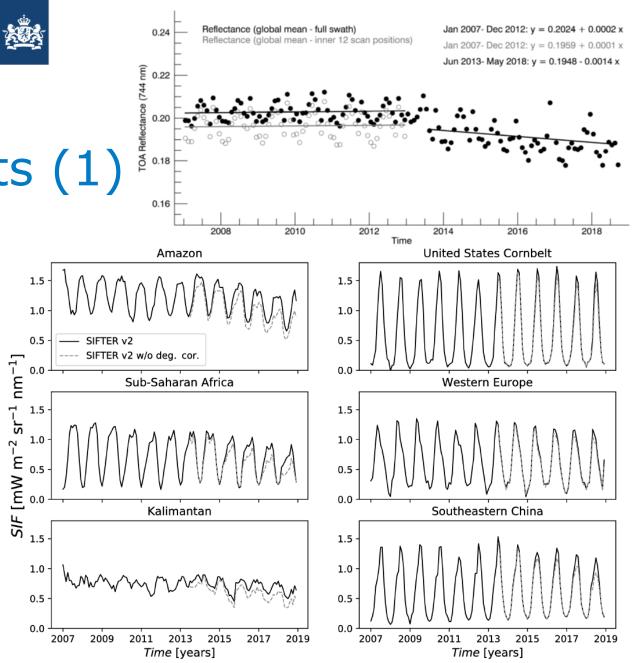


Retrieval improvements (1)

DEGRADATION CORRECTION

- A degradation is found in the GOME-2A reflectance data after July 2013 when observing reference site Lybia4 (upper figure)
- > This degradation propagates into the SIF signal, resulting in a downward trend (lower figure)
- We apply an empirical correction based on the reference reflectances calculated over Lybia4 and use these to correct global reflectance before retrieval.
- This method results in a decrease of the degradation as can be seen from the solid black line in the lower figure
- The degradation is most prominent in (sub-)tropical environments. For details on other regions, please refer to van Schaik et al. (AMTD, 2020)



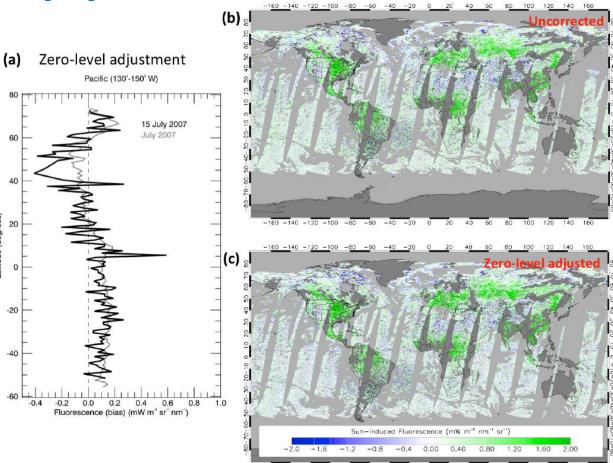




Retrieval improvements (2)

LATITUDE BIAS CORRECTION

- A latitude bias is observed, likely related to instrument warming when passing over the sunlit side of the earth and associated Focal Plane Array temperature variations, resulting in slitfunction variability
- This anomaly is propagated into the SIF signal resulting in an underestimation of SIF at Northern latitudes, and an overestimation at Southern latitudes
- A correction is applied by sampling ocean measurements (zero-level) in 1 degree latitude bins, fitting their SIF-to-reflectance relation, and using this linear fit to determine the offset for all retrievals in that 1 degree latitude bin
- > This results in a better representation of acrossglobe relative SIF signals. With especially higher signals in at the Northern latitudes.





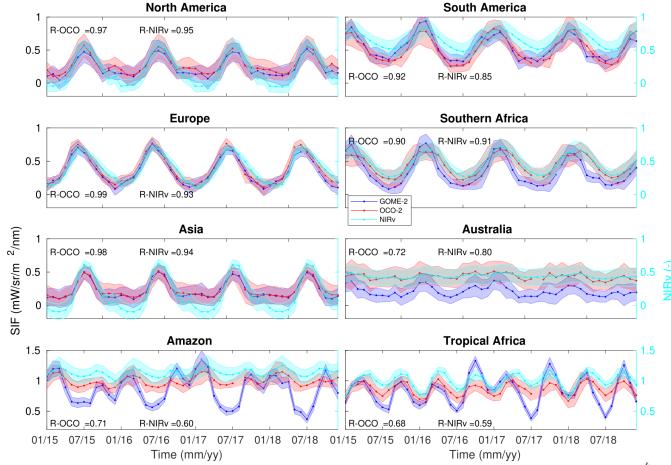


Intersatellite comparison

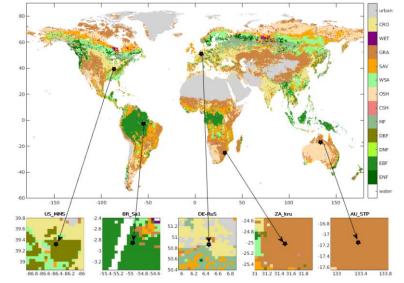
SIFTER IS COMPARED AGAINST

- > OCO-2 SIF, recalculated to 737nm
- MODIS NIRv (MCDC43C4v006)
- > MPI-BGC GPP
- > In three regions
 - Americas
 - Europe and Africa
 - Asia and Oceania
- > High degree of correlation between among seasonal cycles
- > SIFTER shows a clear double peak in the Amazon
- Discrepancy over e.g. Australia is likely due to the local measurement time (9:30 for GOME2 and 13:30 for OCO-2)





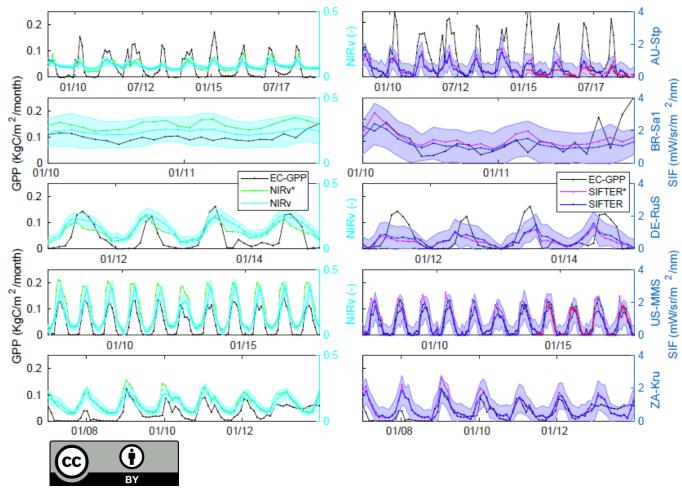




Site_ID	Site_Name	Country	Veg. Type	Lat. (°N)	Lon. (°E)	Period
AU-Stp	Sturt Plains	Australia	GRA	-17.15	133.35	01-'08 12-'18
BR-Sa1	Santarem-Km67-Primary For.	Brazil	EBF	-2.86	-54.96	01-'00* 12-'11
DE-RuS	Selhausen Juelich	Germany	CRO	50.87	6.45	01-'11 12-'14
US-MMS	Morgan Monroe State For.	USA	DBF	39.32	-86.41	01-'99* 12-'17
ZA-Kru	Skukuza	South Africa	SAV	-25.02	31.50	01-'00* 12-'13

- SIFTER* = SIFTER at NIRv resolution using a NIRv 0.5 to 0.05 degree scaling factor.
- Allows for high spatial resolution comparisons including sub-pixel land cover heterogeneity
- Scaled sub-pixel SIFTER product shows significant better relation with the Flux tower GPP.

Comparison with flux tower GPP

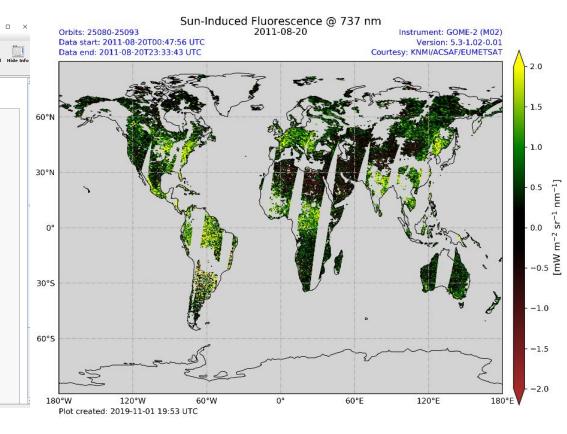


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Name	Long Name	Туре	
	. S-03M_GOME_SIF_02_M02_20110820004830Z_2	Local File	Group "METADATA"
Se METADATA	METADATA	-	
S PRODUCT	PRODUCT	-	In file "S-03M_GOME_SIF_02_M02_20110820004830Z_20110820233417Z_N_0_20191010133613Z.nc
🗢 corner	pixel corner index	1D	// group attributes:
🗢 delta_time	offset from reference start time of measurement	1D	:AlbedoPolynomialOrder = 4L; // long
fluorescence	surface upwelling shortwave flux in air due to flu	Geo2D	:RefsetTransparentWindows = 712L, 713L, 748L, 757L, 775L, 785L; // long
fluorescence_precision	surface upwelling shortwave flux in air due to flu	Geo2D	:RetrievalWindow = 734L, 758L; // long
🗢 ground_pixel	ground pixel	1D	:ReferenceAreas = "[u\'barren(16.0, 30.0, -8.0, 29.0)\']";
🗢 latitude	pixel center latitude	Geo2D	:RefsetAlbedoPolynomial = 2L; // long
🗢 longitude	pixel center longitude	Geo2D	:NumberOfPrincipalComponents = IOL; // long
principal components	principal components	1D	:FluorescenceGaussianCenter = 737L; // long
🗢 qa value	data quality value	Geo2D	:FluorescenceGaussianOneSigma = 33.9; // double
🔹 scanline	along-track dimension index	1D	:EccentricityOfEarthOrbit = 0.01671022; // double
🔻 😂 SUPPORT DATA	PRODUCT/SUPPORT DATA	-	:EarthPerihelionDOY = 3L; // long :RetrievalDOY = 231L; // long
V DETAILED RESULTS	PRODUCT/SUPPORT DATA/DETAILED RESULTS	_	:RefsetStartDate = "fluor llb 2007 01 23";
albedo fit coefficients	Fitted constants to surface albedo polynomial	Geo2D	:RefsetEndDate = "fluor llb 2012 12 31";
autocorr of fit residual	Autocorrelation in the fit residual	Geo2D	:ProductAlgorithmVersion = 0.02; // double
fit residual	Residual of the data fit to the model	Geo2D	:AscNodeCrossingTime = "2011-08-20T00:26:37.000";
mean radiance	Spectral mean of input radiance	Geo2D	:AscNodeLongitude = -44.6903; // double
<pre> pc_fit_coefficients </pre>	Fitted atmospheric transmission eigenvalues	Geo2D	:BaseAlgorithmVersion = "5.3";
reduced chi squared	Reduced chi squared of the fit	Geo2D	:ConfigurationFileVersion = 0.01; // double
V GEOLOCATIONS	PRODUCT/SUPPORT DATA/GEOLOCATIONS	-	:DegradedRecordCount = OL; // long
latitude bounds	latitude bounds	2D	:DegradedRecordPercentage = OL; // long
Iongitude bounds	longitude bounds	2D 2D	:MissingDataCount = 0L; // long
			:MissingDataPercentage = OL; // long
scanning_direction	Scan mirror movement direction	Geo2D	:DispositionMode = "0";
scattering_angle	scattering angle	Geo2D	:GranuleType = "DP"; :Inclination = 98.679; // double
solar_azimuth_angle	solar azimuth angle	Geo2D	instruction = 96.09; // double
🗢 solar_zenith_angle	solar zenith angle	Geo2D	instrumentWode = "NORMAL VIEW";
viewing_azimuth_angle	viewing azimuth angle	Geo2D	:OrbitType = "LEO";
🗢 viewing_zenith_angle	viewing zenith angle	Geo2D	:ParentProduct = "GOME_xxx_1B_M02_20110820004830Z_20110820005130Z_R_0_20120527171052Z";
🔻 🔄 INPUT_DATA	PRODUCT/SUPPORT_DATA/INPUT_DATA	-	:ProcessingCentre = "O3KNM";
cloud_fraction	Cloud fraction input from FRESCO	Geo2D	:ProcessingMode = "R";
🗢 cloud_pressure	Cloud pressure input from FRESCO	Geo2D	:ProductSoftwareVersion = 0.01; // double
🗢 model_irradiance	Irradiance spectrum used in the fit model	1D	:ReceivingCentre = "SVL";
pc_vectors	Atmospheric transmission eigenvectors used in	2D	:ReferenceTime = "2011-08-20T00:49:26.000";
reflectance	Reflectance input to model fit	Geo2D	:SatelliteID = "MO2";
reflectance_precision	Reflectance input to model fit standard error	Geo2D	:SensingEndTime = "2011-08-20T23:33:43.000";
surface_albedo_assumed	Surface albedo from the level1b product	Geo2D	:SensingStartTime = "2011-08-20T00:47:56.000"; :StartOrbitNumber = 25080L: // long
surface_altitude	Surface altitude from the level1b product	Geo2D	:SubSatellitePointEndLat = 33.417; // double
÷ time	reference time for the measurements	-	Subsate(litePointEndLat = 33.41/) double
wavelength	the wavelenghts at which the retrieval fluoresce	1D	:SubSatellitePointStartLat = 32.818: // double
2	-		:SubSatellitePointStartLon = 52.646; // double
			:BevisionID = "UNKNOWN":
	Show: All variables		:ParentCloudFile = "S-03M_GOME_NF0_02_M02_20110820004830Z_20110820005130Z_R_0_20190705005154Z";



Please visit <u>http://temis.nl/surface/sif.html</u> and try out the GOME-2 SIFTER product!



Feedback is very welcome. Thank you.