Wildfire risk predictions and fire management in Estonia: todays practice, recent development project and prospective for the future

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Todays practices at the Environment Agency, Weather Service **The usage of operational satellite data for wildfires monitoring in Estonia** Daily preparation of wildfire risk map



REPUBLIC OF ESTONIA Environment Agency

The usage of operational satellite data for wildfires monitoring in Estonia

J.Služenikina, I.Vahter

Extremely dry spring & summer 2018



Fire hazard risk map 03.06.2018



Based on precipitation data & relative humidity

Temperatures over 30°C spread by heat wave 30.07.2018 reached up to 70°N

MetOp-B, IR 10.8 µm color enhanced

Hot spots from NASA FIRMS 03.06.2018

- Based on VIIRS (375 m) and MODIS.
- Possible to look up to 7 days back.
- Coordinates, date, time, Brightness Temperature in CSV format.
- Possible subscribe to receive email alerts.



https://firms.modaps.eosdis.nasa.gov/map/#z:6;c:28.2,59.4;l:24hrs



View map image on NASA FIRMS server

Hot spot on Island Saaremaa 06.05.2020

FIRMS Rapid Alert system

06.05.2020 at 10:18 UTC

VIIRS 375 m NOAA-20 hot spots.

NRT Alert ~03 h after overpass.

 latitude	longitude	bright_ti4	scan	track	acq_date	acq_time	satellite	confidence	version	bright_ti5	frp
58.5943	22.83623	328.6	0.56	0.43	5/6/2020	1018	NOAA-20	nominal	1.0NRT	288.5	6.8
58.5975	22.83582	331.2	0.56	0.43	5/6/2020	1018	NOAA-20	nominal	1.0NRT	288.8	6.2

EARS-VIIRS 750 m NOAA-20



06.05.2020 14:02 UTC



- Hot spots visualization (**BT > 303.2 K**) using 10.8 µm (M15) channel.
- EARS-VIIRS M-band has lower horizontal resolution, but better temporal resolution (~30 min after overpass)







Sentinel-2 01.08.2018 on the border between Latvia and Estonia

Suomi-NPP 17.07.2018, Sweden





Sentinel-2 16.08.2018, Estonia

Local fire detection with Sentinel-3 OLCI



Dust & smoke distribution from Russia 01.10.2020 caused by extremely dry air & massive wildfires

1. Operational monitoring by MSG RSS data



Natural color RGB





RSS data helps to monitor the distribution of aerosols with 5-min time step

2. Monitoring of aerosols distribution by Sentinel-5P products & polar data MODIS/VIIRS



Sentinel-5P showed high concentrations of aerosols in the total column of troposphere next day, 02.10.2020

EUMETSAT H-SAF Soil moisture product (H14)

Receive via EUMETCast, in-house daily visualization (ESTEA)



levels:

- 0-7 cm
- 7-28 cm
- 28-100 cm
- 100-289 cm

- ✓ Based on: ASCAT, ECMWF, SYNOP, soil & surface maps etc.
- ✓ Independent to the cloudiness.
- ✓ If the ground is frozen, soil moisture shows 0.

Horizontal resolution 25 km

http://hsaf.meteoam.it/Products/ProductsList?type=soil_moisture

Soil moisture product (H14)

Fire hazard risk map



Soil moisture map fits well with fire hazard maps. Thus it is considered useful for further development and integration into fire hazard risk map

New ASCAT Root Zone Soil Moisture Profile Index 10 km sampling in NRT -- H26

The analysed soil moisture fields are based on the assimilation of ASCAT-derived surface soil moisture. Then, re-scaled soil wetness index by normalising by the saturated soil moisture value as a function of soil type.





Todays practices at the Environment Agency, Weather Service

The usage of operational satellite data for wildfires monitoring in Estonia Daily preparation of wildfire risk map



13.05. on peamiselt sajuta ilm. Tuleoht püsib IV-V klassi piires.

14.-16.05. sajab mitmel pool hoovihma. Saju võimalus on suurem Lääne-Eestis. Tuleoht väheneb aeglaselt Lääne-Eestis kuni I-III klassini, Ida-Eestis püsib kohati IV klassi piires.

17.05. sajab kohati hoovihma. Tuleoht on II-III, Ida-Eestis kuni IV klassini.

- I Tuleohtu ei ole (0 60) II – Tuleoht on väike (61 – 130) III – Keskmine tuleoht (131 – 450) IV – Suur tuleoht (451 – 2400) V – Äarmiselt suur tuleoht (> 2400)
- I-IV klass: lubatud on metsa kasutamine puidu saamiseks, jahinduseks, teadus- ja õppetööks, samuti võivad inimesed metsas vlibida puhkuse ja sportimise eesmärgil ja varuda metsasaadusi
 - V klass: kohalikud omavalitsused võivad keelata igasuguse metsa kasutamise ja võõras metsas viibimise
- II-V klass: töötab metsatulekahjude avastamise süsteem ja päästeteenistusel on valmisolek metsatulekahjude kustutamiseks

Tuleohu indeks 03.06.2019



4.06 kohati võimalik hoovihm. Tuleoht püsib III klassi piires. 5.06-6.06 on olulise sajuta ilm. Tuleoht püsib III klassi piires.

7.06.-8.06. päeval sajab mitmel pool hoovihma. Tuleoht püsib III klassi piires, kohati tõuseb IV klassini, kuid tugeva hoovihma korral langeb mõnes kohas I klassini.

Today fires hazard is calculated according to Nesterov model at weather stations and then interpolated Tueshuindeks 20.03.2019



- I Tuleohtu ei ole (0 100) II – Tuleoht on väike (101 – 400) III – Keskmine tuleoht (401 – 3000) IV – Suur tuleoht (3001- 7000) V – Äärmiselt suur tuleoht (> 7000)
- I-IV klass: lubatud on metsa kasutamine puidu saamiseks, jahinduseks, teadus- ja õppetööks, samuti võivad inimesed metsas viibida puhkuse ja sportimise eesmärgil ja varuda metsasaadusi.
- V klass: Päästeamet võib keelata metsas küttekoldevälise tule tegemise, grillseadme kasutamise, suitsetamise või võõras metsas viibimise.
- II-V klass: töötab metsatulekahjude avastamise süsteem ja päästeteenistusel on valmisolek metsatulekahjude kustutamiseks.

Tähelepanu lõkketegijad!

Jälgige tuule tugevust. Vastavalt siseministri määrusele Ľ' on lõkke süütamine keelatud, kui tuule kiirus on 5,4 m/s või enam (kui lõkkekoha läheduses on hoone, põlevmaterjali hoiukoht, mets, kuivanud taimestik või turbapinnas, millele võivad tule tegemisel sädemed langeda).

- Published daily at around 11 a.m.
- Covers actually the previous day and night.
- Interpolation of temperature is somewhat reasonable, interpolation of precipitation is extremely coarse (local high variability is totally ignored)
- Relatively small rain event may stop the accumulation of fire risk index and set it to zero (in Nesterov model)
- Rescue board uses this data for official announcements. Like restrictions to move around in the forests /warning to be careful
- Warning released by administrative units

Recent Project in the framework of the RITA program with improvement of wildfire management as one of the four major parts

RITA PROGRAM REINFORCEMENT OF SECTORAL R&D ACTIVITY 1 SUPPORT TO STRATEGIC R&D





RITA REMOTE SENSING

Euroopa Liit Euroopa Regionaalarengu Fond

Eesti tuleviku heaks

Service contract 7.8-3/18/17 01.01.2019-31.12.2020

TARTU ÜLIKOOL

Leader of the consortium: Uni Tartu Partners: TalTech, University of Life Sciences, OÜ KappaZeta

Ministry of Interior, Ministry of the Environment, Ministry of Rural Affairs, Ministry of Economic Affairs and Communication, ETAG









FIRE,WATER, LAND, HOUSE and FUTURE

Remote Sensing RITA R&D requirements



SPECIFIC RESEARCH QUESTIONS FIRE

- Research questions related to prevention and suppression of wildfires:
 - Estimation and projection of fire hazard / risk
 - Management of fire-fighting spreading of fire and smoke management decisions for relocating resources and selecting directions
 - Damage (both damage happened and potential damage prevented by rescue) assessment



Rescue board has data (available for public now) on fire events

Landscape fires between 2014 – 2020

Data: Rescue Board Map: Evelyn Uuemaa/ Dept Geopgraphy TU

Bar chart shows seasonal distribution by months

Outcomes of the RITA Project FIRE

Could we use existing (and potentially developed) EO services?

- Resolution (spatial, temporal, details (vegetation classes, relief) limitations
- Too slow to notice actual fire events
- Good background

https://firms.modaps.eosdis.nasa.gov/map/#z:6;c:27.7,59.0;d:2019-06-02..2019-06-

O

IDENTIFY

PAN

03;l:Suomi_NPP_Orbit_Asc, Suomi



 $\left(+\right)$

MAXIMIZ

OVERLAY

HELP

Last Updated: 2019-06-03 18:06 GMT Version: VIIRS 375 m VASA

http://effis.jrc.ec.europa.eu/

http://effis.jrc.ec.europa.eu/static/effis_current_situation/



1 min andmed 2015 07-08 03:00 - 07-08 14:00

Meteorological data. Temperature and wind from METCOOP HARMONIE model,

Precipitation from Estonian weather radar adjusted according to data from weather stations





- There are still some problems with precipitation data
 - Missing data
 - Over or underestimates 300 mm per 3 hours or 600-700 mm per day
 - Max measured in Estonia daily 148 mm per 24 h 4.07.1972, max per 10 min 2.3 mm 23.07.1957 would give 41.5 per 3 h

Probleemid radariga





Potential fuel – forest by species composition, thickness of the vegatation layer and density etc characteristics from LiDAR measured data.

potentia than forest Reedbeds, bogs, grasslands – other fuel



Fire risk index interpolated by square far way standard so km compared to



Index values of Nesterov and Canadian FWI and classes of fire risk, May 20, 2018.



Tuleohuindeksi klassid, 2018-05-20





Generalized values vy 7 x 7 pixels (right). Original values at left.





1. Better spatial resolution and more precise meterological data including the precipitation data towards which fire risk is the most sensitive.

2. More detailed potential fuel amount and structure data allow better estimate fire risk and also possible behaviour and spread speed of fire.

3. Calculating fire risk index on raster by 1x1 km². No interpolation of complex characteristic but interpolation of input data.

4. Nesterov model vs "Canadian" model.

Modeling the spread of the fire in case of event and possible damage as well as potential damage avoided Prototypes developed

Option to apply one of the results in real life – renewal of wildfire risk map (LIFE Adaptest)

Proposal Evaluation Form									
	EUROPEAN COMMISSION	Evaluation							
* * *	Programme for Environment and Climate Action (LIFE)	Summary Report							
all: Type of action: Proposal number: Proposal acronym: Puration (months): Proposal title: Activity:	LIFE-2021-STRAT-two-stage LIFE-PJG 101069566-2 LIFE21-IPC-EE-LIFE-SIP AdaptEst 111 Implementation of national climate change adaptation activities in Estonia. LIFE-2021-STRAT-CLIMA-SIP-two-stage								

Action C6 Development of monitoring, information, and support system

C6.1 Updating and applying the fire hazard map compiling tool into operational work of Estonian Weather Services

Thank you for your attention!

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