

# Evapotranspiration and surface fluxes products

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- Introduction
- Products
- Examples and applications
- Conclusion



### Transpiration of vegetation

### 1. Root-zone water



### 2. Root water uptake



- Water taken to leaves through roots
- Light is necessary

3. Exchange plantatmosphere



Water vapour is released into the air through leaves stomata



### **Evapotranspiration**





### The water cycle



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• The energy balance

$$Rn = (1 - \alpha)K \downarrow -\varepsilon\sigma T_s^4 + L \downarrow$$
$$Rn = H + LE - G$$



### LE: latent heat flux

surface flux associated to evapotranspiration (ET).

### H: sensible heat flux

exchanged energy flux between atmosphere and surface.

G: ground heat flux:

exchanged energy flux between surface and soil.

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Evapotranspiration & surface fluxes





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## • LSA-SAF – products







### Methodology



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### • 30 min Evapotranspiration (mm h<sup>-1</sup>)

e.g. 3-hourly sampling on 25<sup>th</sup> August 2019.



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## • 30 min Evapotranspiration (mm h<sup>-1</sup>)

### e.g. 25<sup>th</sup> August 2019 at 12 h UT.

0.2



MET

Data files available each 30 min + quality flags.

0.0

0.4

0.6

0.8





30 min Latent and Sensible Heat Fluxes (W m<sup>-2</sup>)

e.g. 6-hourly sampling on 25<sup>th</sup> August 2019.







30 min Latent and Sensible Heat Fluxes (W m<sup>-2</sup>)

e.g. 25<sup>th</sup> August 2019 at 12 h UT.









• Daily Evapotranspiration (mm d<sup>-1</sup>)

e.g. sampling a few days in 2019.









## • LSA web site: to get information

http://lsa-saf.eumetsat.int

go to

- → 'Products'
- → 'Evapotranspiration & Energy Fluxes'

to find

- a short description of the product
- documentation
  - Product User Manual ('PUM') to help using the product;
  - Algorithm Theoretical Basis document ('ATBD') to understand methodology;

Products

How to appreciate evapotranspiration data from LSA SAF files quickly?

- Validation Report ('VR') to know about data quality assessment.







## LSA web site: LSA tool box

http://lsa-saf.eumetsat.int

### go to

- → 'News&Media'
- → 'News & showcases'
   to find news and applications.



Home About - Products - Get Data - Help&Support - News&Media - Account -

### A User Tool to Aid Exploitation of LSA SAF Products

How to aggregate evapotranspiration data from LSA SAF files quickly?



Are you a new user and you would like to get the monthly accumulation of evaportanspiration over your country quickly? Use version 2.0 MSG Toobox under Windwas to generate generferenced data (g. G. GoelTF) over your country, which can be imported in your favourite software. All details are written here: https://fandsaf.pma.plen/getdata/msg-toobox/. For Linux users, please see the list paragraph.

MSG Tobox is a Java-based software intended for efficient processing of operational LSA SAF products in order to mate possible further analyses and use in GS and remote sensing software. Is primary objective is the production of daily composites from sub-daily (et., 15 min, 30 min, hourly) frequency input products. Additionally, nadaly or periodic (10-daily, monthly) and yearly) composites can be produced from respectively sub-daily and daily frequency input products. The software is able to remod data into latific coordinate system over the user-defined domain of choice. Output can be saved in three different (Ife formats. DL-EIVL GeDTFF and Integrated Land and Vater Information System (UKS).

- MSG Toolbox has four tabs, as is displayed in Figure 1 on the left
- Welcome tab: basic information about the software
   Grids tab: orid definition and remapping.
- Compositing tab: select data and define scenarios for temporal compositing.
- · Processing tab: track processing of input data



#### Latest News

 Heatwave strikes Europe
 July 10, 2019

 June ends with swettering temperatures across Europe
 June 11, 2019

 Vegetation Response Variability from Meteosat
 June 11, 2019

 How do land and climate type as well as irrigation affect vegetation signal from space?
 June 7, 2019

 New version of MSG Evapotranspiration products (instantaneous and daily) has been released (LS-311 and LS-312).
 June 7, 2019

A User Tool to Aid Exploitation of LSA SAF June 3, 2019 Products

How to aggregate evapotranspiration data from LSA SAF files quickly?





#### Figure 1 - MSG Toolbox Welcome tab

Daly evaportanspiration data from LSA SAF (DMET, LSA-312) are aggregated using IVSG Toobox. Figure 2 below displays four utiliferent monthly composites for June 2018: average, maximum and minimum evaportanspiration as wells as the monthly sum of evaportanspiration over the vestern half of Europe. Other LSA SAF products can also be imported in the software. For example, free, vegetation, and surface temperature, relation fluxes, and surface albedo products (see the ISG Toobox manual for ful details).

#### Evapotranspiration & surface fluxes





### LSA web site: show cases

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to find news and applications.



Evapotranspiration difference (ET – ET0) and FVC anomaly both highlight that mostly areas of S and SE Europe experienced strongest drought in August 2017. The local details might differ but the general picture is quite consistent for both evapotranspiration difference and FVC anomaly maps. Only negative anomaly is isom in FVC anomaly figures, i.e., positive anomaly is masked, conclusions are insulin for August 2015, but this mice the vegation and evapotranspiration directive provide and anomaly in answer in N. W and Central Europe.



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#### Satellite Derived Evapotranspiration Is Advantageous for Drought Detection

Analysing Drought Impact by Combining Evapotranspiration and Vegetation Signal

A combination of satellite derived evapotranspiration and vegetation signal improves locating and analysing drought affected areas. In the scope of drought monitoring, satellite vegetation signal, e.g., fraction of vegetation or every reliable indicator of vegetation health. However, for assessing drought stress (i.e. the current conditions vegetation is exposed to), evapotranspiration is as a very important variable. In this sense, the difference between reference and actual evapotranspiration can correlate with the drought stress as experienced by vegetation.

Next figures display satellite derived evaportanspiration (top) and vegetation (bottom) from LSA SAF: all products are prepared on a daily basis from Meteosat satellite. Actual evapotranspiration (MET, LSA-302), difference between reference (ET0, LSA-303) and actual evapotranspiration, fraction of vegetation cover (FVC, LSA-421) and FVC anomaly (difference between current vegetation and its long-term average in 2004-2016) are shown for August 2017 and 2018. ET0 and ET are calculated as monthly total in the same August periods. ET approaches ET0 when there is ample water. Therefore, a large difference between the two indicates a shortage of water, which could lead into drought when dry conditions are persistent.





- Daily Evapotranspiration (mm d<sup>-1</sup>)
  - e.g. extraction of an area of interest.







### Average 1-10 June 2019











Average 11-20 June 2019











Average 21-30 June 2019











### Average 1-10 July 2019











### Average 11-20 July 2019











Average 21-31 July 2019











Average 1-10 August 2019









Average 11-20 August 2019









Average 21-31 August 2019









Average 1-10 September 2019











 $F_{ev} = \frac{LE_{10-day}}{(LE+H)_{10-day}}$ 

### 10-day evaporation fraction

Average 11-20 September 2019





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Average 21-30 September 2019











- Reprocessing of MSG evapotranspiration and surface fluxes
  - Based on recent LSA Climate Data Records used as forcing
  - Period from 2004
- Adaptation to MTG
  - Continuity with MSG
  - Taking advantage of new opportunities (e.g. increased temporal and spatial resolution)

- New data record in collaboration with CM SAF
  - Compatibility with LSA SAF Climate Data Records on ET & SF
  - Adaptation to MFG



### Next steps



### Adaptation of methodology to CM SAF



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Evapotranspiration & surface fluxes





### Summary

- Evapotranspiration and surface heat fluxes (LE, H) have been developed in LSA SAF
- Production done in NRT
- On-going developments in view to build new data records
- Adaptation foreseen to MTG.
- Users are invited to exploit available products
  - Documentation available from LSA SAF web site
  - Contact help desk for questions
  - Interaction welcome with development team to let us know about your experience and needs.
- Any questions ?



- Acknowledgments
  - To all validation data providers
  - EUMETSAT
  - ESA / PRODEX Program / BELSPO





- More information about our activities:
  - http://hydroland.meteo.be