Planning of LMA campaigns in Africa in the context of the LI Cal/Val activities

Progress Meeting #1

09 February 2021

Online 11th LIMAG Meeting

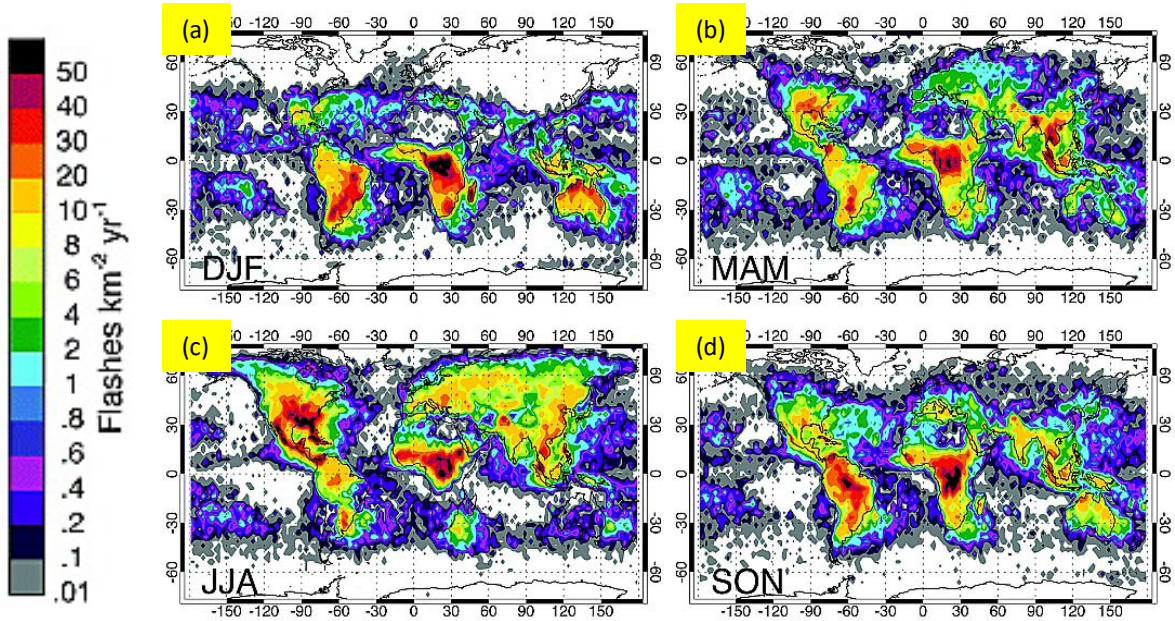
CONTRACT EUM/CO/20/4600002481/BV

Outline

- **Context**
- **Objectives of the study**
- **Status of the activities**
- **Milestones and deliverables**
- **Way forward**

Context

- EUMETSAT to launch in 2022 the Lightning Imager (LI) on Meteosat Third Generation (MTG) mission
- **MTG-LI validation then required**
  - **Africa : region of interest but where and when?**
  - Other regions in MTG-LI FOV covered by ground-based Lightning Locating Systems (LLSs) with appropriate Detection Efficiency (DE) and Location accuracy (LA) including LMA networks

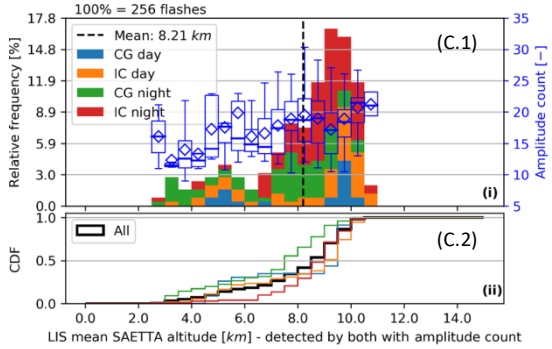


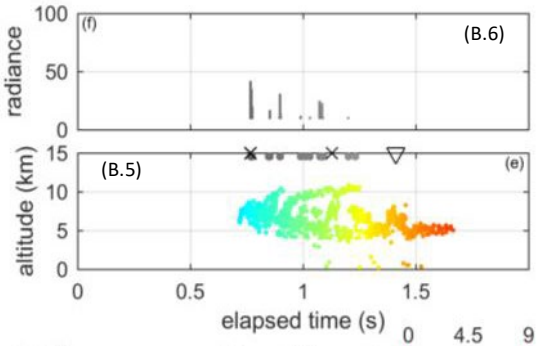
Seasonal lightning distribution as derived from LIS and OTD optical records (Christian et al., 2003).

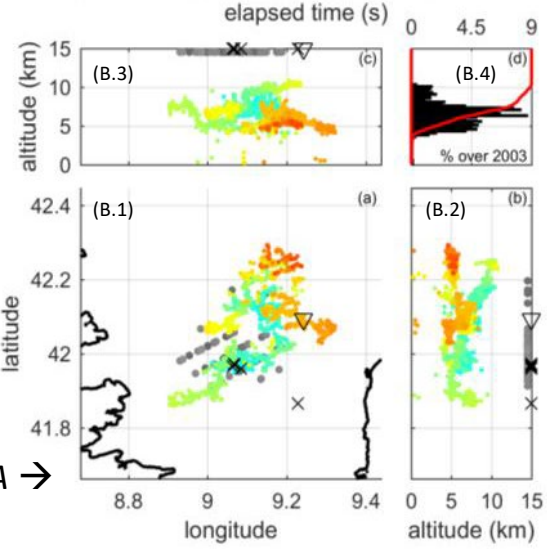
LMAs to Support MTG-LI Cal/val Campaigns

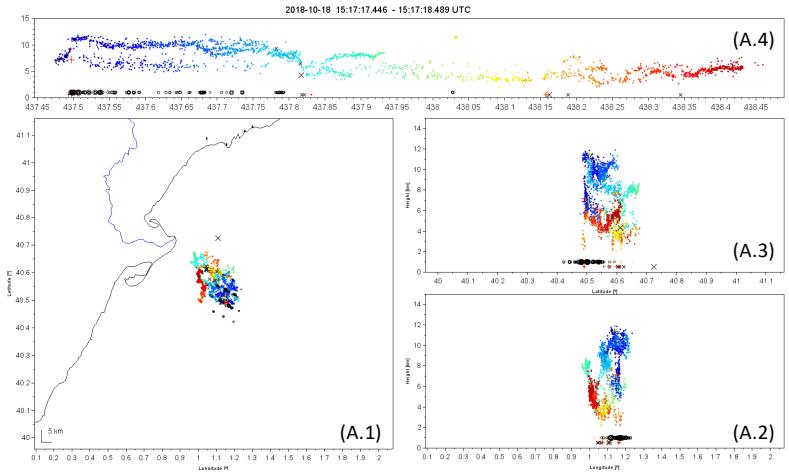
- Mapping in 3D of the lightning flash based on its VHF radiation relevant for MTG-LI performance assessment
- High performances in terms of DE and LA within a range of few hundred kilometers
- Two European (UT3 & UPC) mobile networks with expert teams for short and mid-term field deployment and already used in comparison with ISS-LIS and GLM records in Europe and in the world

(Erdmann et al., AMT, 2020)









←*ISS-LIS and UPC LMA*

ISS-LIS and UT3 LMA →

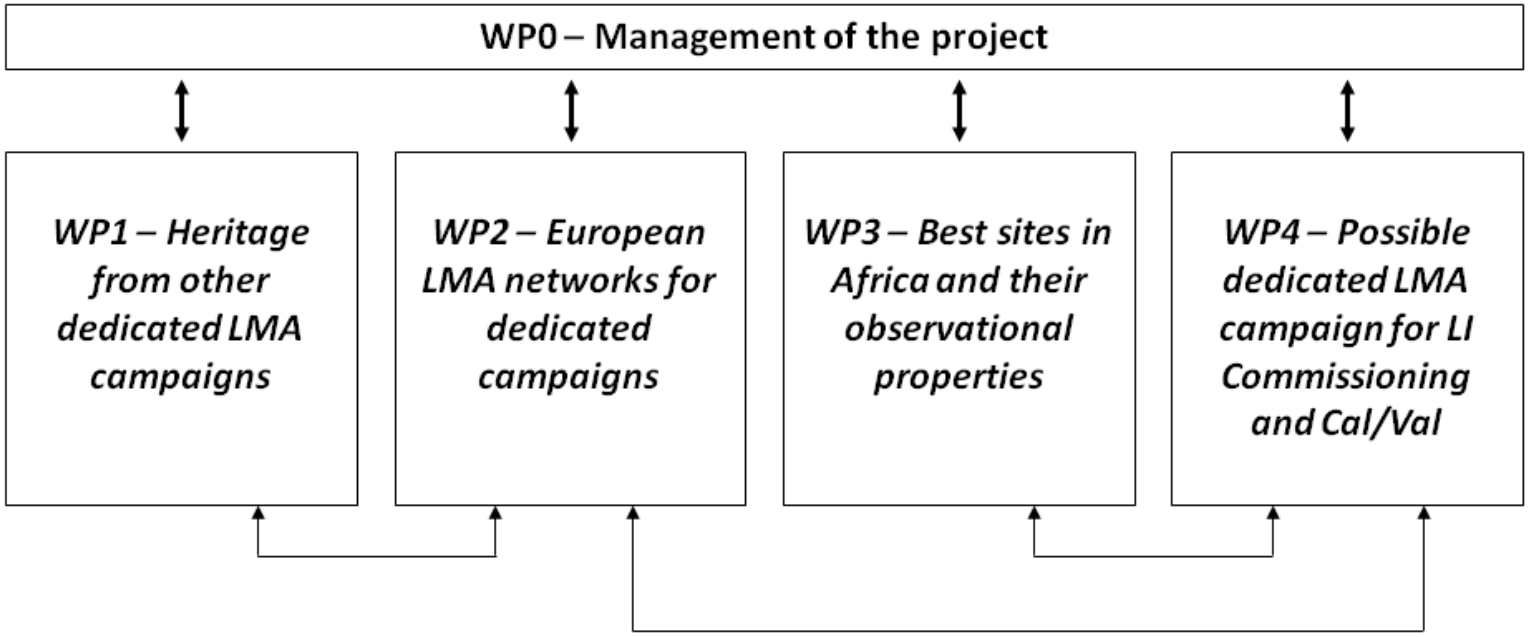
Objectives of the Study

- **To propose scenarios of LMA-based LI validation campaigns in Africa**

- Four main items have to be addressed:
  - **Which are the dedicated LMA campaigns run or being run providing data for comparisons against space-borne lightning optical imagers? Which are their key characteristics and results?**
  - **What type of dedicated campaign(s), with intellectual/human resources needed, could be performed by relocating the European LMA networks, as we know them today?**
  - **What are the best sites over African territory to run a dedicated LMA campaign? What is the lightning activity in such sites?**
  - **What are the possible examples of dedicated campaign that EUMETSAT could consider to run after the launch of LI?**

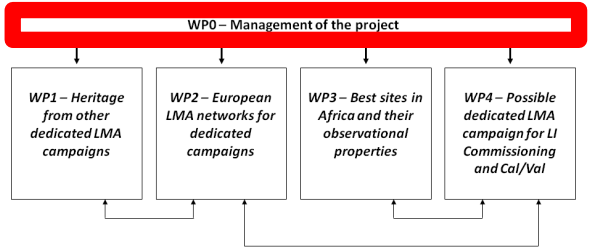
Team, Study Duration and Work Breakdown Structure (WBS)

- Team : **UT3/LA** (E. Defer, S. Prieur, P. De Guibert; Toulouse, FR)
  UPC/LRG (J. Montanyà, O. van der Velde, J. López; Terrassa, SP)
  USP (C. Morales; Sao Paulo, BR)
- Study duration : **24 weeks** (T0 = 14 December 2020)
- WBS : **4 technical Work Packages (WP) and 1 management WP**



Overview of WP Achievements (W01-W07)

WP0 – Management of the Project



WP0 Objectives (W01-W24)	Status
Coordinate the overall activities of the different WPs	*Running activity*
Ensure that work is carried out in accordance with the schedule and the SOW	*Running activity*
Secure the prompt initiation and smooth running of the project activities	*Running activity*
Produce timely all the deliverables and reports,	*Running activity*
Organize and attend all meetings	*Running activity*

Main achievements:

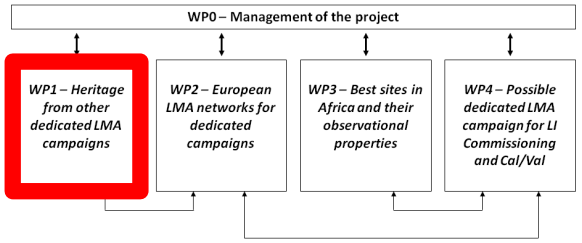
- **Monitoring of the activities through study meetings (08/01, 22/01, 04/02) and email exchanges**
- **Delivery of monthly reports and Progress Meeting presentation during 11th LIMAG Meeting**

Main difficulties:

- **None**

Overview of WP Achievements (W01-W07)

WP1 – Heritage from other dedicated LMA campaigns



WP1 Objectives (W01-W08)	Status
Review the literature to identify past field campaigns dedicated to the characterization of any space-borne optical lightning imager (LIS, GLM) with LMAs	*In progress*
Assess and synthesize the observational strategies, main results, (pre-, during and post-campaign) logistical, technical and data issues, and lessons learned	*In progress*
Exchange with key-campaign Principal Investigators either through informal discussions or a formal survey composed of items proposed by the Consortium	*In progress*

Main achievements:

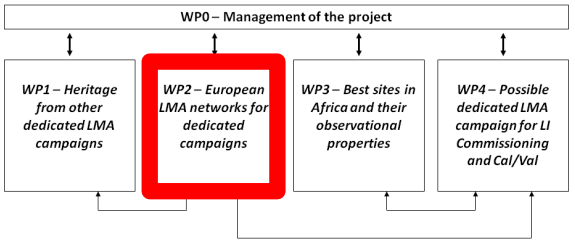
- **Identification of some key campaigns and opportunities with permanent LMA networks through literature (e.g. CHUVA-GLM, GOES-R Post Launch Test airborne science field campaign, RELAMPAGO, and ASIM Colombia; Ebro LMA & SAETTA studies).**
- **Synthesis of key information through tables.**
- **Definition of the items of the survey : on-site and remote teams, preparation, shipping, deployment and dismantlement, operation, data processing, data analysis, costs.**
- **S. Goodman and R. Blakeslee have been contacted to provide a list of potential survey recipients .**
- **Survey to be sent out to the LMA/GLM/LIS community before 12 Feb 2021.**

Main difficulties:

- **None.**

Overview of WP Achievements (W01-W07)

WP2 – European LMA networks for dedicated campaigns



WP2 Objectives (W04-W12)	Status
Evaluate the potential of the Consortium LMA networks, in their current configurations, in the perspective of a field deployment within MTG-LI field-of-view based on the heritage of past LMA-based GLM and LIS cal/val campaigns	In progress
Investigate the relevance to complement the Consortium networks with other LMA stations (from the US), other lightning sensitive sensors (e.g. magnetic, electric and electrostatic sensors, fast video camera...) and cloud/rain radars	In progress
Assessment of the required and available human resources and facilities during the MTG-LI campaign	In progress
Assessment of the (human, hardware, financial) resources required to maintain and prepare UT3 & UPC LMA networks until the MTG-LI campaign	In progress

Main achievements:

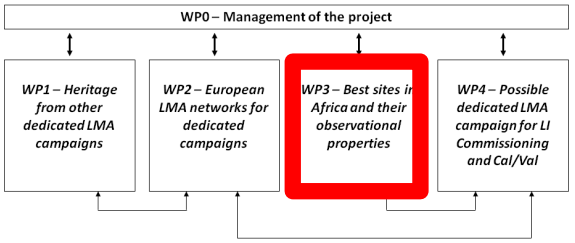
- **Very preliminary assessment conducted that helped refine the items of the survey mentioned before.**

Main difficulties:

- **None.**

Overview of WP Achievements (W01-W07)

WP3 – Best sites in Africa and their observational properties - 1



WP3 Objectives (W02-W22)	Status
Definition of the criteria to define a "relevant site" to support to MTG-LI cal/val activity based on the characteristics of lightning activity, previous published works, and EUMETSAT specifications.	*In progress*
Create regional, hourly, weekly, monthly storm climatology over Africa based on >10 years of SEVIRI cloud products and lightning (LIS, GLD360) records	*In progress*
Identify relevant sites for the deployment of LMA networks	*In progress*
Derive several field campaign properties (e.g. campaign duration, period during the year) at the identified sites based on analysis of seasonal and diurnal cycles of the convection	*In progress*

Main achievements:

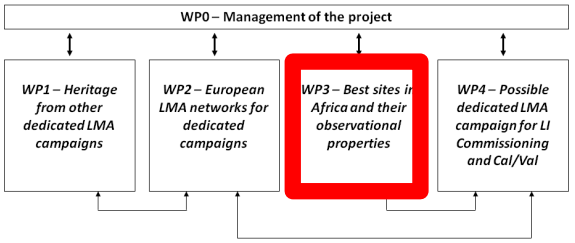
- **Development of the SEVIRI based climatology using the 10.8 µm IR band of convection occurrence and its diurnal cycle over the entire Africa for the year 2020 (prototype).**
- **Exploration of the Very High Resolution (VHR) Gridded Lightning Climatology Collection data (https://ghrc.nsstc.nasa.gov/lightning/data/data_lis_vhr-climatology.html) to produce annual, monthly and diurnal maps of lightning activity over Africa.**

Main difficulties:

- **None.**

Overview of WP Achievements (W01-W07)

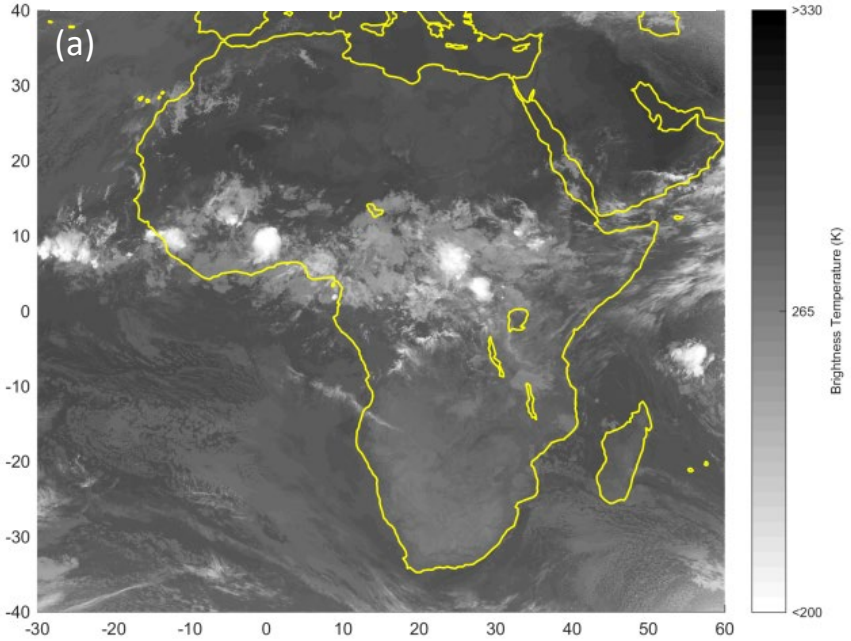
WP3 – Best sites in Africa and their observational properties - 2



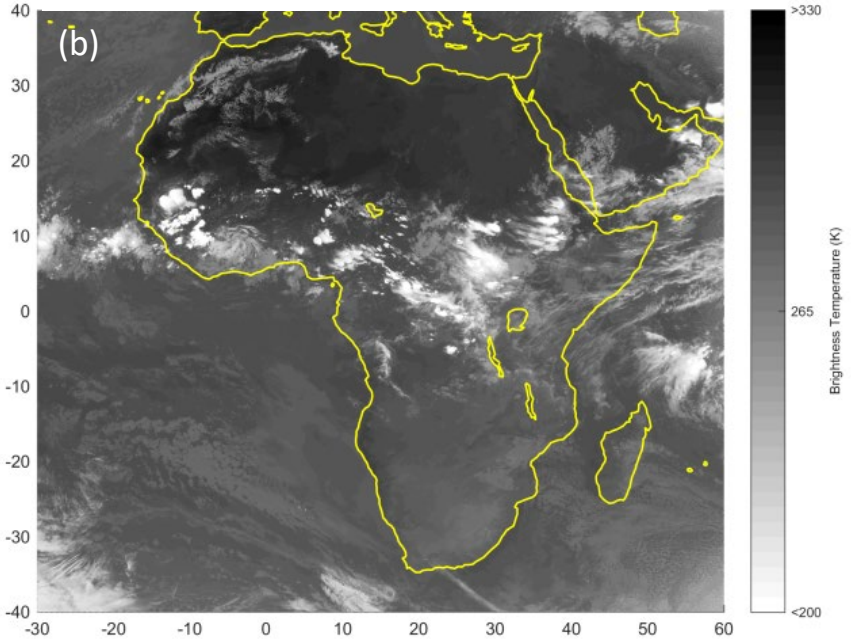
SEVIRI-based climatology

Step #1 : 15-min images

01 July 2020 – 04:00 UTC



01 July 2020 – 16:00 UTC



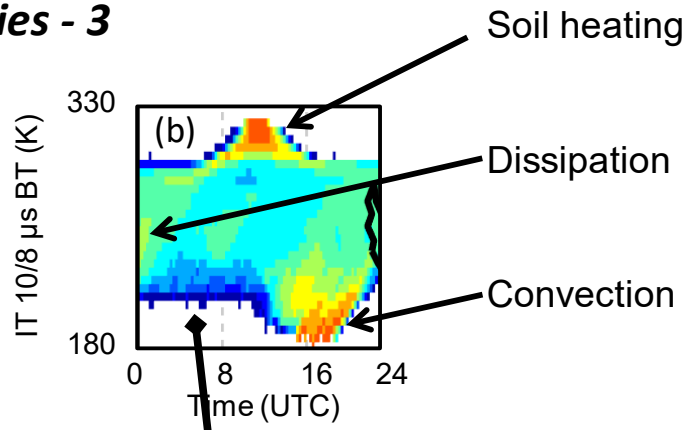
Overview of WP Achievements (W01-W07)

WP3 – Best sites in Africa and their observational properties - 3

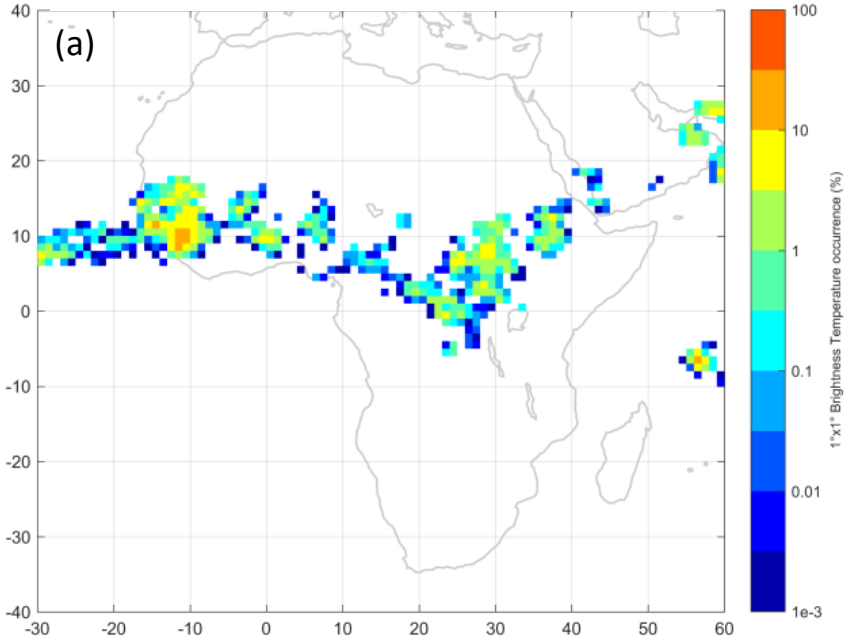
SEVIRI-based climatology

Step #1 : 15-min images

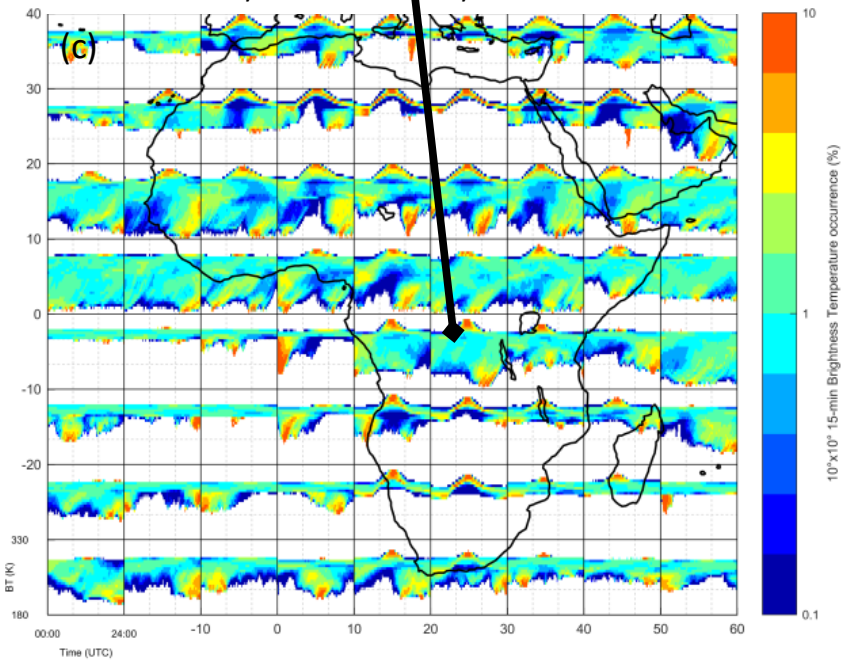
Step #2 : daily occurrence (BT < 200 K) and diurnal cycle



01 July 2020 – entire day – 1° x 1°

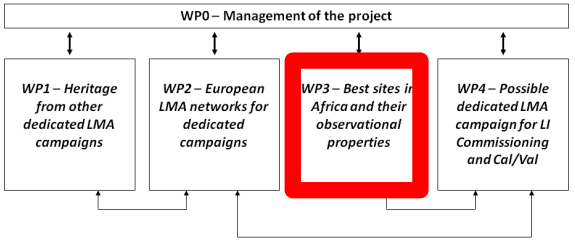


01 July 2020 – entire day – 10° x 10°



Overview of WP Achievements (W01-W07)

WP3 – Best sites in Africa and their observational properties - 4



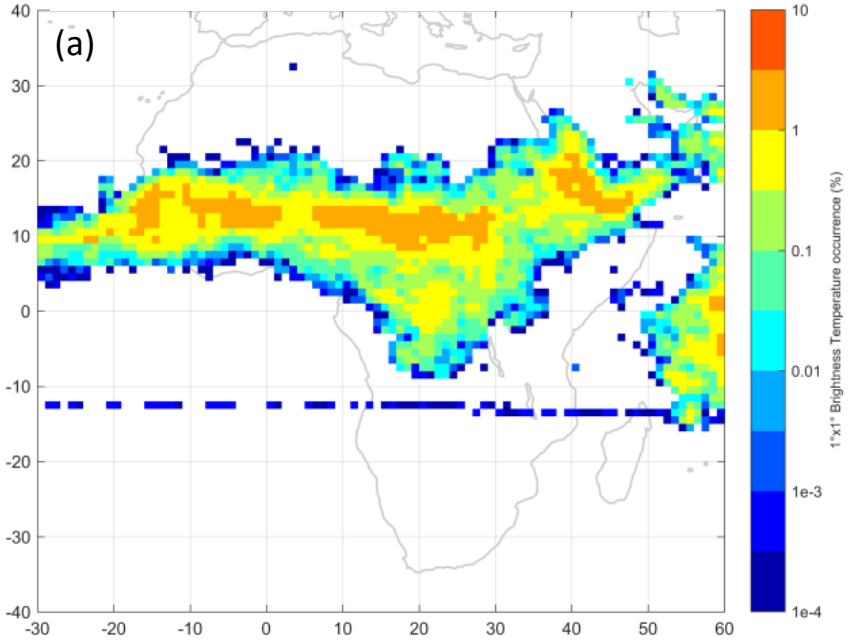
SEVIRI-based climatology

Step #1 : 15-min images

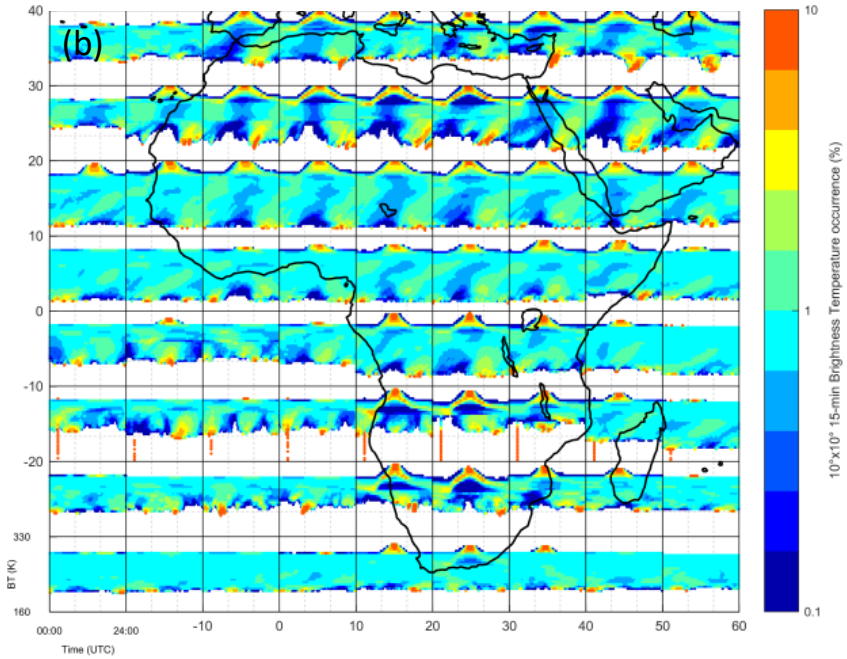
Step #2 : daily occurrence(BT < 200 K) and diurnal cycle

Step #3 : monthly occurrence (BT < 200 K) and diurnal cycle as a start

July 2020 – entire month – 1° x 1°

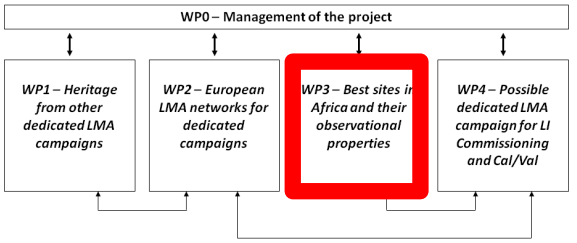


July 2020 – entire month – 10° x 10°



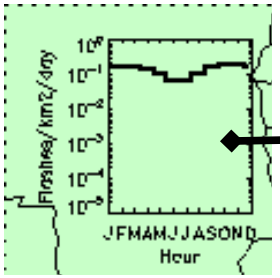
Overview of WP Achievements (W01-W07)

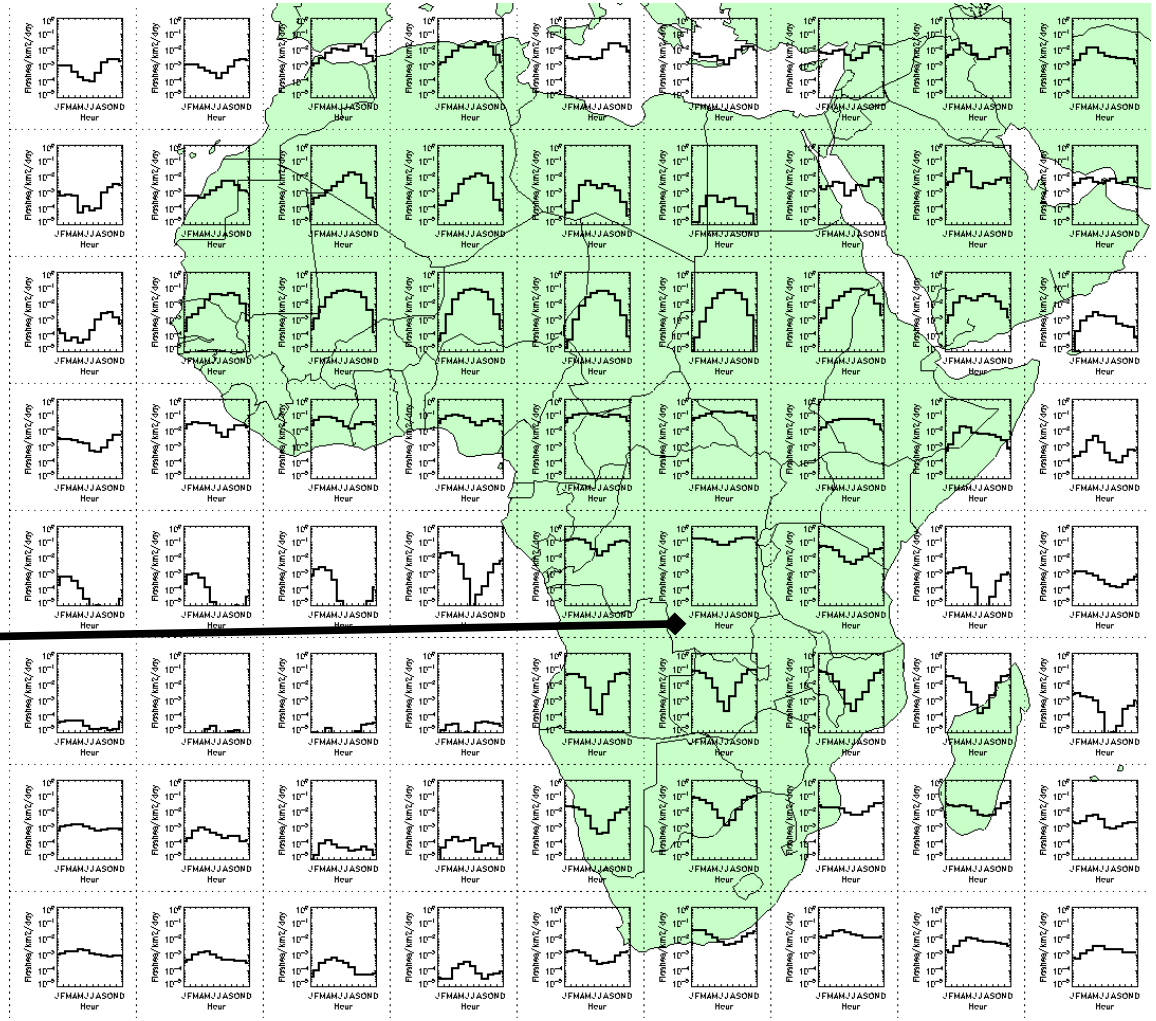
WP3 – Best sites in Africa and their observational properties - 5



TRMM-LIS-based climatology

- **Annual flash density**
- **Monthly flash density**
- **Three-month (seasonal) flash density**
- **Diurnal flash rate distribution**
- **Diurnal flash rate distribution (seasonal)**
- **…**

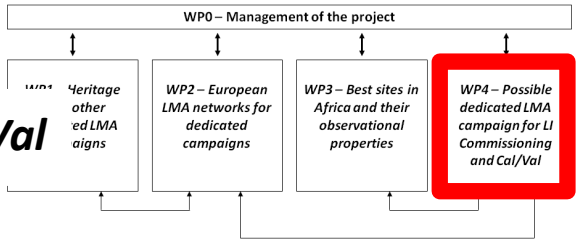




Monthly flash density (flash/km^2/year) computed per 10° x 10° region based on TRMM-LIS data

Overview of WP Achievements (W01-W07)

WP4 – Dedicated LMA campaign for LI Commissioning and Cal/Val



WP4 Objectives (W16-W24)	Status
Propose plans for dedicated LMA campaigns for the potential regions identified in WP3 based on WP2 assessment, including an analysis on logistical, environmental and operational implications	*Not started*
Conduct a risk analysis related to the LMA operation for the proposed scenario	*Not started*
Exchange with EUMETSAT office of International Relations (SCIR) on the feasibility of dedicated campaigns in the candidate locations emerging from the study	*Not started*

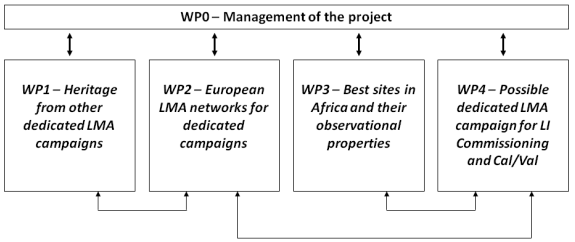
Main achievements:

- **n/a.**

Main difficulties:

- **n/a.**

Deliverables and Milestones



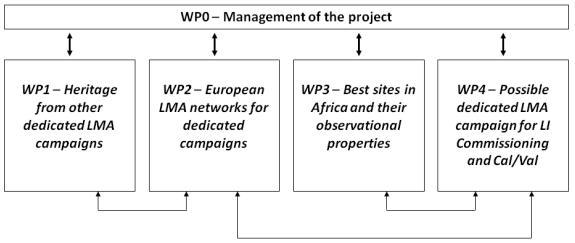
- **Milestones**

Reference	Date	Description
Kick-off (KO)	T0 – 17 days	Start of the activities; online meeting
1st Progress Meeting (PM-1)	T0 + 6 weeks	Presentation of the study status; online meeting
Mid-Term Review (MTR)	T0 + 12 weeks	Presentation of the study status; online meeting
2nd Progress Meeting (PM-2)	T0 + 18 weeks	Presentation of the study status; online meeting
Delivery of draft Technical Report (TR) and Plans for Dedicated Campaign (PDCs)	T0 + 24 weeks	Presentation of the final results of the study; meeting at EUMETSAT headquarters
Review of draft TR and PDCs	T0 + 26 weeks	Review of the delivered material; online meeting
Delivery of Final TR and PDCs	T0 + 28 weeks	Final delivery; online meeting

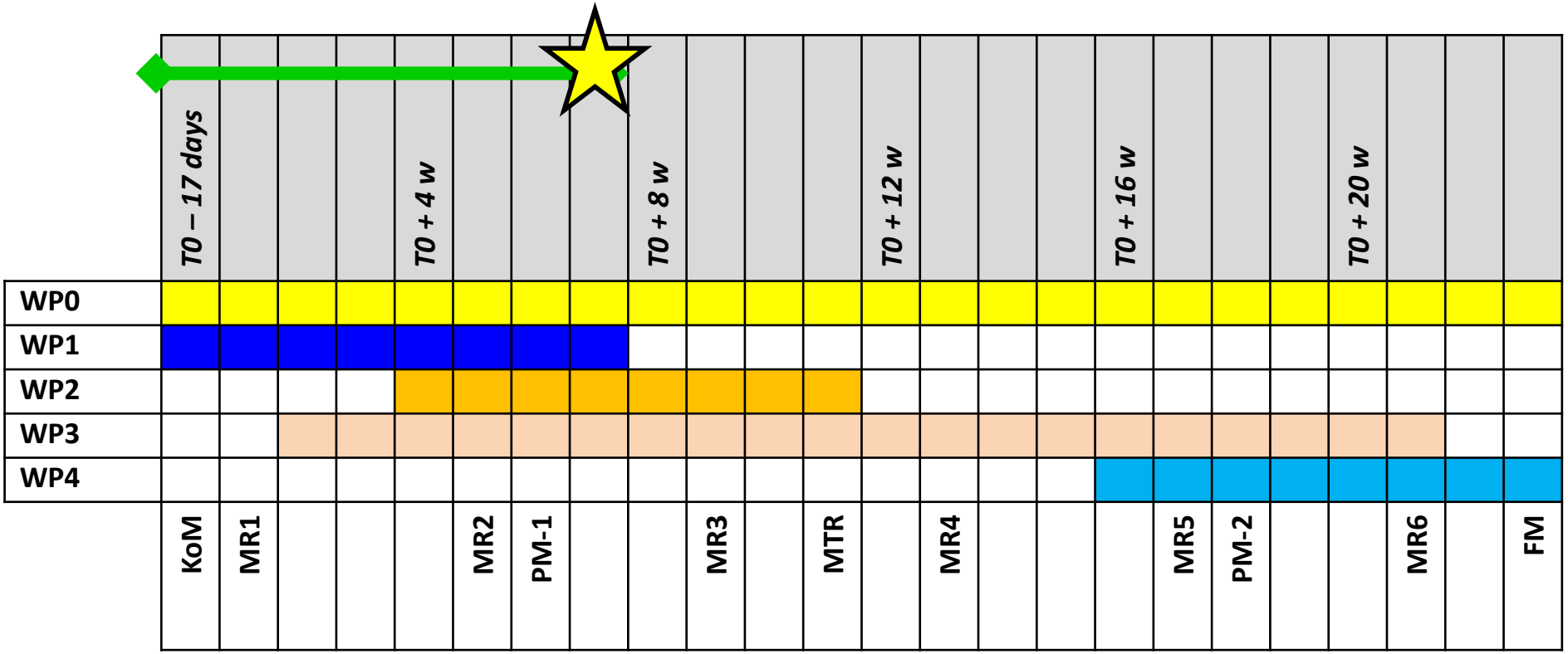
- **Deliverables**

Reference	Date	Description
KO presentation	T0 – 17 days	Status & plans at the start of the study
Monthly report	During the 1st week of each calendar months	Short description of activities and status of study (1-2 pages)
PM-1 Presentation	T0 + 6 weeks	Status of the study
MTR documentation and presentation	T0 + 11 weeks (one week prior to MTR)	Presentation of the status of the study; planning for the remaining time of the study
PM-2 Presentation	T0 + 18 weeks	Status of the study
Draft TR and PDCs	T0 + 23 weeks (one week prior to FP)	Full (draft) technical report and campaign plans
Final TR and PDCs	T0 + 27 weeks at the latest	Final technical report and campaign plans

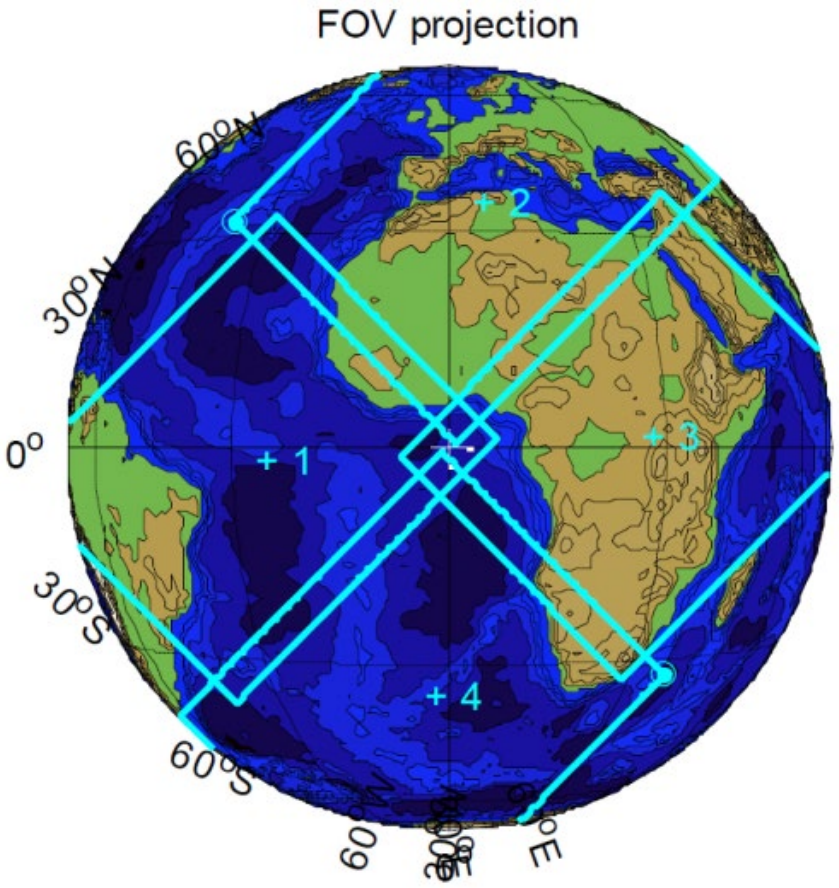
Way Forward



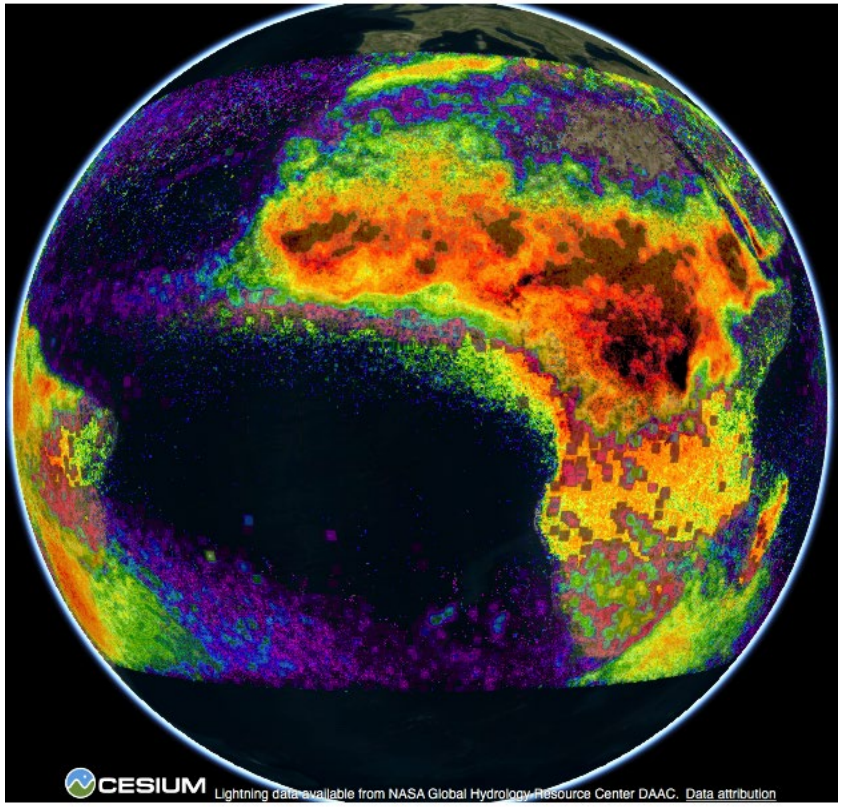
- **Pursue the study along the initial schedule with**
  - **Completion of WP1 activities**
  - **Pursue of WP2 and WP3 activities**
- **Next milestone : Mid-Term Review (T0 + 12 weeks)**



Thanks ! Any question ?



https://www.eumetsat.int/mtg-lightning-imager



TRMM LIS 0.1 Degree Very High Resolution Gridded Climatology
https://ghrc.nsstc.nasa.gov/lightning/data/data_lis_vhr-climatology.html