Lightning Imager – User Readiness

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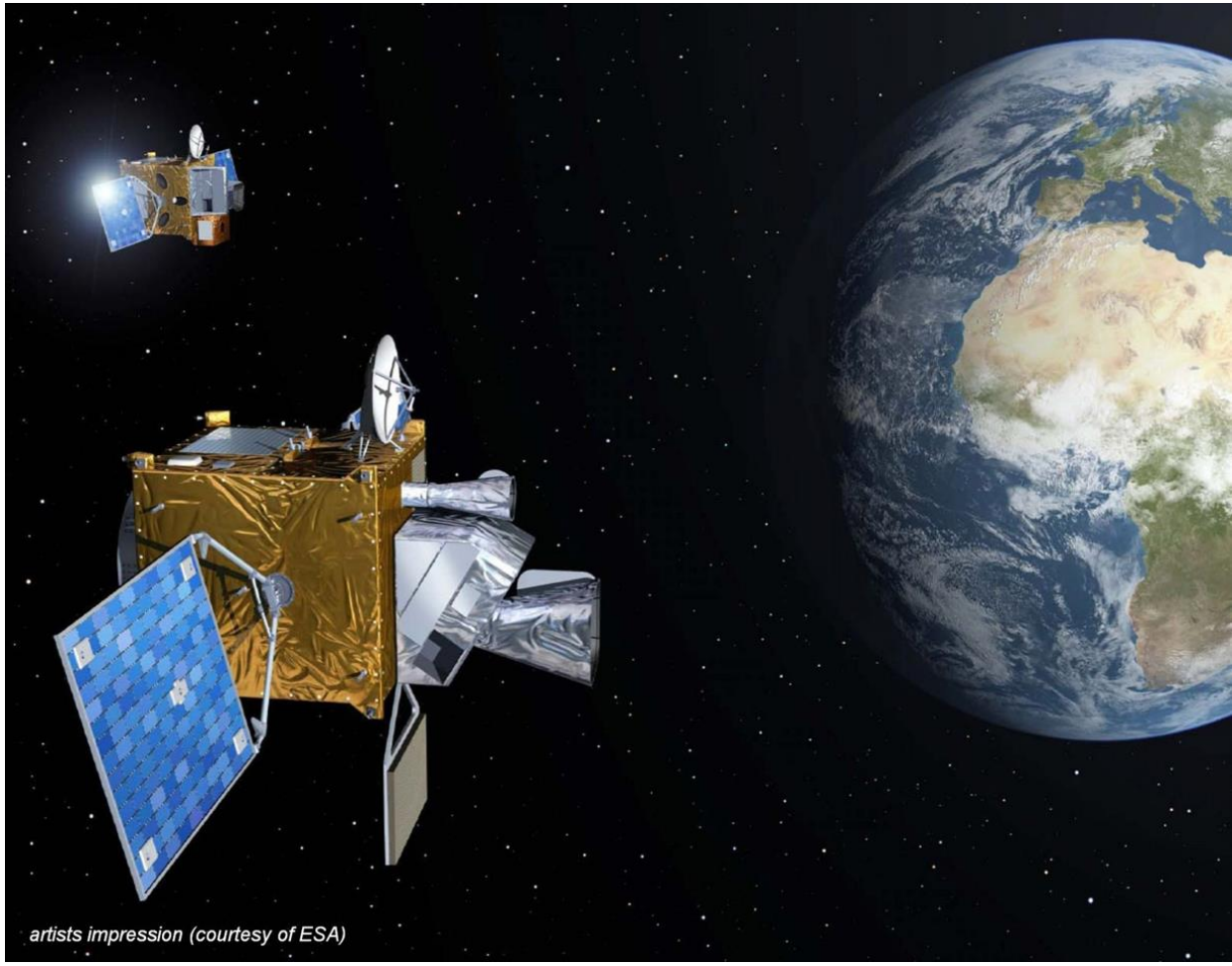
MTG Lightning Imager (LI) will be a novel instrument designed to monitor the real time activity of atmospheric lightning from the geostationary orbit.

As the preparations to its launch are on the way the following questions arise:

- How do the main data users (i.e., operational forecasters) plan to use the data?
- What benefits they expect to get from it?
- What are their typical ways of monitoring lightning at present?
- And, if the instrument and data is not yet available, how to demonstrate the applicability already now?!

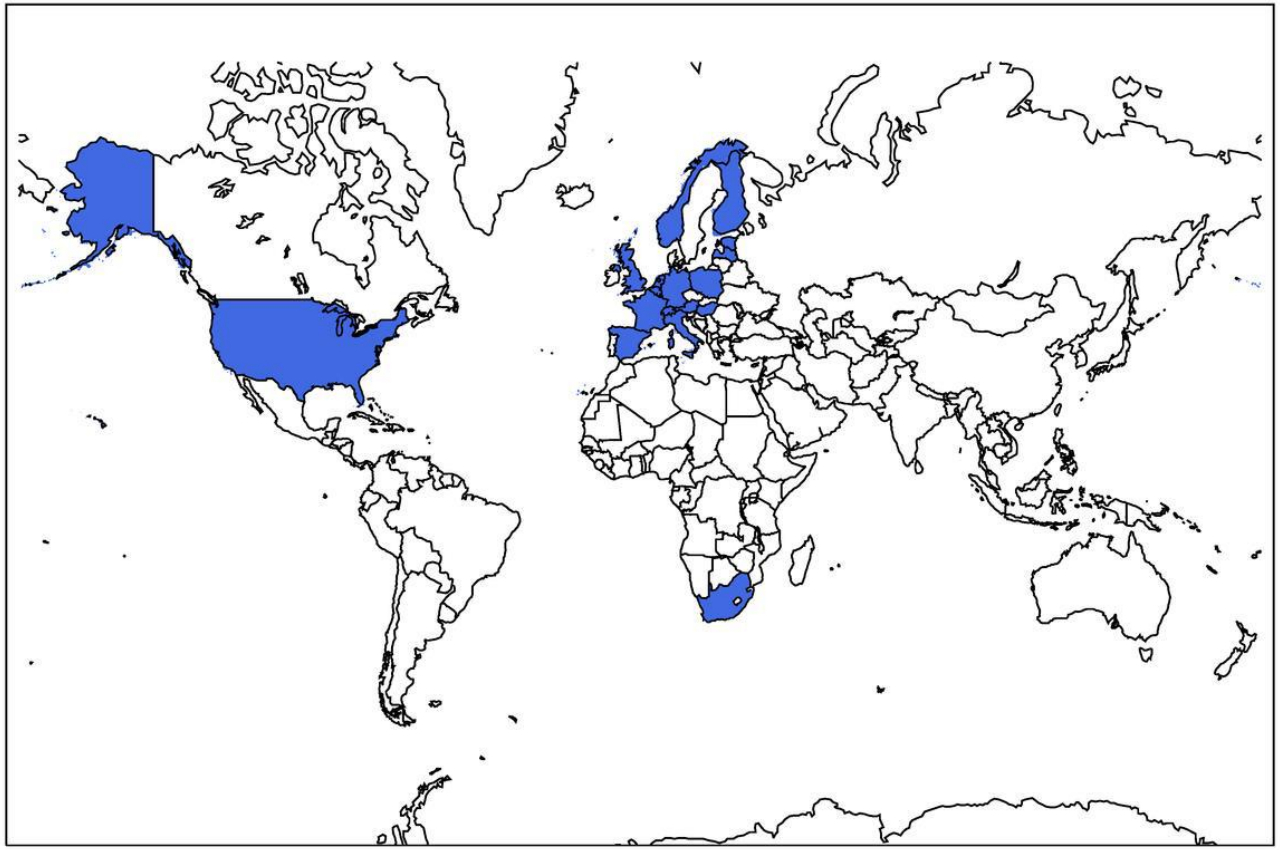


An Eumetsat LI MAG study has been prepared and accomplished with the following objectives:

- Chart the readiness and expectations of the main data users (i.e., NMHS's in Europe);
- Generate LI-proxy data available for testing by the main data users;
- Collection and analysis of the feedback and input regarding the proxy data, its use in the case studies, and the LI products (flashes, accumulated products).

In order to chart the readiness and expectations of LI, a brief questionnaire has been launched and distributed among the main LI data users, i.e., National Meteorological and Hydrological Services (NHMS) of EUMETSAT's Member and Cooperating States in Europe, as well as some selected organizations worldwide.

The total number of valid responses received was 62, originating from 17 different countries (15 EUMETSAT Member States in Europe, plus USA and South-Africa) and 20 different institutes, of which the majority (94%) is NHMS.



Knowledge of LI

- 31% (19/62) of the respondents indicate not to have heard about LI prior to this questionnaire.
- 82% (51/62) of the respondents are satisfied with the information received prior to the questionnaire, whereas 18% (11/62) would like to receive more details about the physical principle of detection.
- 60% (37/62) of the respondents would like to receive training related to the use of MTG LI data in the future.

Use of satellite and/or LLS data

- The majority of the respondents (56/62, 90%) indicate that their organization currently makes use of EUMETSAT data.
- Most of the respondents (57/62, 92%) indicate to make already use of observations of electrical activity observed by a ground-based lightning location system. The bulk of these networks have regional coverage (47/62, 76%).

Expectations and use of LI data

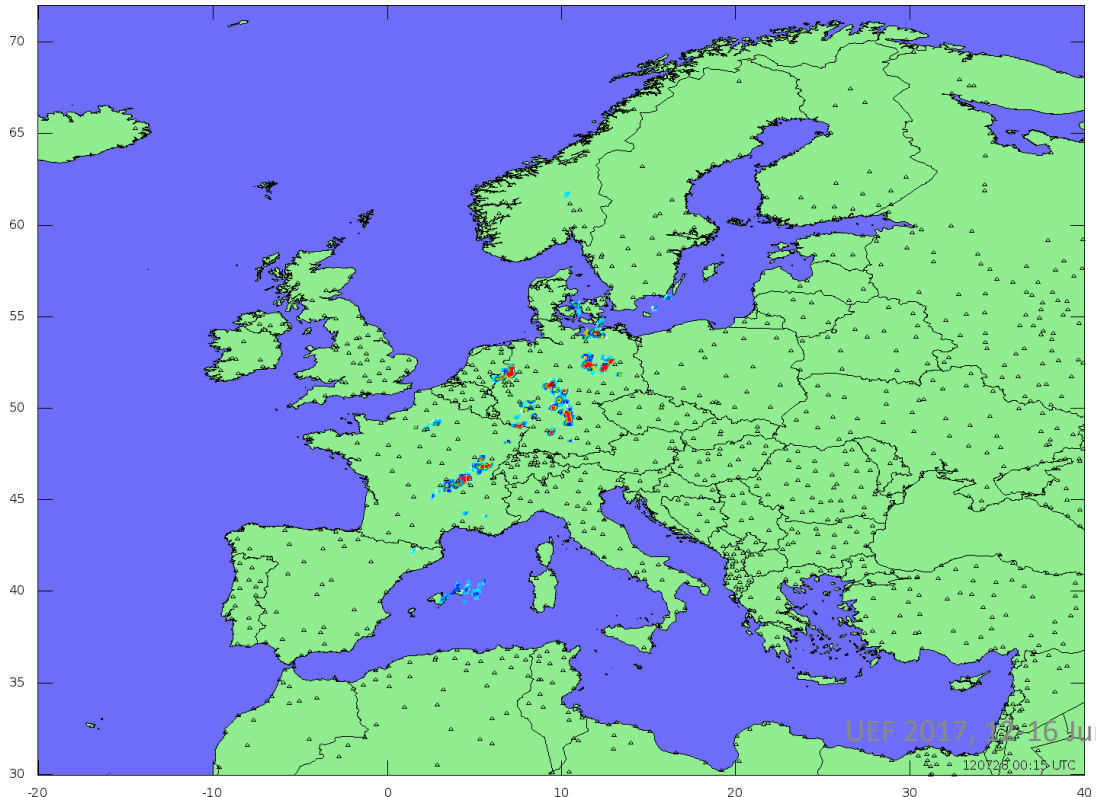
- LI will bring an improved performance and homogeneity over a more extended region than is currently possible with regional LLS. The possibility to observe lightning over mountainous and maritime regions is highly rewarded.
- LI is expected to be very useful in nowcasting of severe weather phenomena associated with deep convection, as well as when combined with other satellite data products available.
- 56% (35/62) do not know, or is not sure whether their organization is planning to incorporate MTG LI data, whereas 40% (25/62) expects or is sure the LI will be used.
- 75% (45/62) believes that observations by LI will complement the lightning data they are using today, and is thought to play an important role as a “Weather forecast and warnings” tool.
- The majority of respondents believe that the domain to receive LI should be larger than their respective country borders in order to anticipate on the arrival of convective developments further away.

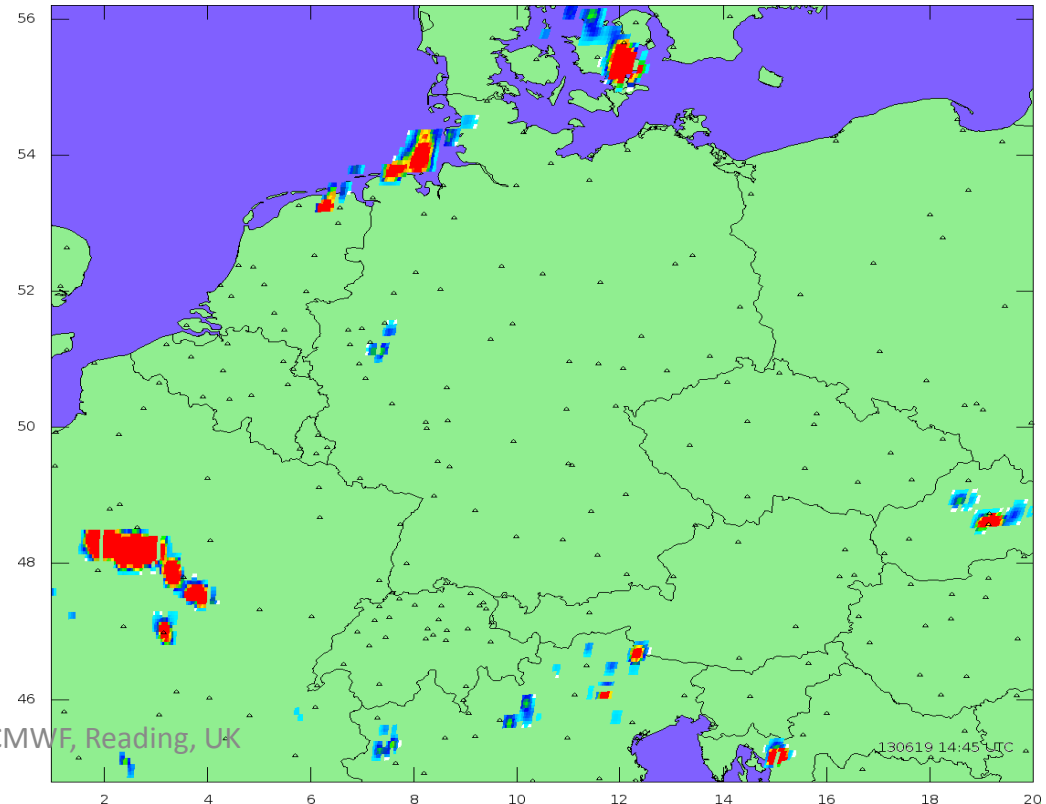
Generation of LI data

- The proxy data generator for LINET ground-based data has been developed within the LIMAG group. The generator reads in the ground-based data and transforms the data to statistically resemble the optical data in terms of groups per flash, radiance and surface area, respectively. Distribution functions were developed for the event rate, i.e., the number of optical events per optical flash, radiance, and footprint, i.e., the surface area of the optical event. All of these three parameters are log-normally distributed.
- The optical data refers to the data of the Lightning Imaging Sensor (LIS) on the TRMM-satellite on Low Earth Orbit (LEO).
- The basis for the proxy data generation is to first analyse the event rate of the ground-based data and see how it corresponds with the event rate distribution of the optical data.

Proxy data experiments with NMHS's and their operational users of lightning data with historical case studies were planned.

- An internal study team with operational forecasters and researchers has been set up (FMI, RMI, IMWM-NRI, DWD);
- Data visualisation and reporting tools for the case studies were created:
  - one covering **the whole Europe** (common tool for all);
  - another for **a zoomed/specific region for each country.**

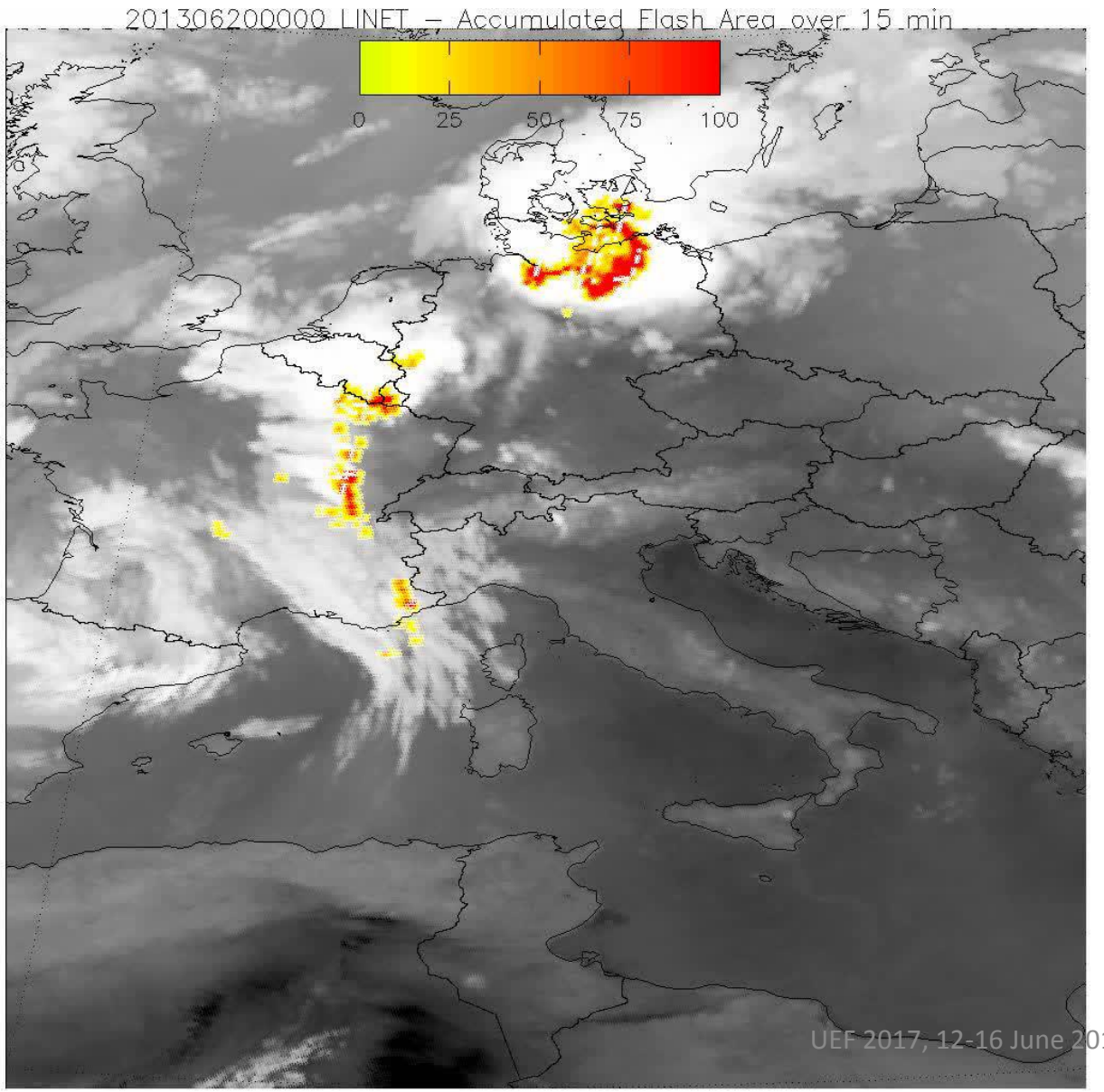


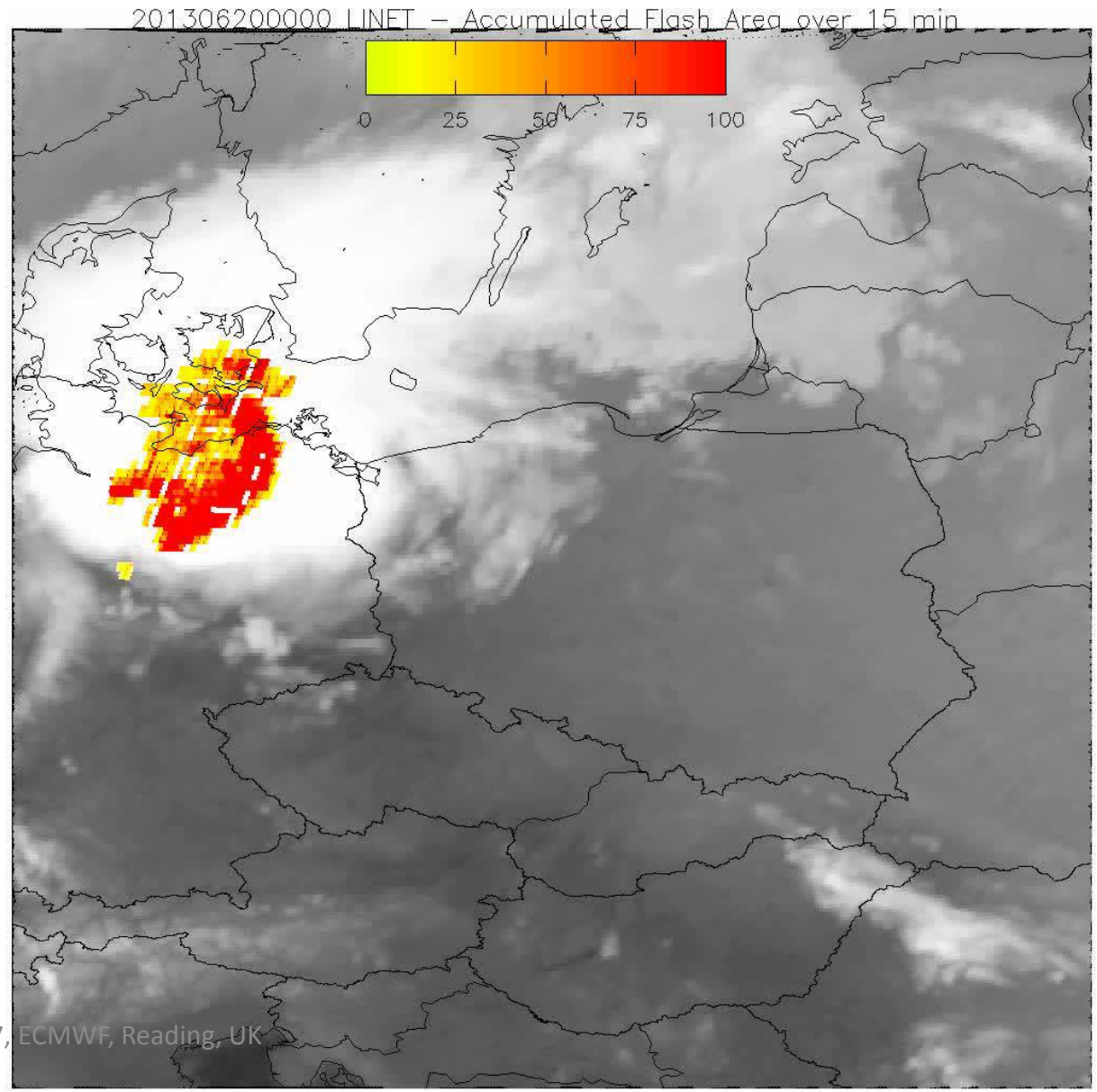


Proxy data experiments were conducted with help of the operational forecasters. The following procedure was used at each of the NHMS:

1. The responsible person for organising the training at each of the NHMS described the purpose of the study and a short introduction regarding the LI for the forecasters.
2. The forecasters then independently tested the proxy data visualisations in contrast to their previous usage, understanding and experiences on lightning location data, and provided feedback to a questionnaire.
3. After the testing, a wrap-up discussion session was organised with the forecasters.

NMS	# of participants
FMI	4
IMWM-NRI	32
RMI	2
DWD	3


201306200000 LINET – Accumulated Flash Area over 15 min
0
25
50
75
100


201306200000 LINET – Accumulated Flash Area over 15 min
0
25
50
75
100

Based on the forecaster feedback and the testing sessions, the following conclusions can be made:

- There is no single tool or “best practice” to use the data, but it is actually totally dependent on the forecasters' preference.
- LI has as an advantage in comparison to ground-based systems that propagating thunderstorm systems can be tracked already way before they arrive to a certain country or region. A continental scale visualization is an added value.
- The flash density (accumulated product) mapping tool is very useful for visualizing lightning activity; it presents the scale of the approaching storm and can be used to produce warnings.
- LI information superimposed onto satellite imagery (FCI) should give good combined information of thunderstorms.
- The LI information will reach the end users much faster than scanning-based imagery data (e.g. radar).
- Each forecasting office employee in Europe will look at the same data fields of LI information which can be great advantage in cases of transnational cooperation between institutes. In case of severe storms, the forecasters cooperate with the neighbouring countries through briefings. However, each country/institute might use different criteria with relation to severe storm warnings.
- Not a replacement of current ground-based network, but a useful addition:

  Continuous data (same detection efficiency for large coverage)

  Larger coverage, useful e.g. for approaching weather systems from the Atlantic, weather forecasts for emergency services / relief organisations that temporarily work overseas, aviation meteorology (e.g. for aircraft routing).

Thank you ☺

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