NEMO Vol 2.
Status of the NEar real-time MOnitoring system

Esther Drolshagen¹, Theresa Ott¹, Detlef Koschny², Gerhard Drolshagen¹, Pierrick Mialle⁴, Jeremie Vaubaillon³, and Björn Poppe¹

¹University of Oldenburg
²ESA, SSA-NEO Segment
³Observatoire de Paris
⁴CTBTO PTS/IDC, Vienna International Center
Emphasis:
Bright fireballs, not all meteors

Goal:
Validate models of meteoroid fluxes and the near-Earth asteroid population

Fireball over Warwick, Australia – 18. Aug. 2017
Main Objective

Difficult (e.g. at ESA) to react to queries from public or journalists.

Current Situation

+ additional fireball systems

NEMO

Fireball Sighting

Brighter – 10 mag

Twitter

IMO

Cneos

Aerospace

Google Alerts
Events brighter $-10 \text{ mag}$

- **FIS**
  - Fireball Information System from Space Situational Awareness – Near Earth Object (NEO)
  - in preparation at the NEO Coordination Center in Frascati, Italy
Information on Objects which:

- Regularly impact the Earth atmosphere
- Are too small to be detected by NEO surveys
- Cause bright fireballs

➔ Close the gap between large meteoroids and small asteroids
Data sources

- Data from infrasound stations of the CTBTO – Comprehensive nuclear-Test-Ban Treaty Organisation
- Publicly available data from US Government sensors
- Re-entry predictions of satellites and space debris
- Internet and social media
- Meteor networks

+ additional fireball systems
Some specific goals

Europe: Objects > 10 cm
Local Meteor Detections
29 June 2018 – the Netherlands

www.imo.net
FRIPON

Fireball Recovery and InterPlanetary Observation Network

- Flux determination
- Sky Coverage

FRIPON.org
Some specific goals

Global: Objects > ca 1 m
Social Media

The NEMO-PC


13 retweets

Google Alerts
From CNEOS (Center for NEO Studies) and JPL (Jet Propulsion Laboratory)
CTBTO

IMS (International Monitoring System) - Infrasound

Meteor signal in waveform

Period @ max Amplitude
Very bright daylight #fireball explodes over #Russia, #meteorites possible

A very bright daylight fireball exploded over western Russia at 01:11 UTC on June 21, 2018. The event lasted several seconds before the object disintegrated in a bright fireball. The bright light was visible in several regions of Russia, including the city of Yaroslavl and nearby areas.

watchers.news

04:52 - 21. Juni 2018
NEMO Event
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)

Pierrick Mialle
IDC, CTBTO

I56 - PMCC
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)

10 Infrasound stations
- a source energy of 2.4 kt TNT.
- a size of about 4 m

CNEOS/JPL found
- a time of 01:16:20 UT
- a velocity of 14.4 km/s
- a source energy of 2.8 kt TNT.
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)

Detected with weather radar
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)

Scientists from the Ural Federal University

- Found 3 meteorites
- Smallest: 3 cm
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)
Daytime fireball over Russia
21 June 2018 - 01:15 UT (04:15 LT)

On 21 June 2018, a very bright fireball occurred over western Russia around 01:15 UT (04:15 LT). The event was captured on video and caused a lot of public attention. The event has been reported by witnesses from the cities of Kursk, Lipetsk, Voronezh and Orel. Many of them reported a loud sonic boom.
First NEMO Event was in August 2017

About one year of test-operation

Since then there are 135 Events in our alert-data-base

Fireball count
Outlook

- Stable NEMO monitoring of:
  - Twitter
  - Facebook
  - News
  - Etc.
- FRIPON fireball flux determination
- Reliable infrasound energy determination and semi-automation
- Data from existing fireball networks and other sources
  - Access, analyze, and combine
Thank you for your attention
References


- https://cneos.jpl.nasa.gov/fireballs/


- Edwards et al. (2006) Estimates of meteoroid kinetic energies from observations of infrasonic airwaves

World Map Event

# Fireballs

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<tr>
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