

A real-time VIIRS Active Fires detection and warning system for Sweden

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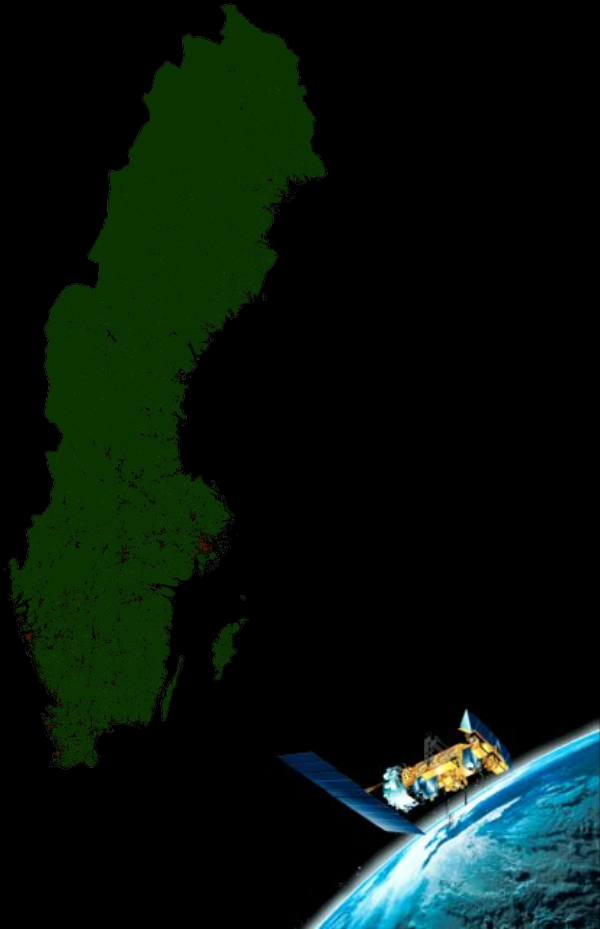
Outline

- Background
- VIIRS & Active Fires algorithm used
- 2018 season analysis
- Operational setup
- 2020 season real time test - evaluation
- Summary



Swedish fire season(s)

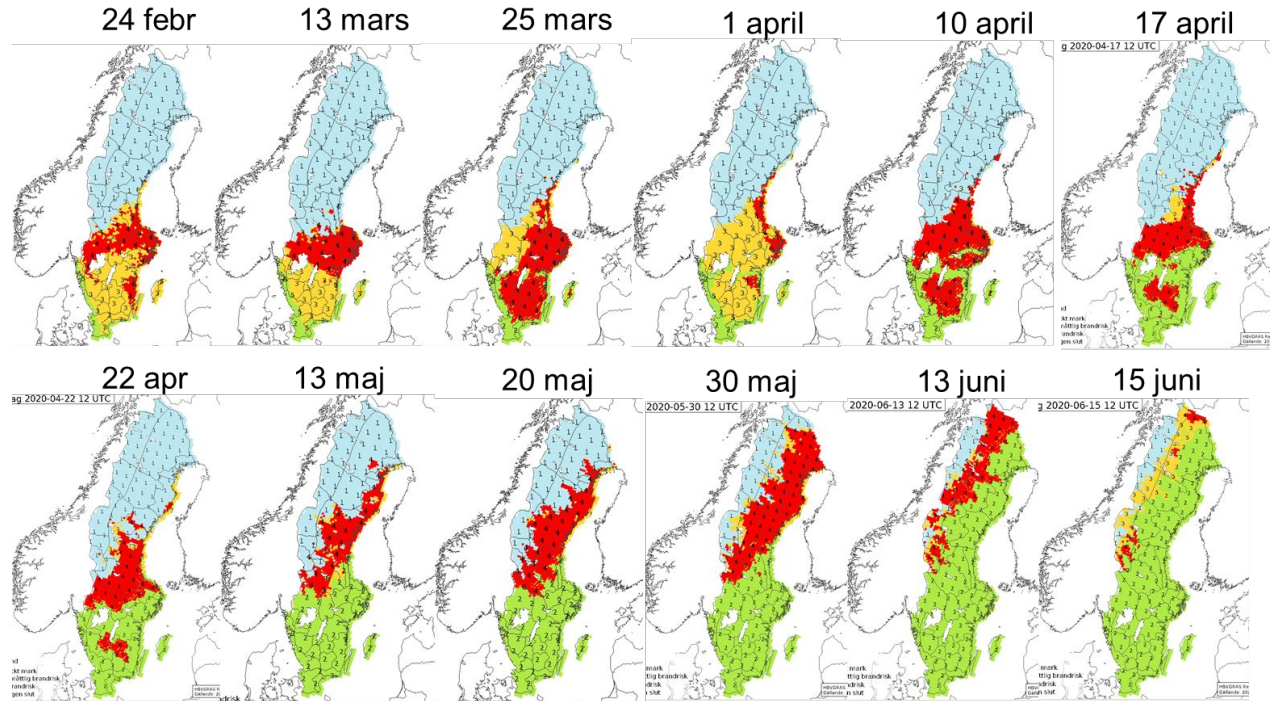
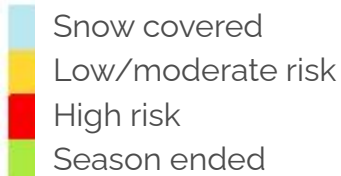
- Grass fires & Forest fires
- Two “seasons” with overlap
 - From ~February to ~October



Swedish fire season - 2020 example

Grassfire season moves slowly to the north

Grassfire



Swedish fire season - 2020 example

Forest fire season moves northwards

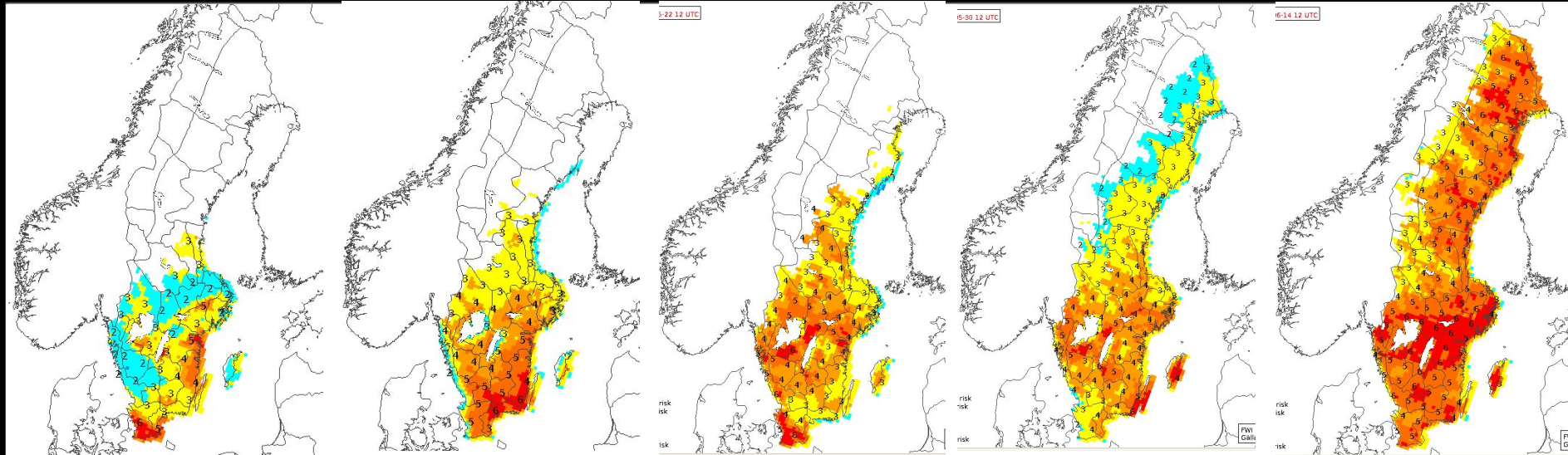
April 13

April 23

May 22

May 30

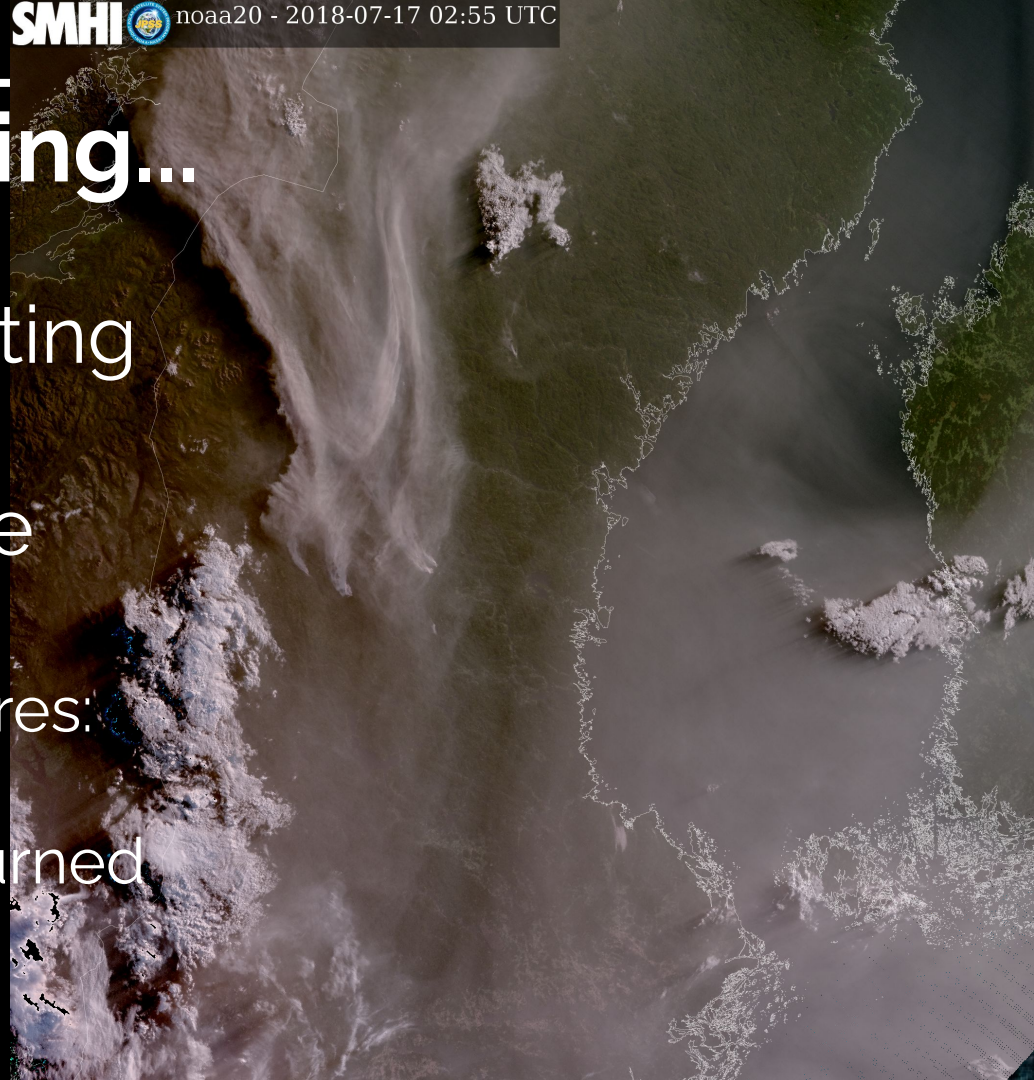
June 14



FWI Index

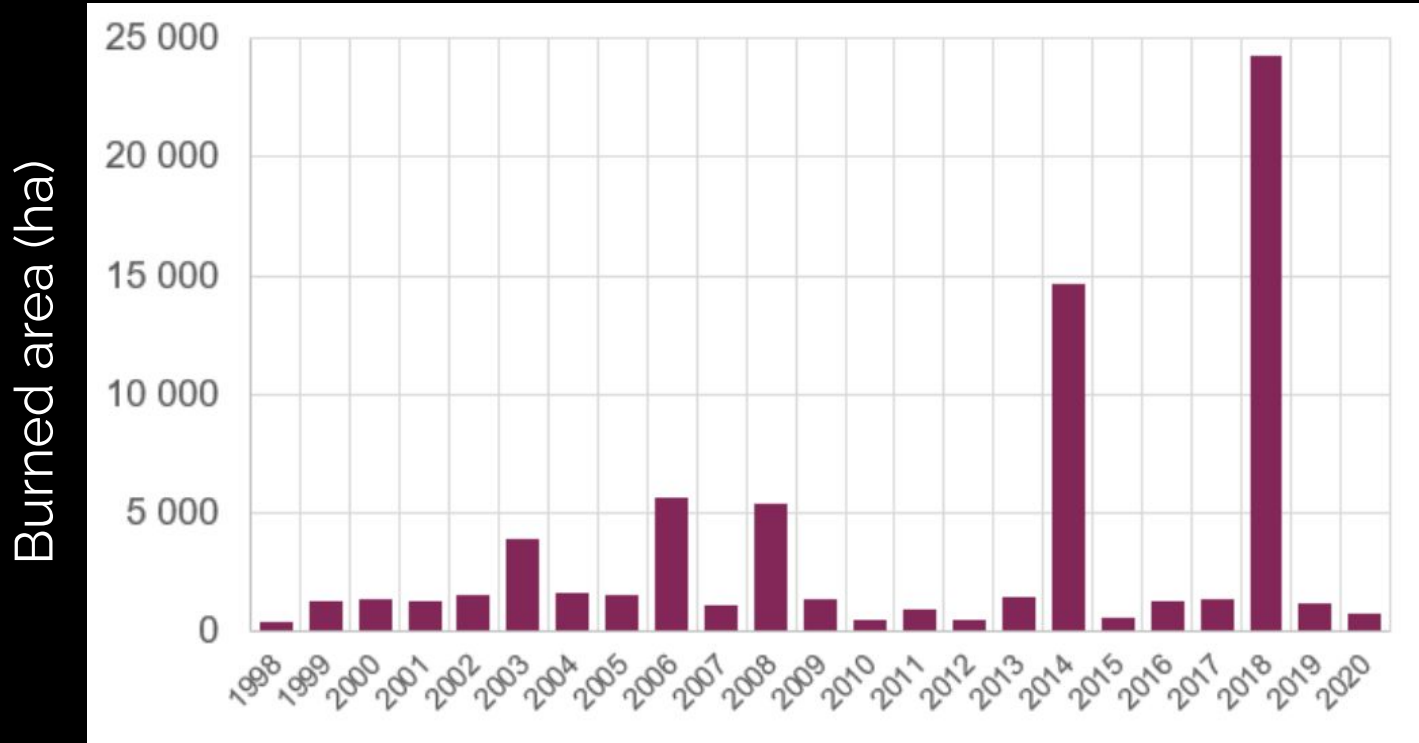
Climate is changing...

- One large devastating fire in 2014
- A very intensive fire season 2018:
 - ~200% increase in fires:
8081 fires
 - 800% increase in burned area: **24310 ha**



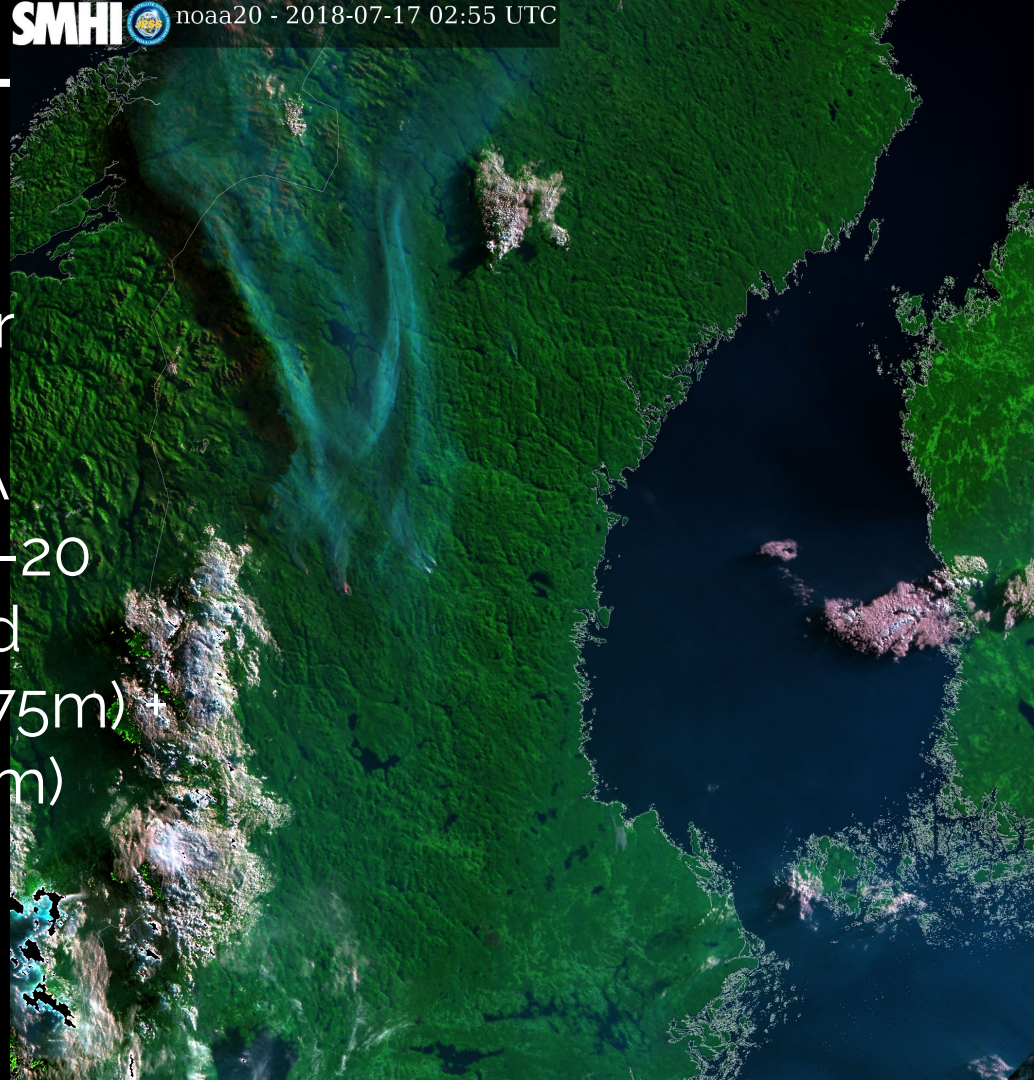
Climate is changing...

Burned area for Swedish wildfires 1998-2020



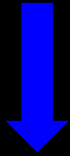
VIIRS

- Visible/Infrared Imager Radiometer Suite
- On board NOAA/NASA Suomi-NPP and NOAA-20
- 22 channels, 16 M-band (750m) and 5 I-band (375m) + 1 Day-Night-band (750m)

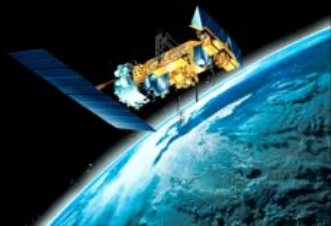
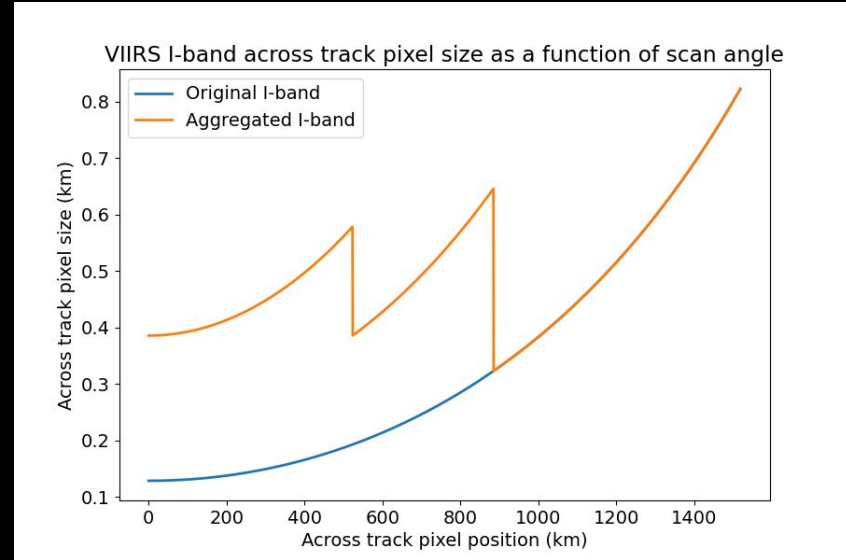


VIIRS

- Onboard aggregation limiting pixel growth across swath
- High geo-location accuracy (<50m)

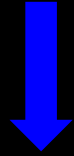


Fire detection location error < ~250 meter,
except at the very ends of swath

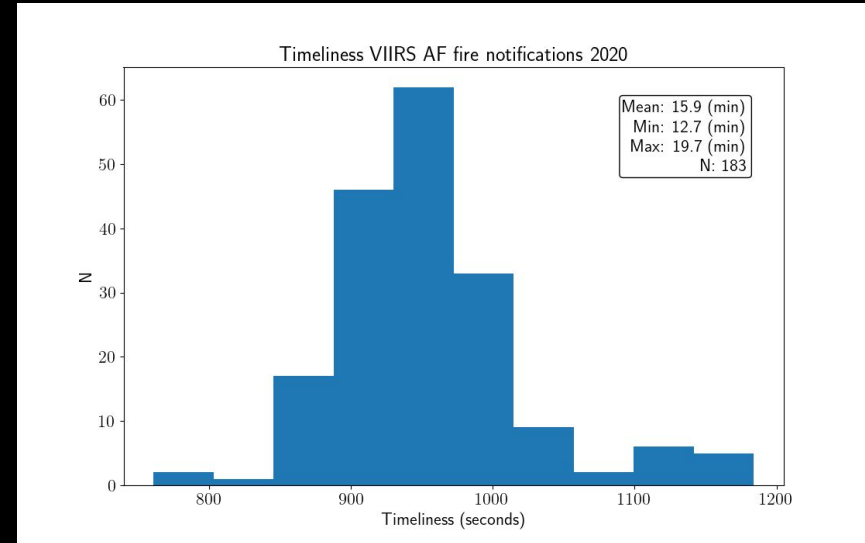


VIIRS

Provides Direct Broadcast



Low latency ~15 min



VIIRS - coverage

Coverage every 50 minutes over northern Scandinavia from local midnight till around 14:00

Southern Sweden:
~01:00 - 04:00 &
~11:00 - 14:00



VIIRS Active Fires

- NOAA JPSS Active Fires Team
- Detection using I-bands
- FRP derived using M13 ($\sim 4\mu\text{m}$)
- Implemented in the Community Satellite Processing Package (CSPP) for Direct Readout applications


Giglio, L., Schroeder, W., Csiszar, I., and Tsidulko, M., 2016. VIIRS Active Fire Algorithm Theoretical Basis Document, version 2.6. NOAA. Available at

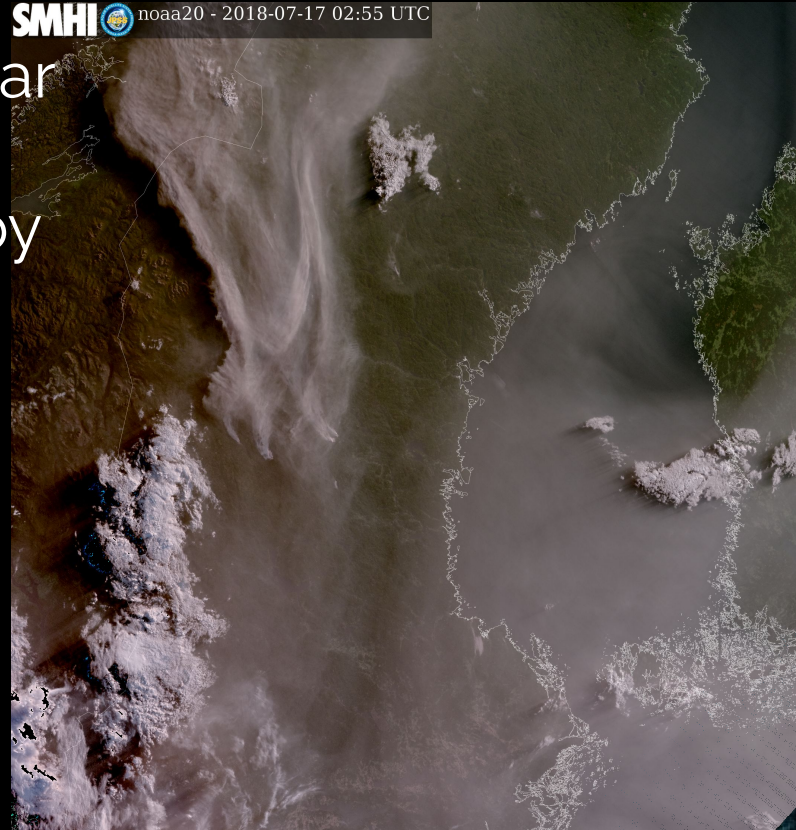
https://www.star.nesdis.noaa.gov/jpss/documents/ATBD/ATBD_NDE_AF_v2.6.pdf

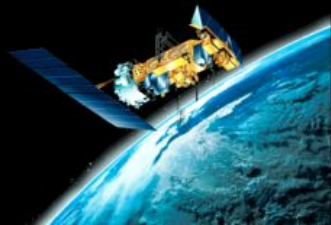
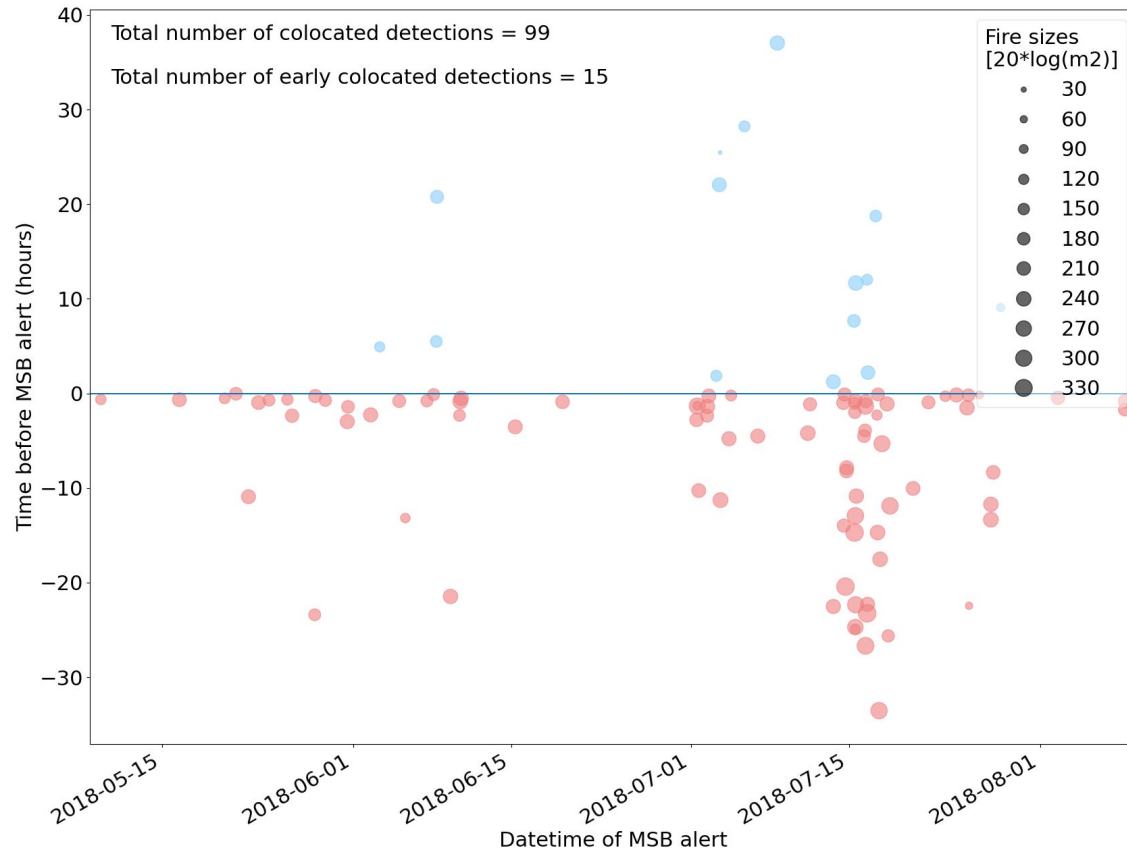


2018 season analysis

- 8081 registered fires - entire year
- 6839 in period May 6 to Aug 9
- VIIRS AF data kindly provided by FMI - S-NPP only!
- Collocating registry with VIIRS detections
- Search radius: 750m
- $\Delta t < 36$

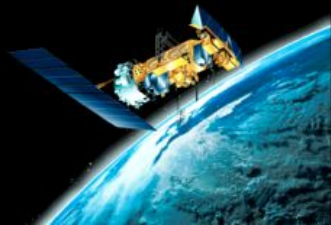
SMHI  noaa20 - 2018-07-17 02:55 UTC





2018 season analysis

- Carefully analysed all 15 early detections
- 4 possibly mistaken by another fire (collocation issue)
- 3 caused by lightning
- The 2 largest ones - caused by lightning:
 - Detected by satellite ~12 hours before - final burned area 19.6 ha
 - Detected ~2 hours before - final area 40 ha

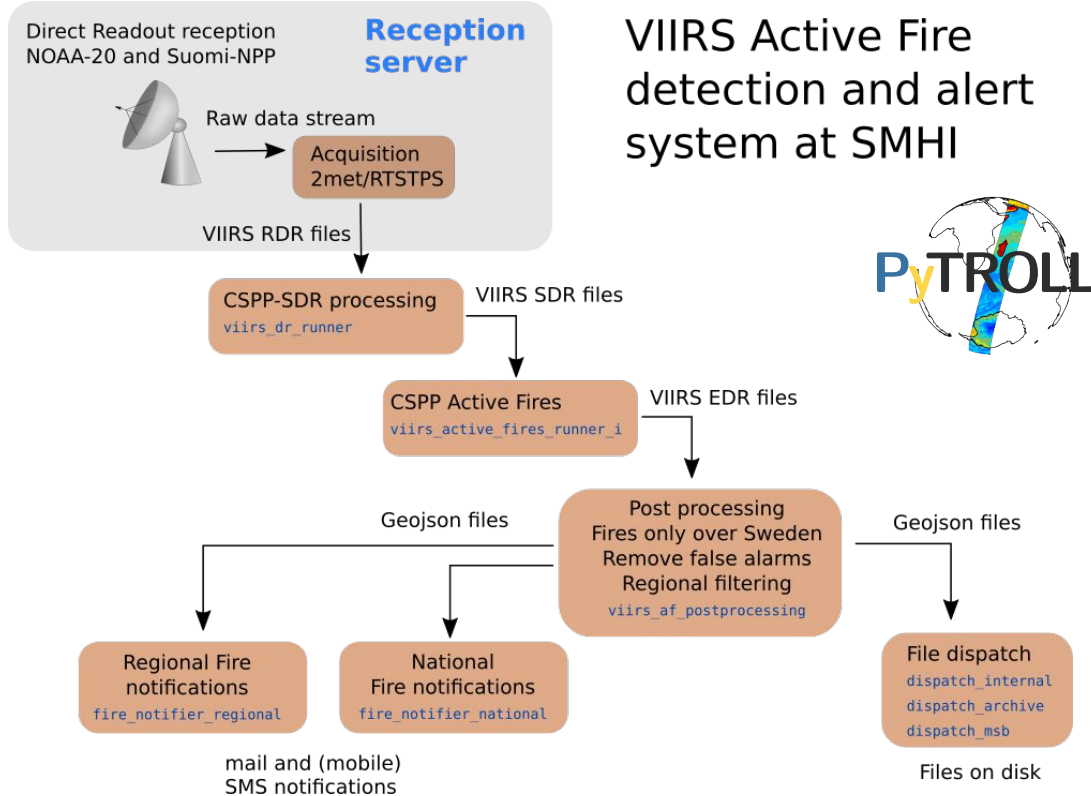


Operationell Setup

- Local implementation of CSPP VIIRS-AF
- Locally received VIIRS data in Norrköping
- Detection ~15 minutes after observation



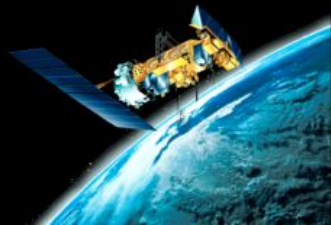
Operationell Setup



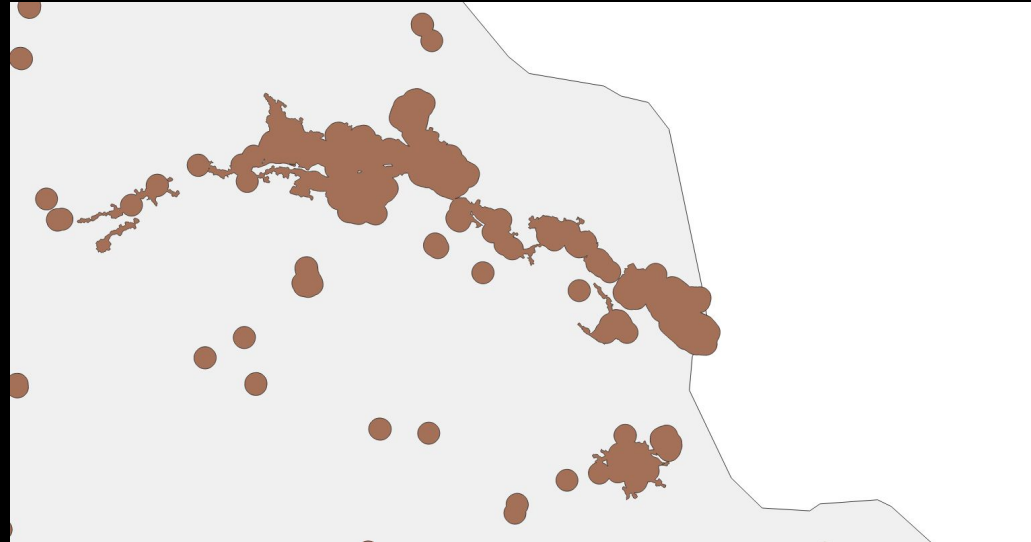
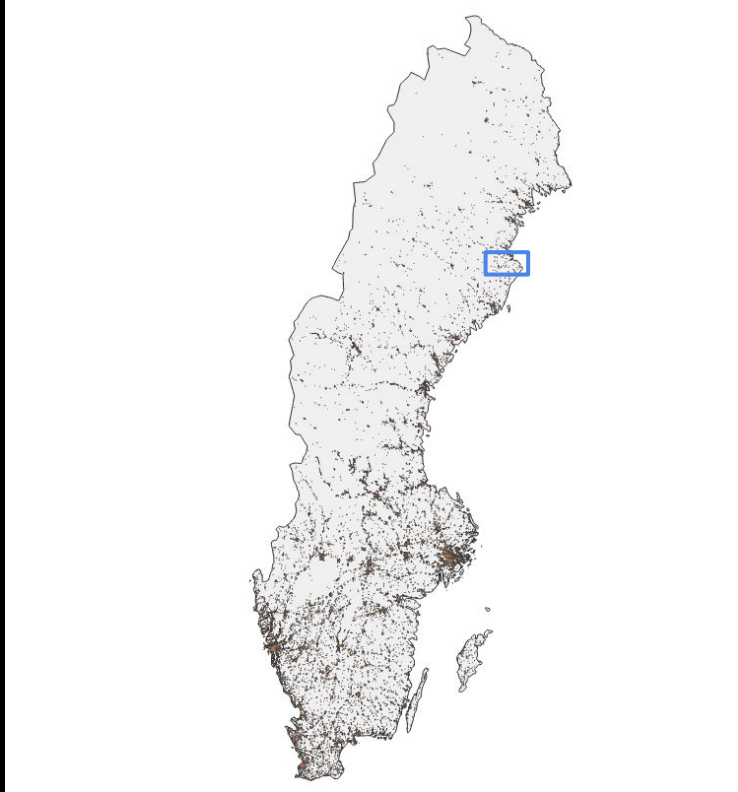
Minimising “false” detections

Filtering out detections inside:

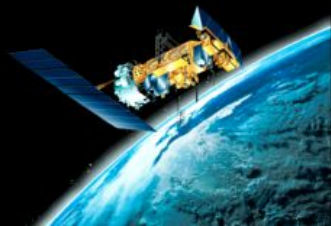
- *Populated areas*
- *Industrial areas + 500m*
- *Industrial buildings + 500m*



...using shape files

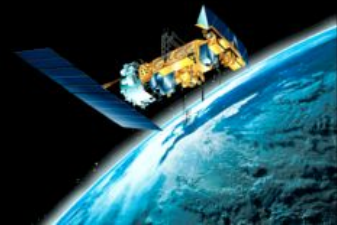
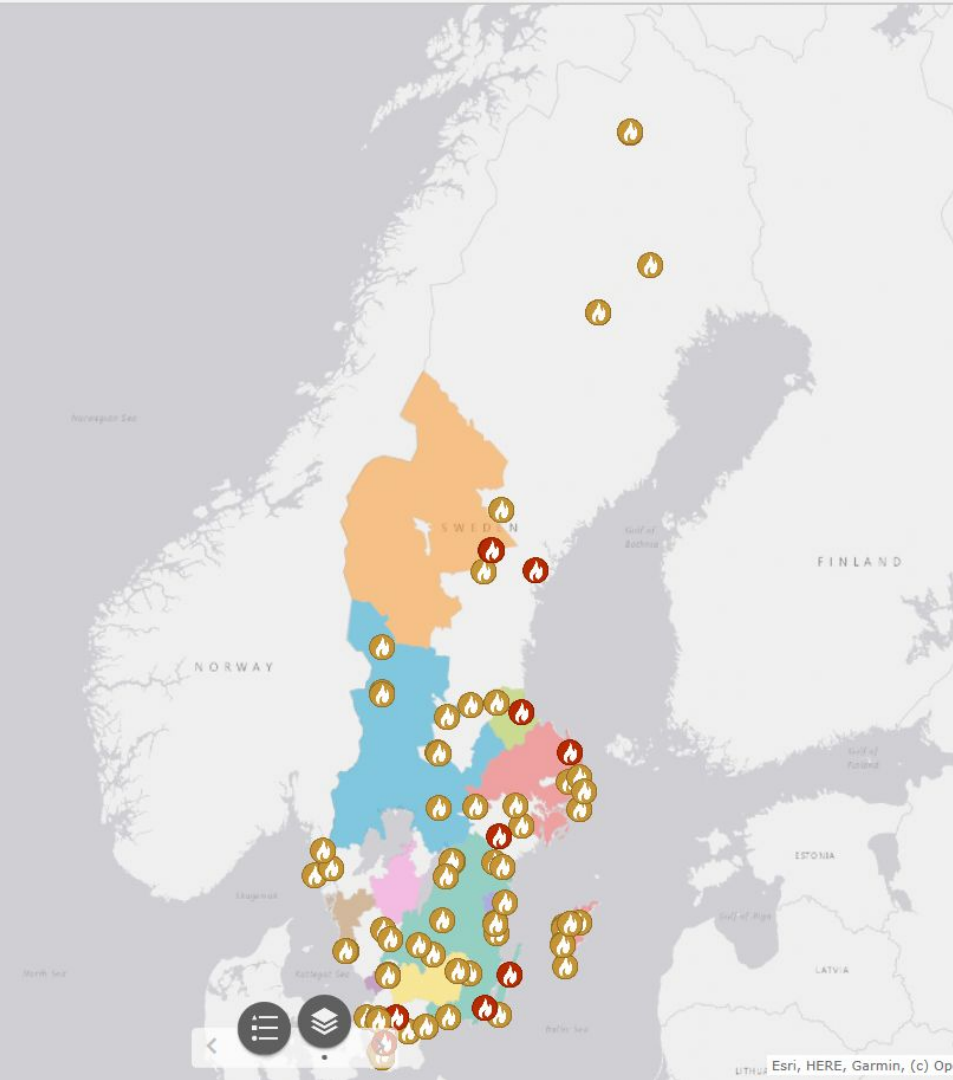


Real-time test 2020



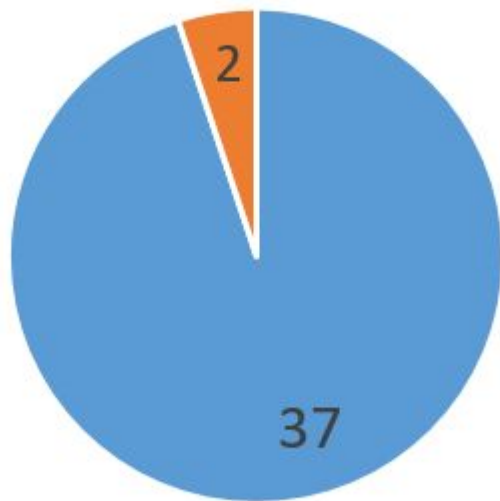
Evaluation:

- 110 unique evaluated detections
- 39 evaluated by rescue services
- Many detections in northern Sweden in June
- NB! Map is from July 3rd and onwards



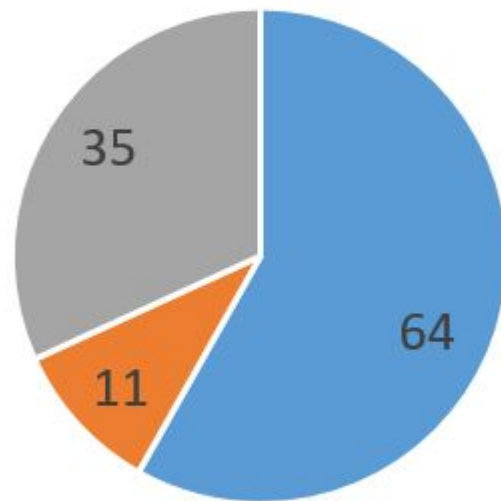
Summary evaluation (2020)

Was it a fire? (Rescue services)



■ Ja ■ Nej

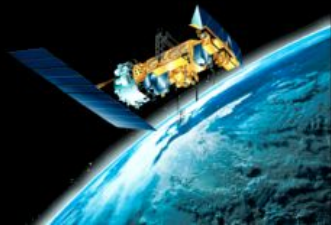
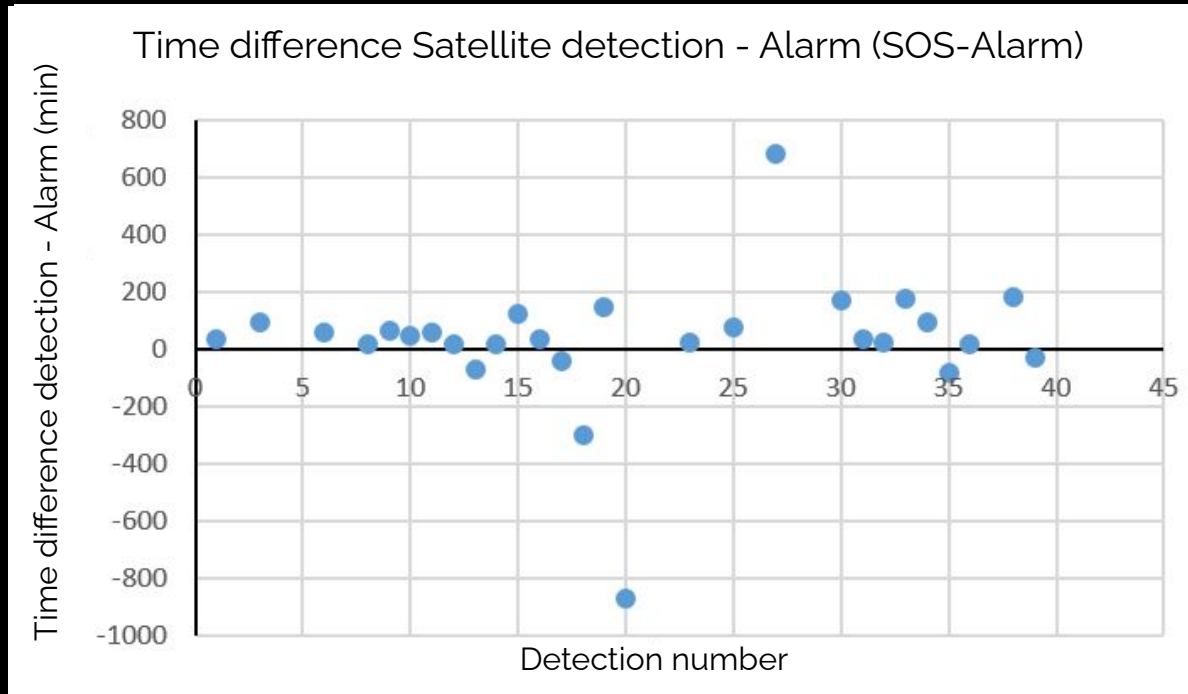
Was it a fire? (All)



■ Yes ■ No ■ Don't know

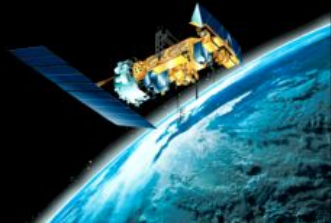
Summary evaluation (2020)

6 out of 28 fires detected earlier by satellite



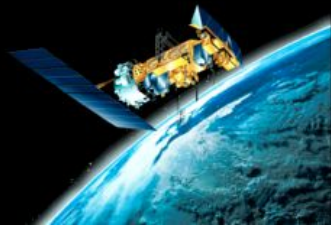
Conclusions

- Growing incentive to use satellite data for early warning in Sweden
- A detection a few hours early can have high socio-economic benefit
- VIIRS AF data of high quality
 - Accurate
 - Sensitive
 - Low FAR

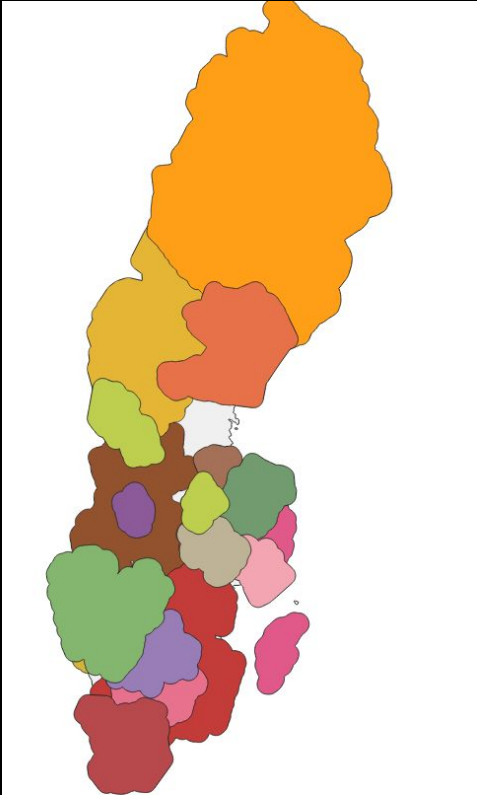


Conclusions

- Filtering out potential sources for false detections essential!
- A real-time/real-life test is going on for the second season now
- Looking forward to MetImage!
 - It will fill an important data gap in the early evening
 - But will it be as capable as VIIRS?



2021 “test”



- Regional notifications
- 19 regions participating
- Majority via SMS
- Covering almost entire Sweden
- Likely to include SOS-Alarm

