European Commission

esa

RESULTS FROM EU-ESA WORKSHOP ON NEO IMMINENT IMPACTORS WARNING COORDINATION

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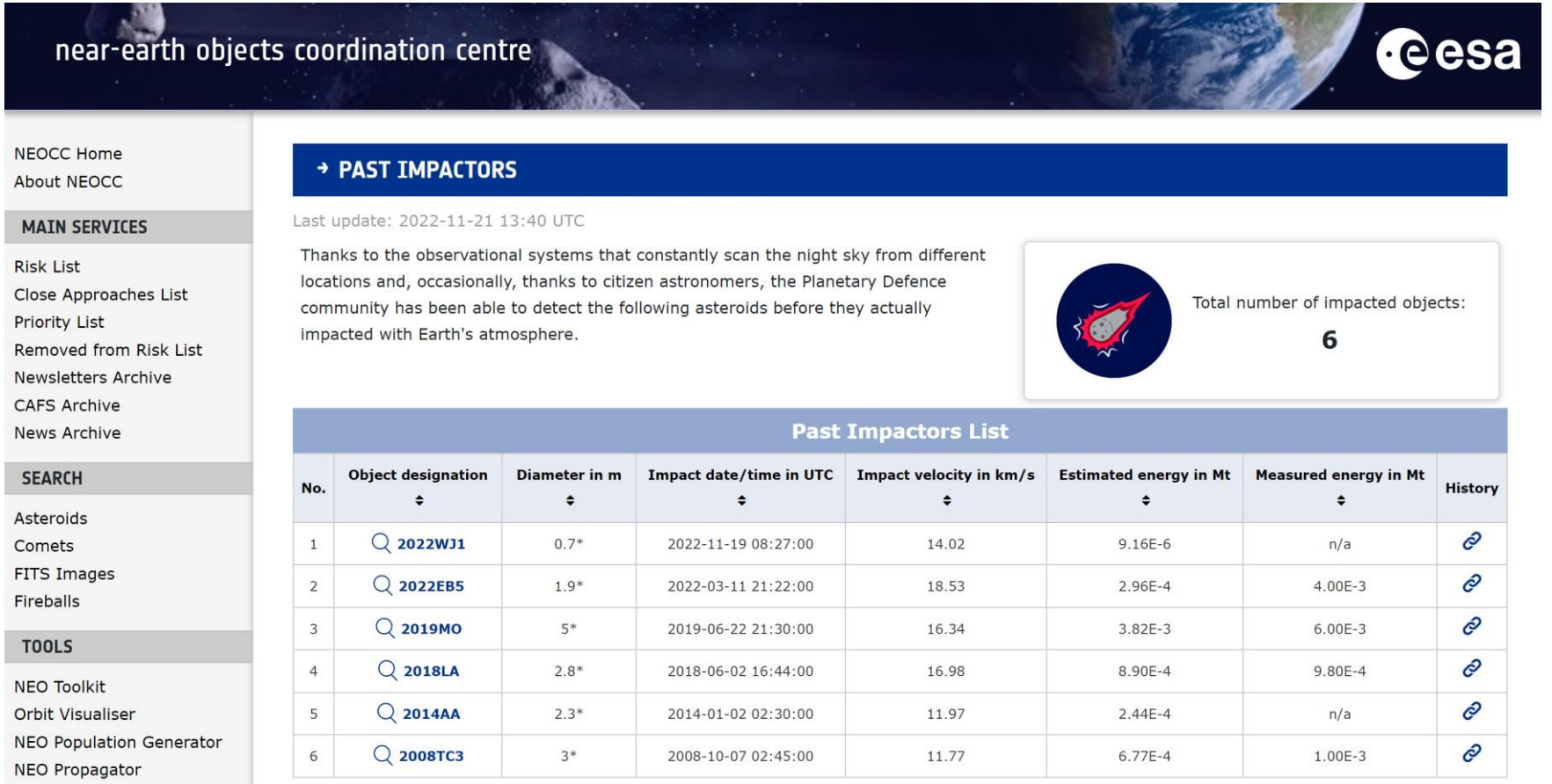
ESA ESRIN

8th Planetary Defense Conference - 06/04/2023

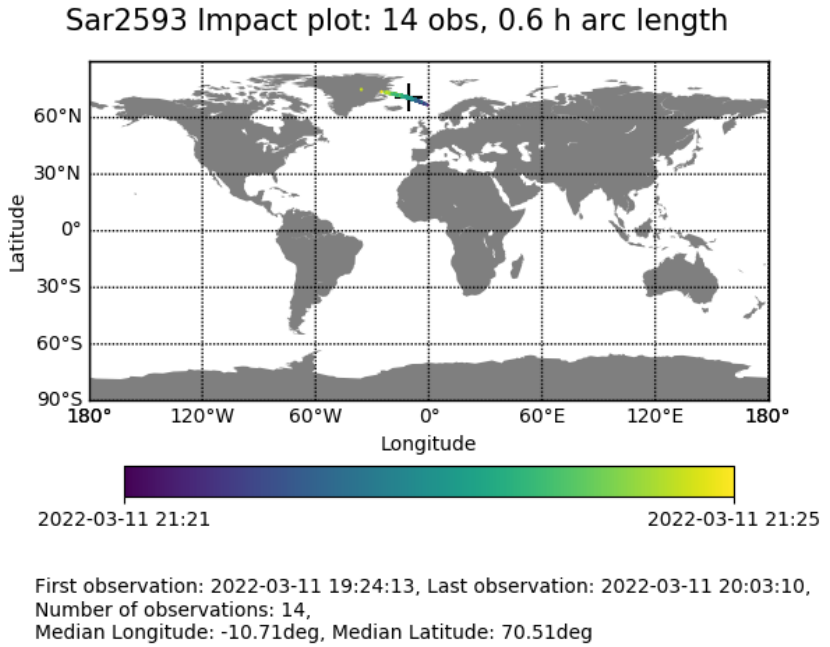
BACKGROUND

- EU has tasked and funded ESA a number of activities until 2027 in the NEO field
- We have to organise **one conference per year will be organized until Q4/2027**



BACKGROUND / 2022 ACTIVITY

- 2022 EB5 impacted the Earth on 11/03 over the Norwegian sea
- The object was discovered by K. Sárneczky from the Konkoly Observatory (Hungary) just 2 hours before impact



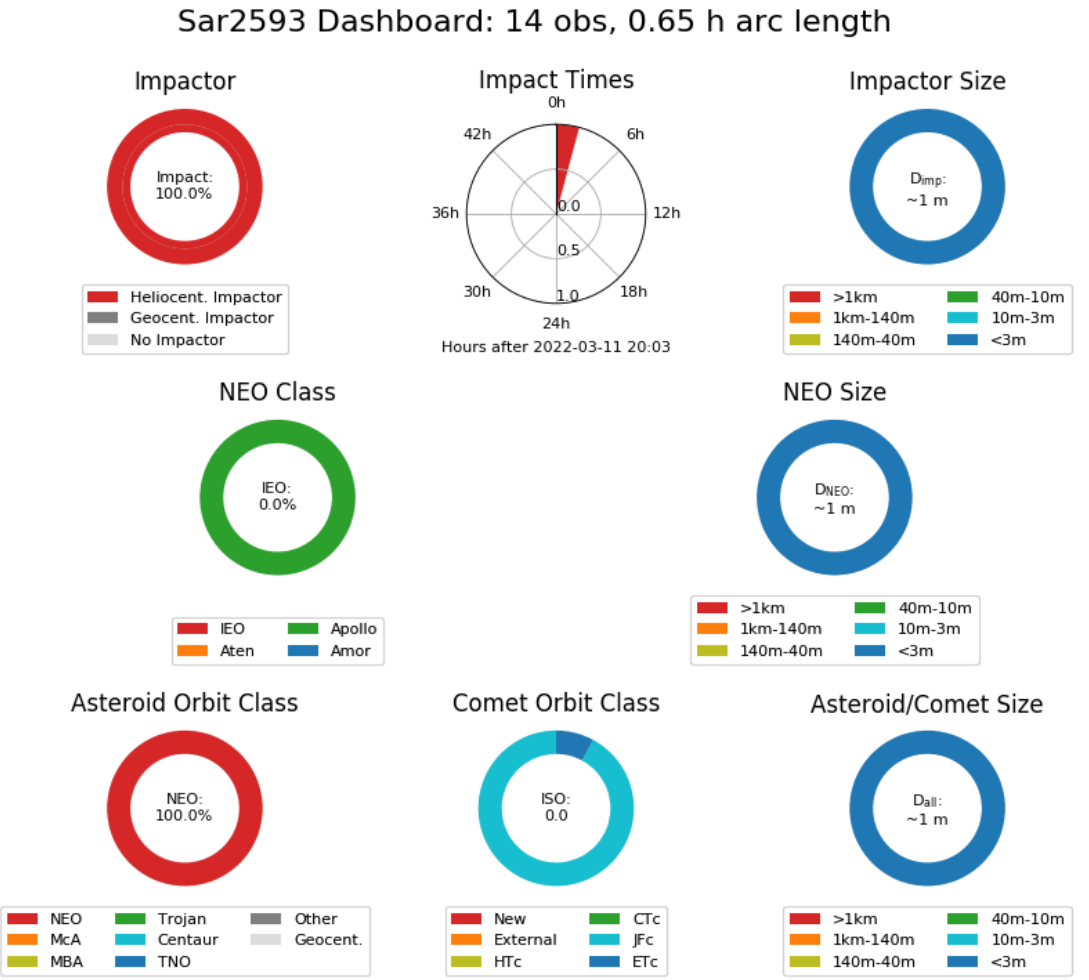
Credit: ESA / NEOCC

- 2022 WJ1 impacted the Earth on 19/11 over the Great Lakes area
- The object was discovered by D. Rankin from the Catalina Sky Survey 3 hours before impact

Credit: Rob Weryk

BACKGROUND / STATE OF THE ART

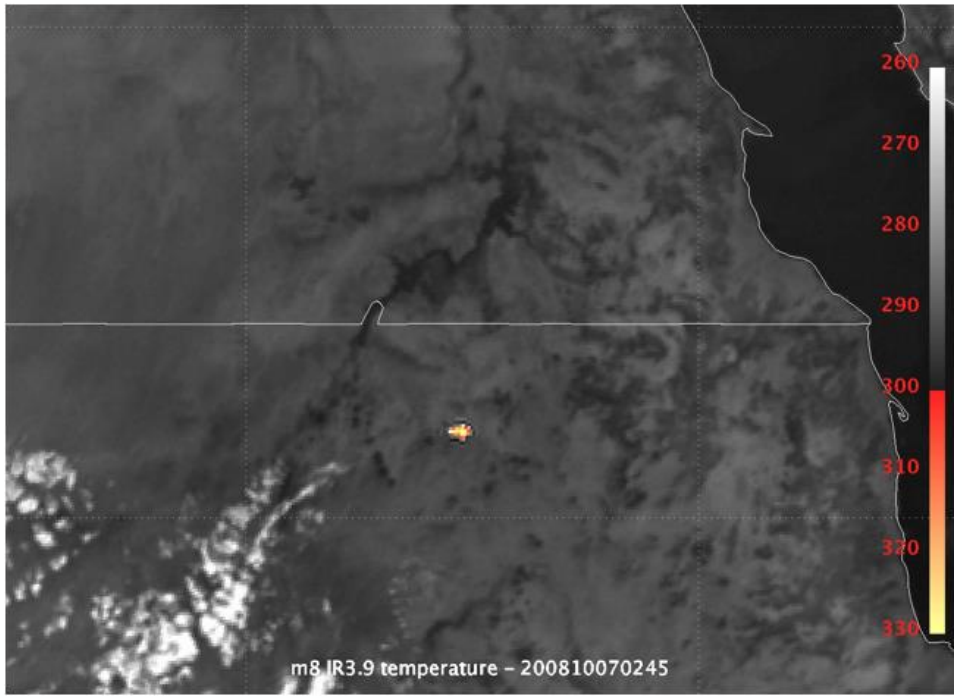
- Several systems are currently operating to alert of imminent impactors to the expert community: **Meerkat** (ESA, non-public), **Scout** (NASA) and **NEOScan**
- These services are based on **systematic ranging algorithms** and provide impact chances, ephemerides calculation, best observation locations/times, etc
- When one is detected, those experts typically trigger the NEO observational community to increase the **number of measurements as fast as possible**
- It would be of great help if a **network of interested observers** could be established to support these efforts



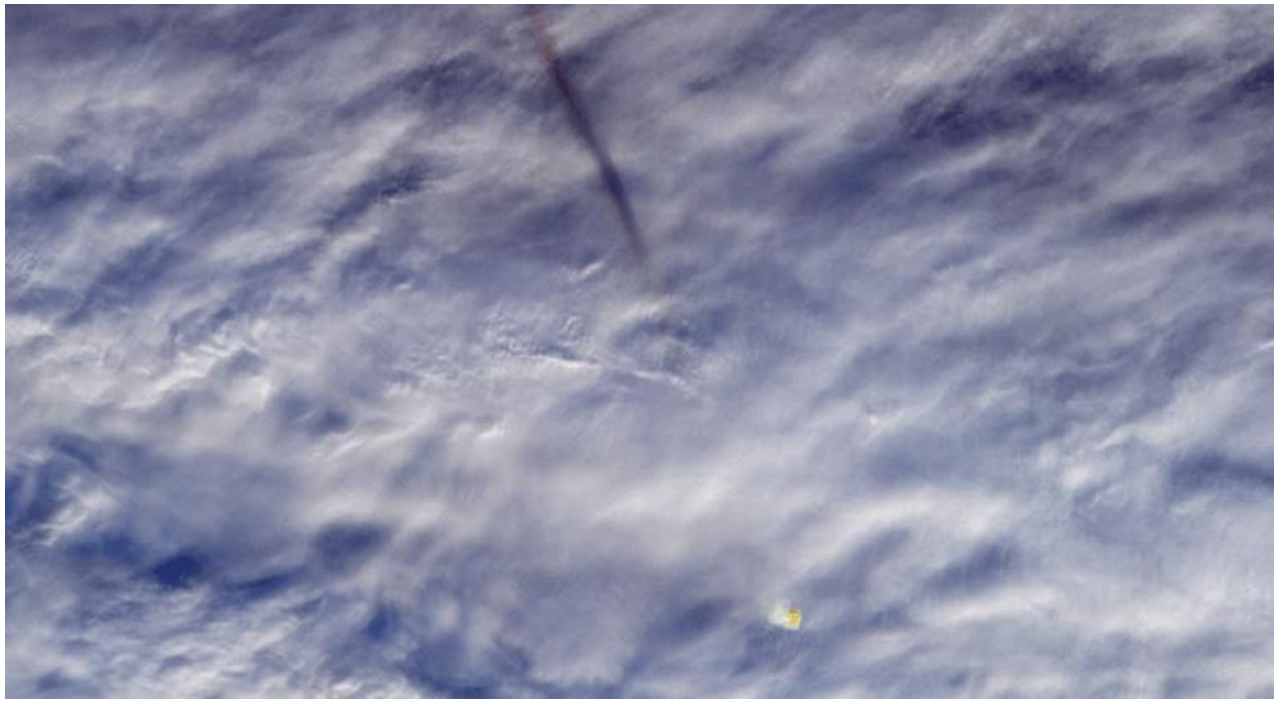
Credit: ESA / NEOCC

BACKGROUND

- Furthermore, this could be extended to the EO and METEO community such that **satellite imagery** is gathered (e.g. 2008 TC3 and the Bering Sea events), and possibly targeted, whenever feasible



Credit: EUMETSAT / Meteosat 8



Credit: NASA/GSFC/LaRC/JPL-Caltech, Terra satellite, MISR Team

SUMMARY FOR 2022 EVENT

Item	Proposal
Subject	**Coordination of Imminent Impacts**
Purpose	To share the current state of the art in different areas and to foster the creation of a multi-disciplinary network of imminent impactor observers (observatories, satellite operators and fireball networks) and a notification system for the network
Time	12-14 December 2022
Location	ESOC
Potential attendees EU	ESA/PD, ESA/EO, Copernicus, EUMETSAT, ASI, ESO, observatories, fireball networks
Other potential attendees	NASA, worldwide observatories
Attendance	45 onsite & 45 remotely
Mode	Hybrid
Talks	By invitation

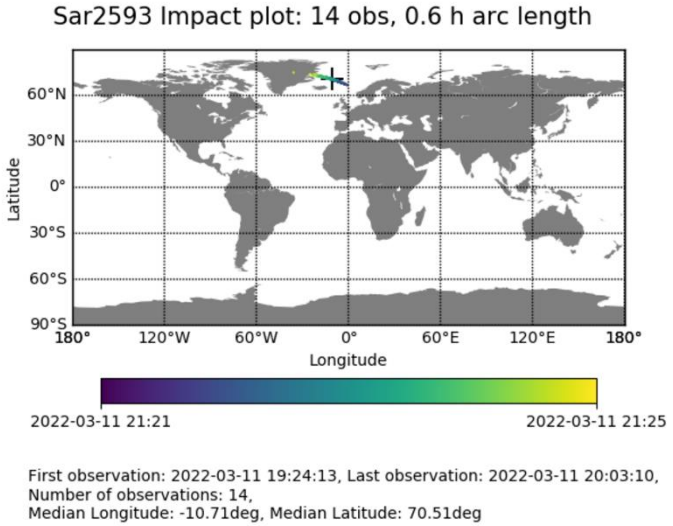
SESSIONS

1. New developments and updates to imminent impactor services
2. Observatories and observation networks for imminent impactors
3. Imminent impactor observation opportunities by spacecraft
4. Fireball networks and other sensing capabilities
5. Imminent impactor information exchange solutions (for discussion)

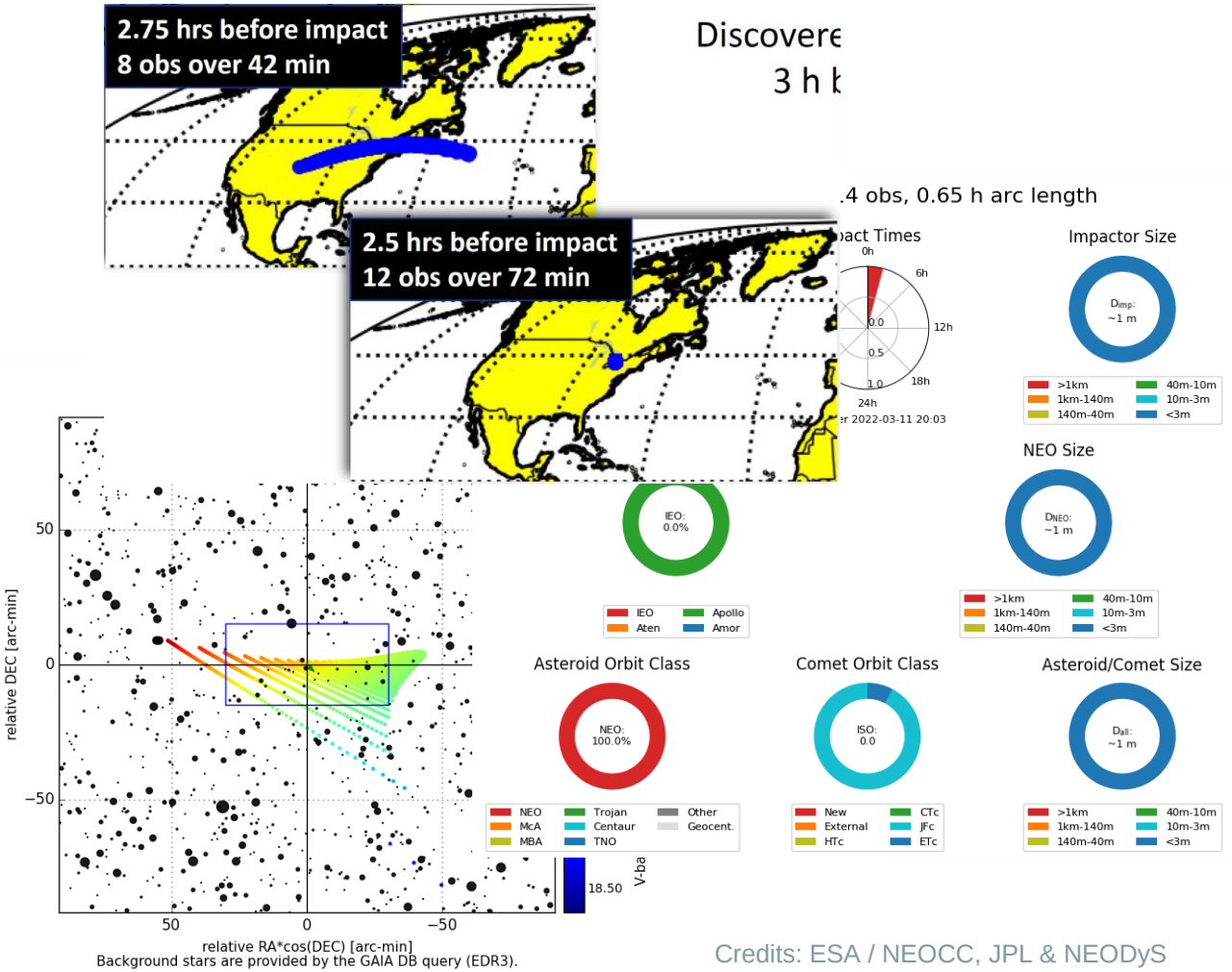
There was ample time for discussion in the different sessions.

SESSION 1 - PRESENTATIONS

- Immediate near-misses and resonant returns
- Evolutions in the processing done by MPC
- Status of Scout, Meerkat and NEOScan
- Rapid response exercise by NEOROCKS project
- Summary on the discovery of 2022 EB5



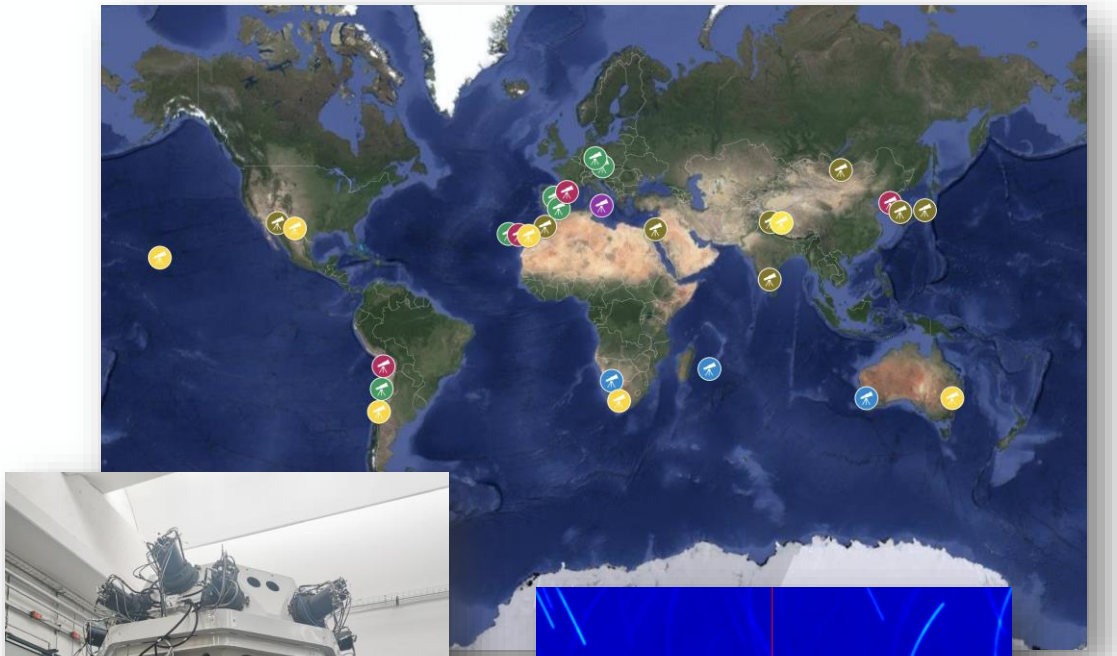
Credit: ESA / NEOCC



Credits: ESA / NEOCC, JPL & NEODyS

SESSION 2 - PRESENTATIONS

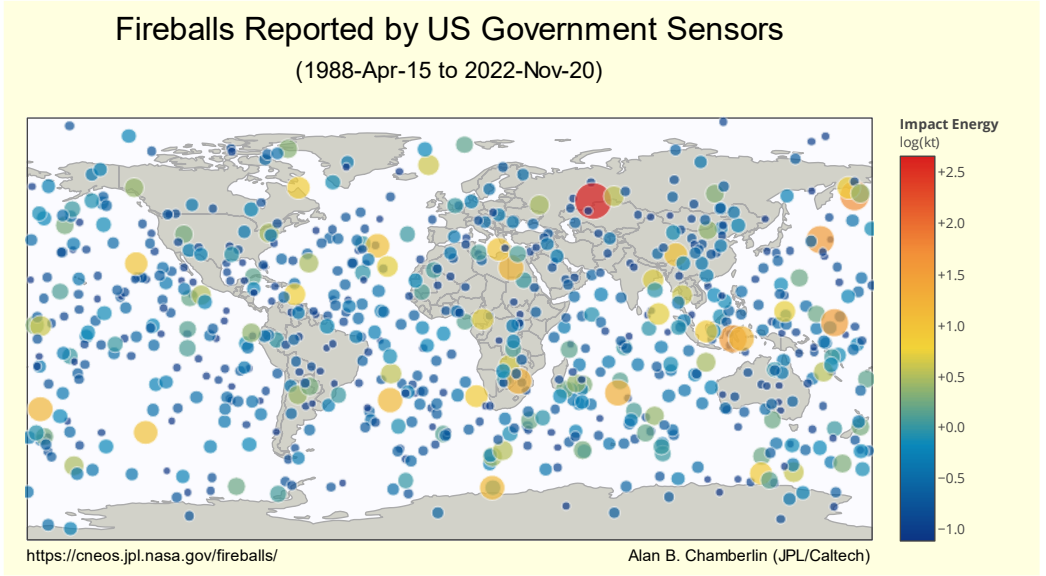
- Pan-STARRS and the case of 2019 OK
- ATLAS survey summary
- Catalina Sky Survey and NEOfixer
- Quick reaction capabilities of ESA's NEO observing network
- Projected performances of current and future ground based telescopes, including Flyeye
- Rubin Observatory expected performances

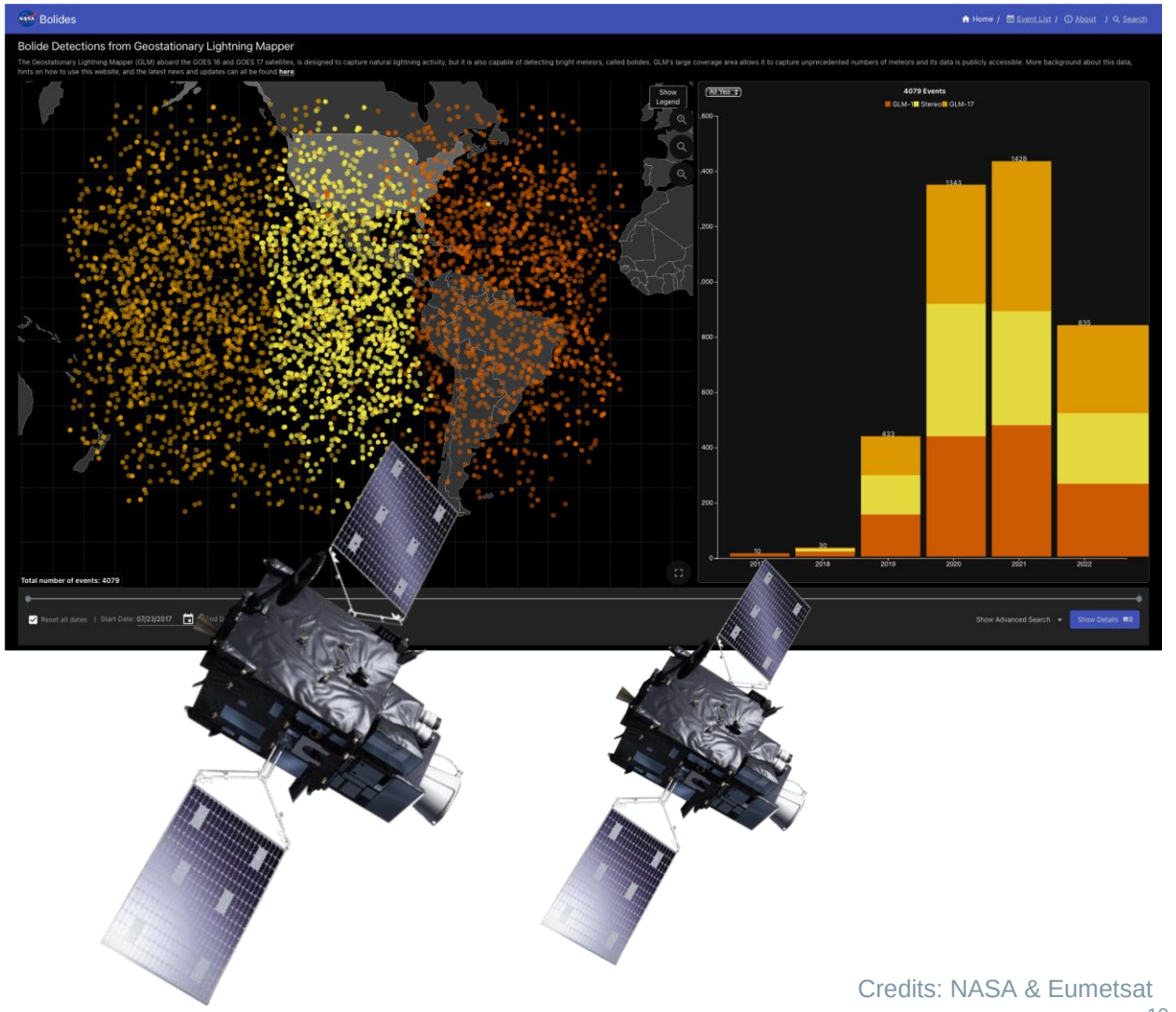


Credit: ESA / NEOCC & OHB Italy

SESSION 3 - PRESENTATIONS

- Pipeline performances and statistical analysis of GOES GLM
- Application of MTG LI to fireball detection
- NASA's PDO program
- Detection of weak meteoroids observed by US sensors

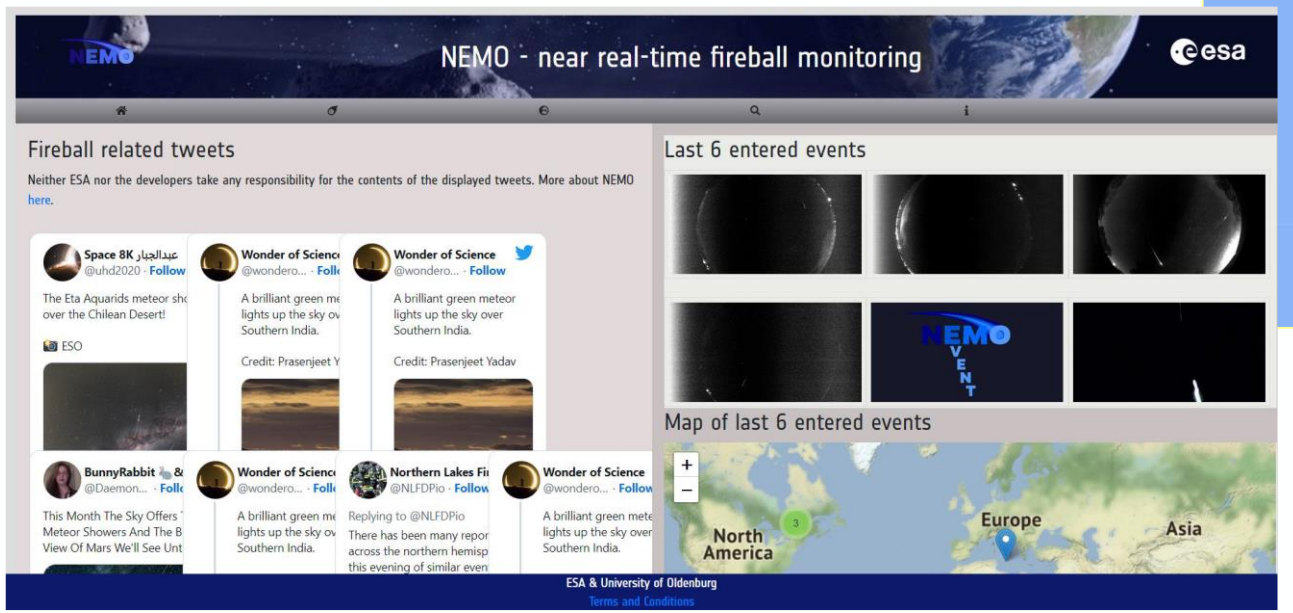




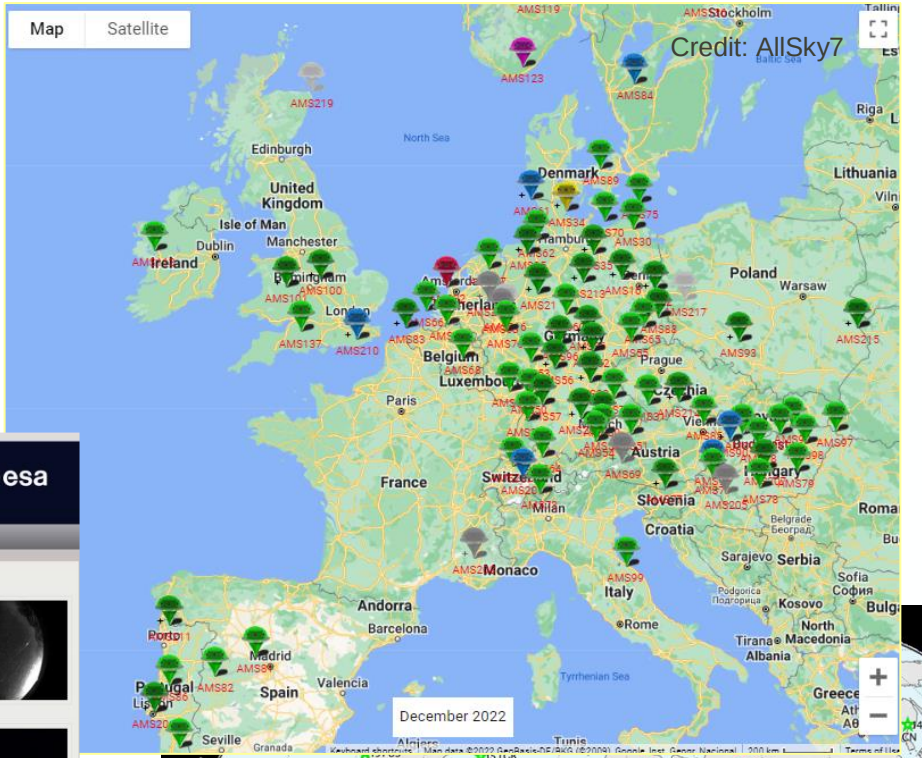
Credits: NASA & Eumetsat

SESSION 4 - PRESENTATIONS

- International Meteor Organisation network
- AllSky7 network
- Infrasound detections by CTBTO
- ESA's NEMO monitoring system



Credit: ESA & U. of Oldenburg



Credit: CTBTO

SESSION 1 – DISCUSSION / SUMMARY

- MPC commented on the current implementations being performed at the centre to increase the automation of the treatment of NEOCP objects
- Role of NEOROCKS EU funded project in exercising for the first time a quasi-fully-automated process to enabling the physical characterisation of an imminent impactor
- Importance of having accurate orbits to enable the observation of NEO physical properties
- Having immediate notification/warning applications on mobile phones, were identified as very useful
- It was recognised and stressed the difficulty that observing imminent impactors represents, moving at high velocities in the sky. It is recommended that observers exercise their processes for this
- When asked whether there was any piece of information required in addition to what is already available from the warning systems, no further information was identified as needed
- A distinction between very close imminent impactors and imminent impactors with a few days warning time needs to be made. In the former case there would be no possibilities to obtain physical properties observations, whereas in the later such would be possible

SESSION 2 - DISCUSSION / SUMMARY

- Losing objects after having been discovered shall be avoided as such as possible
- The lack of telescopes fully devoted to observation of physical properties was identified as a source of risk to the analysis of imminent impactors with warning times larger than a few days. The need to have dedicated means for these purposes was clearly identified
- Small telescopes (e.g. 60-70 cm in diameter) can still be used to determine rotation, taxonomy and colours, without the need to call for larger telescopes
- Standardisation and automated commanding of telescopes might help in automating the whole follow-up process as well as the observations to determine the physical properties

SESSION 3 - DISCUSSION / SUMMARY

- A discussion took place on the need to have ways to activate the community of amateur observers whenever there is a similar case as the ones occurring in 2022
- Low-effort interfaces to Earth observing satellite operators should be established to allow detections from space
- Provision of information at different quality levels has proven of use in the case of GLM (level 2 data was initially used, but availability of level 0 has allowed clear improvements in the process)

SESSION 4 - DISCUSSION / SUMMARY

- It is suggested to improve communications between the asteroid detection community and the fireball networks and infrasound detection networks
- Setting up an alert system to registered phone numbers of fireball network operators would be of great use
- Training of the end users of imminent impactor information by the warning system operators would be useful to help interpreting the provided data
- Infrasound data from the world-wide sensor network of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is regularly used to check for the deposited energy of very bright fireballs
- It was noted that national infrasound networks should be activated to participate in these activities too. A dedicated workshop should be planned for this

SESSION 5 - DISCUSSION / SUMMARY

- The current warning systems are providing the information needed to follow these objects up
- A better communication shall be established between the warning community and the fireball networks and community of physical properties observation
- Having dedicated telescopes for physical observations or having agreements for contingency observations / targets of opportunity (ToO) in specific telescopes is found necessary
- Official response by Agencies and IAWN on immediate impactors with some larger warning times than just a few hours should be clearly established and exercised
- There might be the need to have a very fast response procedure at IAWN to activate the civil protection authorities in these cases
- For objects smaller than 10 m, information on the impact region could be released without problem
- A distribution list of impact information end users should be established to facilitate the direct connection to satellite operators, fireball network operators, etc


VCAM
THANK YOU!!!