EUMETSAT
Monitoring weather and climate from space
Surveiller le temps et le climat depuis l'espace

SALGEE

Drought & Vegetation Monitoring: Energy–Water Cycle

7th SALGEE Virtual Workshop

Summary of the 'Wrap of the Day 1,2,3'

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TBD in Final Discussion, 26 Nov 2021

SALGEE

Objectives of the 7th SALGEE Workshop

Drought & Vegetation Monitoring: Energy – Water Cycle

1) Using satellite information to characterize droughts on vegetated land surfaces, related processes and consequences, using Climate Data Records (CDRs).
2) The different aspects of droughts – meteorological, hydrological, agricultural and ecological, inviting representatives from the SAFs to share experiences.
3) Fire activity in relation to land surface state and on biomass burning effects.
4) Perspectives and improvements of SAF products by using MTG data and development of new EUMETSAT services.
5) First experiences on using the D&V Cube to access long (Climate) Data Records, analyses and visualization of the results.
   - ❑ illustrate the usage of the D&V Cube in different applications
   - ❑ illustrate the applicability of the D&V Cube for regional application.
6) Workshop discussion and feedback on D&V Cube utlization for potential applications.

Main incomes from the 7th SALGEE Workshop

1) Opportunities for collaboration between SAFs (LSA SAF, CM SAF, H-SAF), ECMWF on D&V topic
2) Extending aspects of satellite data application & LSA
   - Drought monitoring (*meteorological, hydrological, agricultural and ecological*)
   - New operational products (e.g. LSASAF LE, H, others)
   - New indexes – Evapotranspiration Stress Index, IASI dryness vegetation index
   - GPP affected by tropospheric O3 on the background of Mediterranean drought
3) Extending topic of Wildfire, accounting for
   - Biomass burning CO2-Eq emissions, O3 production
   - User preparation for new generation satellites

4) Outlined of perspectives and improvements of SAF products by using MTG data and development of new EUMETSAT services.

5) First experiences on using the D&V Cube to access long (Climate) Data Records, analyses and visualization of the results
   - Feedback and recommendations

Day 1: 24 November 2021

Session 1: Satellite data in support to Land Surface Analyses
Session 2: Energetic loading and land fluxes
Session 3: Soil Moisture

1. **Evolution of LSASAF products that is important for the users** *(Luis Pesanha, IPMA)*:

- **FRP data** assimilation into the Global Fire Assimilation System (GFAS;
- **New algorithm** for the estimation of **Reference Evapotranspiration (ETo)** from FCI on-board of MTG;
- **LSA SAF MTLST** processed at full MTG FCI temporal (10 min) and spatial (2 km x 2 km) resolution;
- The **ET&Surface Fluxes** algorithm for evapotranspiration estimates together with both sensible and latent heat fluxes over the full MTG disk resolution of the thermal infrared channels;
- The **MTG vegetation products** from adapting the SEVIRI algorithms to the enhanced characteristics of the FCI sensor.

There were question, comments and suggestions.

About the SEVIRI emissivity products, the internal product and the new product, which is available to download from the web site (*Sara Venafra*).

2. The use of "all weather" Land Surface Temperature (LST) product

Limitations of using LST from IR are related to cloudy pixels. Passive microwave in window channels can see through most clouds.

It is expected the "all weather" Land Surface Temperature (LST) product to be made publicly available by the end of the year at the ESA Climate office data Portal, together with the LST-CCI IR products.

More information, contacting by email with Carlos Jimenez.

- ✓ Discussions cover of the reliability the product to be included in D&V Cube (in the future) ;
- ✓ The comparison between 'All weather-types' with using MW and the product of LSASAF using IR;
- ✓ About the importance to develop blended products, combining two type of information based on MW observations, which work well in full-sky conditions but with low resolution, and IR observations, which are more accurate, with higher resolution but not so good in cloudy conditions.

3. UTC Gridded Data for Drought and Vegetation Monitoring – EUMESAT's first prototype data cube *(Christine Träger-Chatterjee, EUMETSAT)*

- ✓ TBD during Final Discussion – feedbacks and suggestions about D&V Cube
- ✓ Gathering experience of all that have used it

4. Global and Regional Satellite-based Surface Solar Radiation data sets provided by the CM SAF (*Joerg Trentmann, DWD/CM SAF*)

Comments/Questions

- ✓ The importance of solar irradiance to all processes on the land surface;
- ✓ The importance collaboration between different SAFs;
- ✓ The experience that D&V Cube might be valuable source, much time consuming, we can directly use some outputs.

5. Operational and reprocessed LSA SAF ET and surface energy fluxes products: examples of potential applications' *(Alirio Arboleda, RMI*)

Questions and discussions:

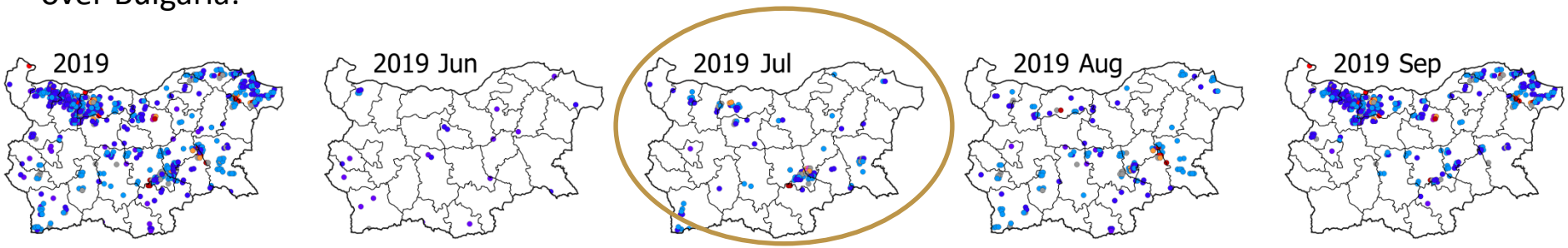
- ✓ LSASAF DMET product to be included in D&V Cube;
- ✓ The interpretation of the when METREF has lower values than DMET? We found some gaps in LSASAF DMET (SAF Europe files / MSG-Disk files)
- ✓ The plans for making available data records that are in process in validation including provide some testing data in advance;
- ✓ About the resolution of the H-SAF SM product, which is used in the
- ✓ Algorithm of Evapotranspiration.

6. Trends and case studies for the H SAF ASCAT root-zone soil moisture data records”

(*David Fairbairn, ECMWF*)

Questions and discussions?

Abut the link between drought and fire activity. For 2019 the fire activity is moderate for July and the presented H-SAF ASCAT root-zone soil moisture fields confirm our results. However the fire activity is extreme in September (around 42-43°N/23-27 °E) and comparison with for this period over Bulgaria:



The usefulness to construct such anomalies using D&V Cube but we have problems in constructing anomalies?

About the use of SM data records from CDOP4 for flood risk assessment and the suggestion for collaboration with the German Hydrological service on providing early warnings.

The effects that sometimes backscattering of the signal, e.g. from rocks might be the reason for false extremes in soil moistening.

7. Applications of H SAF Soil Moisture Data *(Wolfgang Wagner, TU Vienna)*

Questions and discussions:

- The importance to compare with some LSASAF products and having all these products will facilitate our work on combining different SAFs.
- About the SM – Precipitation product as a complement to all other precipitation data sets and the algorithms on the products using ASCAT measurements
- The plans for availability of SM to Rain data and about the earliest data for starting with reprocessing or with NRT generation?

8. A global Sentinel-1 data cube for land monitoring applications *(W. Wagner, TU Vienna)*

- The importance of information from EUMETSAT site about experience from the users on using the Data Cube.
- What are the conditions to access the data trough the EODC cloud environment?
- When we can expect access to larger user community?

Day 2: 25 November 2021

Session 4: Wildfires

Session 5: Drought & Vegetation Monitoring

1. Biomass burning emissions products from geostationary fire radiative power (FRP), MODIS aerosol optical depth (AOD) and Sentinal-5P carbon monoxide (CO) data. Over recent years the growing concern in scientific communities and among international policy makers about climate change has highlighted the requirement for improved information on the dynamics of biomass burning. As a consequence, fire as an agent of change is now systematically investigated.

TBD, Would be relevant FRP parameter related to biomass burning to be included in the D&V Cube, what else, e.g. CO2 Eq. *(in the future)*? (*Hannah Nguyen, King's College*)

Questions & Discussion about following points

The following points are considered and discussed:

- ✓ The possibilities to enlarge the coverage the new FRP product beyond Europe and Africa, and to enlarge the coverage for South
- ✓ The use of the new FRP-based product on biomass burning emissions for climate analyses accounting different gases different gases will be accounted, CO, CO2 and others.
- ✓ What is more important for climate studies – to use CO or CO2Equivalent?
- ✓ TBD with the King's College on these problems
- ✓ About future intention to merge the methodology for geostationary satellites with the results of MODIS, VIIRs instruments on polar satellites in order to have continues in space product.

2. Synoptic and climatic aspects of fire activity, and emission effects, Part I and Part II

Part I. The relationship between fire activity and considered biophysical indexes confirms the value of FRP-Pixel product for climate studies of drought effects.
Part II. The perspectives for further studies on O3 production from wild fires? *(Christo Georgiev, NIMH)*

There was a discussion on the information content from IASY measurements on total O3 retrieval at the level below 500 hPa level a s well as regarding the methodological relation between dry intrusion and fire. The potential for using profiles from data of any other instruments on S-NPP and JPSS, then EPS-SG are mentioned.

TBD, CDRs of FRP-Pixel product to be included in the Cube.

3. Copernicus (incl. supporting missions) data and services for wildfires monitoring and management *(Frederico Fierli, EUMETSAT)*

It was suggested the participating teams, individual participant to rise their interest for specific support in the frame of the User preparation Programs on Drought & Fire problems. Opinion to be expressed during the Final Discussion or in future correspondence.

It is also discussed about Absorption Aerosol Index and related possibility to obtain some kind of measure of aerosol mass in the column, and about the problem of saturation depending on AOD; the FRP product from Santinel 3, its operational status and algorithm (differing to what LSA SAF do) is also discussed.

Day 2: 25 November 2021

Session 5: Drought & Vegetation Monitoring

4. Drought and vegetation monitoring using satellite derived climate data records? *(Julia Stoyanova, NIMH)*

It was discussed the use of SMA (currently from SVAT) to be replaced in the future with satellite information; it would be reasonable the regional assessments to be compared with these H-SAF datasets. About the difference of (LSASAF LST-T2m) as a proxy of sensible heat and possibility to be compared with the new LSASAF H flux product, and the use of information from CM SAF for atmospheric moisture condition (TBD, water vapour columns) and the relevance of inclusion in the D&V Cube.

TBD Possibility for calculation of temperature difference (LSASAF LST-T2m) as a water stress index to be considered in the Cube.

TBD Possibility for calculation of ESI to be included in the Cube that will give possibility these studies to be continued.

5. A climatological assessment of drought impact on vegetation health index presented *(Celia Gouveia, IPMA)*

A discussion about the presented vegetation health index (VHI) of Kogan and possibility to be calculated from the Cube data and potential plans to become LSASAF product. The physical mechanism of the index is clarified and possibilities for collaboration with teams reporting similar problems. The interest of such analyses for the modelling community, for example forecasting the effects of future heat waves and exchange knowledge on these problems among Portugal, Bulgaria and Switzerland. The interpretation of the plots for the regional applications of seasonal course of VHI and SPEI are clarified.

6. The IASI dryness vegetation index (IASIDVI) and its application to the 2017 heat-wave in Southern Italy *(Guido Masiello, Univ. Basilicata)*

About the agreement of satellite derived emissivity and the local measurements concerning the possibility to derive what is the emitting material. The comparison between new IASI NDVI with NWI (Normalised Difference Water Index). Discussion about interpretation of low Index value in 2020 in comparison with 2017 with regard of fire activity over the region. Reliability of using IASI retrievals for observation of temperature, humidity and O3 in near the ground level is discussed. Possibility to include any parameter of atmospheric dryness in the Cube concerning the interest for studying forest dryness, drought and fires. TBD between Portugal, Bulgaria, Italy, EUMETSAT.

7. Estimating the effect of tropospheric O3 on Gross primary productivity over European forests using satellite data *(Jasdeep Anand, Univ. Lancaster)*

Discussion on retrieval of soil moisture field from ERA-5 and recall of presentation of David Fairbairn (from 24 Nov) on using modeling and satellite data for retrieval of SMC down to 3 m depth. It is emphasized that this talk includes a lot of information included due to the character of the study - Influence of O3 as ECV on GPP reduction, e.g data for soil hydrophysics open a lot of opportunities for collaboration with IPMA for fire risk indexes further improvement (at least to try this) and others. Consideration on the significance of these results for applying a complex approach in assessing climate extreme events, including the O3 in reduction of GPP, and taking into account that this effect depends on the type of forest and its age.

Day 3: 26 November 2021

Session 5: Drought & Vegetation Monitoring (Continue)
Session 6: Applications using D&V Cube

1. Multiparametric monitoring of land surface state and anomalies in regional scale, with use of operational satellite products and ground observations, *(Piotr Struzik, Poland)*

Detailed information using LSASAF, H-SAF, NWCSAF, CMSAF products and local IMWM of Poland. A Project on Web services for publishing the products is ongoing. Discussion about

- The care that should be taken in using the new SM product H26, resolution 0.1 deg, by the users due to differences with the previous SM product (H14) and the possible reason is the diffence in assimilated data for producing the product.
- The need of specific concepts, like those shown in the presentation, for efficient use of LSASAF products and the need for special close cooperation among the community on this problem.
- The behavior of LSASAF METREF product by compering with retrievals by using ground observations from synoptic stations (winter months positive and for summer months negative discrepancies).
- Recommendation the use Interim CDRs.

Suggestion: There is an idea to entire group and team SALGEE for a big project for SALGEE to make application studies and to come up Product Guidance for users in the area of Drought& Fire monitoring *(because there are a lot of products including versions of the same products with different retrievals, suitable for different users).*

2. The LSA SAF vegetation products: status, new developments and potential applications. *(Javier Garcia Haro, Univ. Valencia)*

MSG and EPS products FVC, FAPAR,LAI,CWC ,GPP and comparison with products using other satellite instruments, NRT applications, synergies of multiples products, consistent long-term CDRs the correlation between anomalies of FVC and Precipitations

Discussions

- About the relation between Canopy Water Content (CWC) and FVC, the add value of CWC, and the difficulties and shortcomings to validate CWC product.
- About the maps of starting of vegetation season that is very valuable information for the agriculture.

3. Using Land Surface Temperature and Vegetation Indices for Monitoring Drought in Armenia *(Zara Petrosyan, Armenia)*

- Discussions about possibility to use of LSASAF product derived by data from Meteosat located over the Indian Ocean (Metosat IDOC: LST, METREF, Vegetation products and FRP).

4. Towards a long-term (> 15 years) and medium resolution (0.05°) soil moisture dataset over Europe by merging ESA CCI SM and EUMETSAT products, *(Luca Zappa, TU Vienna)*

It is important to know when it is expected these data of improved soil moisture spatial resolution to be available for the users. Is there any intention the data to be included in the EUMETSAT D&V Cube?

Discussion about

- If the soil texture is taken into account in downscaling SM.
- Regarding the possibility the presented downscaled products to be available for use by the users.
- The experience of working with the Data Cube with data provided by external (from EUMETSAT) providers and the documentation for the products. Is discussed.

5. First Experience on D&V Cube application *(Julia Stoyanova, NIMH)*

Discussions about.

The recommendations for DC and the ToolBox improvement could be classified in 2/3 main groups:

- Inclusion of new parameters and indexes combining some of the available parameters available in the cube
- To introduce a procedure in R-Toolbox for constructing own indexes based on existing parameters in the Cube
- Improve the spatial/temporal resolution (precipitations; merging ESA CCI SM and EUMETSAT DC for soil moisture)
- Improving the graphical configurations in the R-ToolBox. How the x- and y-axis can be adapted?
- The examples on applying the Data Cube and ToolBox on useful research and operational applications.
- The need for develop a dynamic type of Cube.
- The practice with suggestions for improvement of the Cube to be illustrated by show cases.

TBD

- Suggestion: There is an idea to entire group and team SALGEE for a big project for SALGEE to make application studies and to come up Product Guidance for users in the area of Drought& Fire monitoring *(because there are a lot of products including versions of the same products with different retrievals, suitable for different users).*
    - The needs to identify or easily motivate the usefulness of a certain data with corresponding use cases when suggesting new data.
    - The feedback on the priorities what kind of data to be included in the D&V Cube