# USE OF SATELLITE DATA FOR MONITORING FIRE EVENTS IN POLAND

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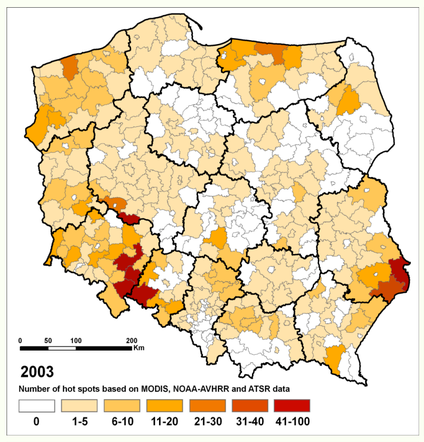
Europe has witnessed an increasing trend in number of extreme fires due to climate change and human activities. Recent studies demonstrated that ~65% of the European and 83% of Polish forests are at a high risk of fires. Statistics provided by the JRC/Ispra show that Poland is a third European country after Portugal and Spain in number of fires reported annually. Fire monitoring system existing currently in Poland is based explicitly on the ground data collection.

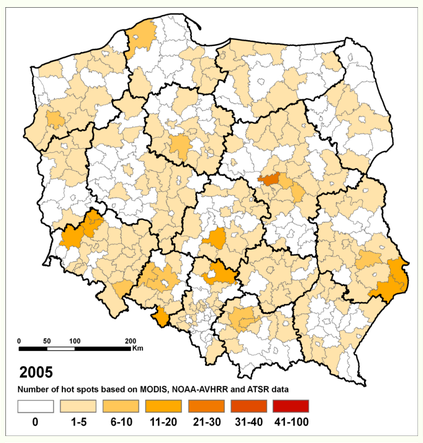
We examined the potential of EO data in monitoring of fire events in Poland. Analysis of active fire products (hotspots) derived by MODIS/Terra & Aqua and ATSR/Envisat (night time fires) were performed over Poland for the period 2001-2013. Additionally an archive of AVHRR/NOAA was processed to extract hotspots for the same study period. All hotspots were incorporated into one Active Fire database that will be cross-checked with the *in situ* data obtained from the National Forest Fire Information System. We analyzed the spatio-temporal distribution of fires across country and obtained a detailed information on location of spring and autumn fires.

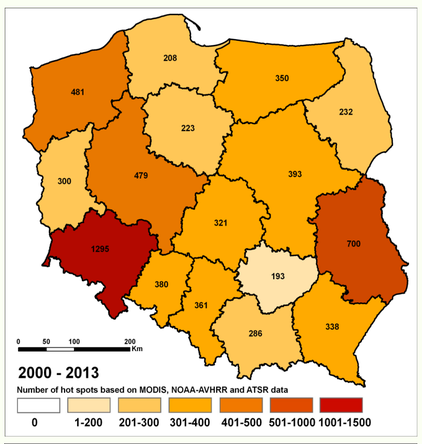
The CORINE land cover 2006 map was used to determine which land cover classes were particularly affected by fires. Furthermore, we investigate the intensity of individual fires using the Fire Radiative Power from MODIS/Terra and Aqua.

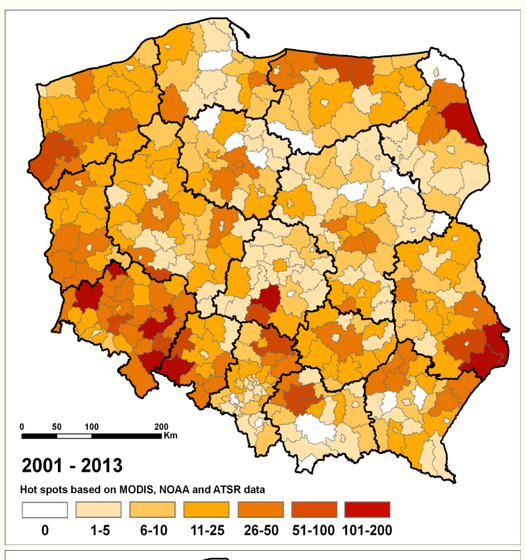
The results show that the arable land was the most fire-affected land cover type, followed by grasslands/pastures, forest, discontinuous urban areas, heterogeneous agriculture area, and wetlands. The highest number of hotspots was recorded in south-western, south-eastern, north-western part of Poland. By contrast, the provinces in central Poland have experienced the lowest number of burnings. Out of the total number of hotspots 21% occurred in 2003 and 12% in 2002. In 2002, around 89% of fires took place in autumn and 5% during spring. In 2005, more than 55% of fires occurred in spring and about 34% in autumn. Fires detected after 2006 predominantly occurred in spring (except for 2008), which confirms the continuity of illegal practices of burning grass in spring time. We found that spring fires are more intensive then autumn fires.

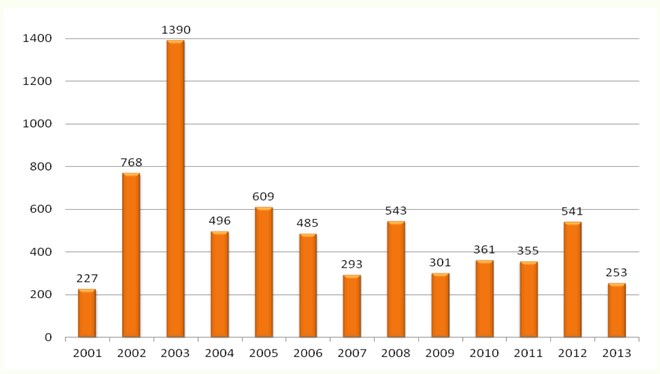
## Spatio-temporal distribution of hotspots from MODIS, AVHRR and ATSR, period 2001 - 2013



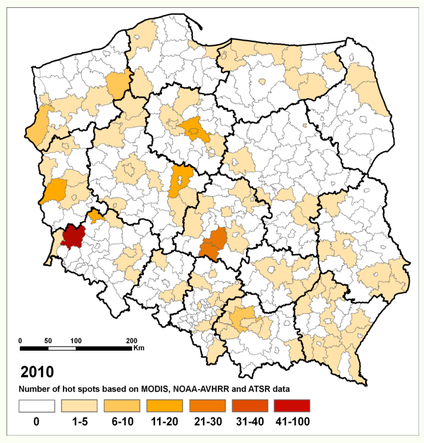



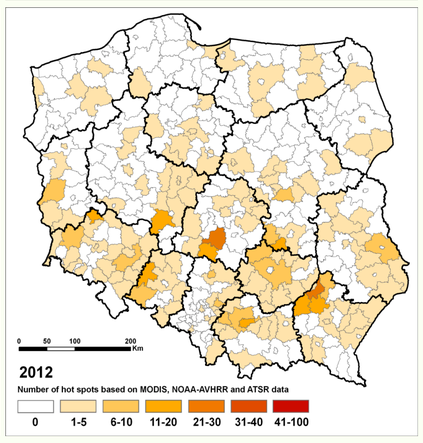



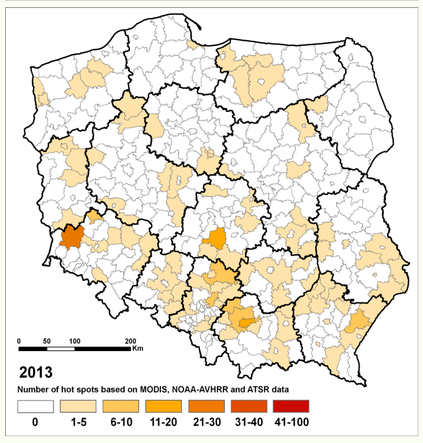



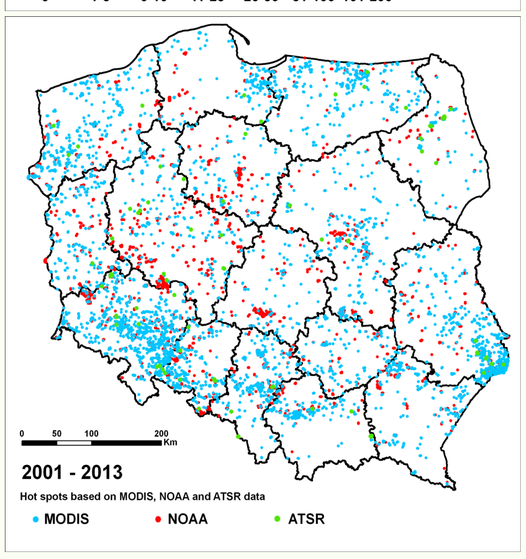



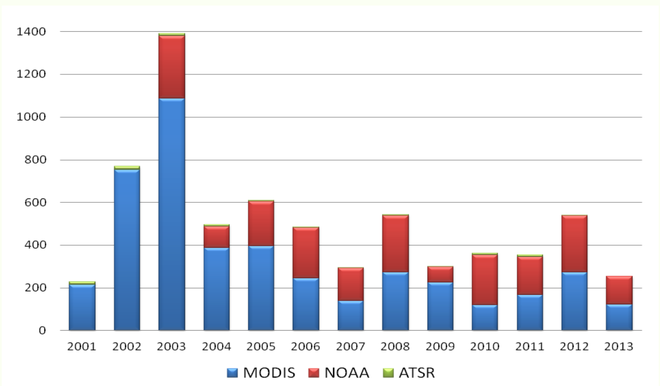

Total number of fires (hotspots) observed by MODIS, AVHRR & ATSR in Poland for the period 2001-2013



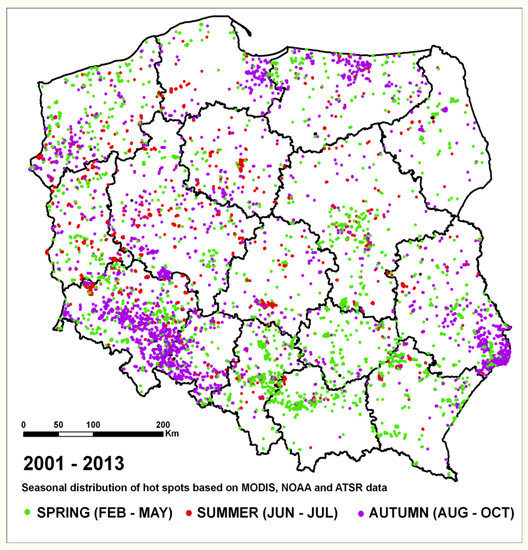



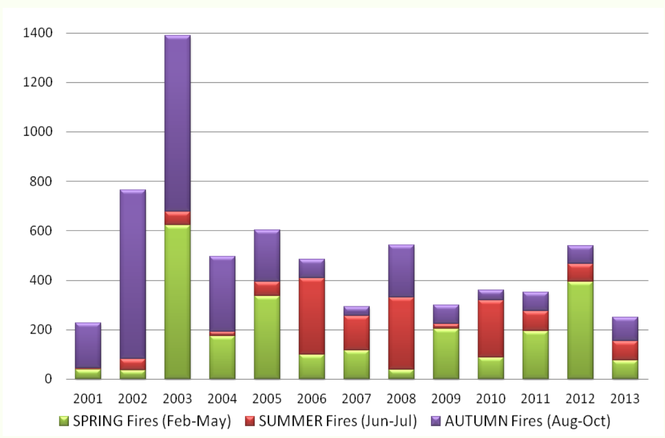




Number of hotspots observed separatly by MODIS, AVHRR & ATSR in Poland for the period 2001-2013

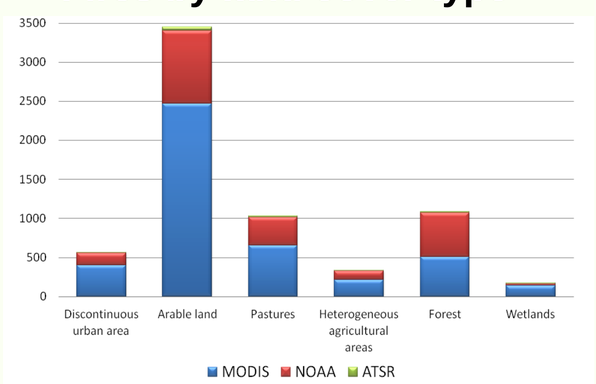
## Seasonal distribution of hotspots

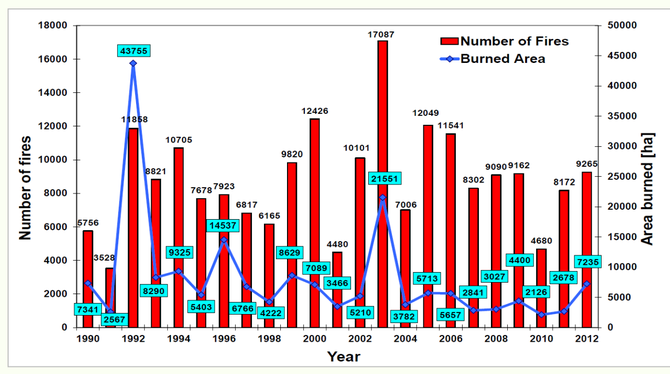



Spring fires are related to illegal practice of burning grasslands or uncultivated land. This practice is still very common in Poland.

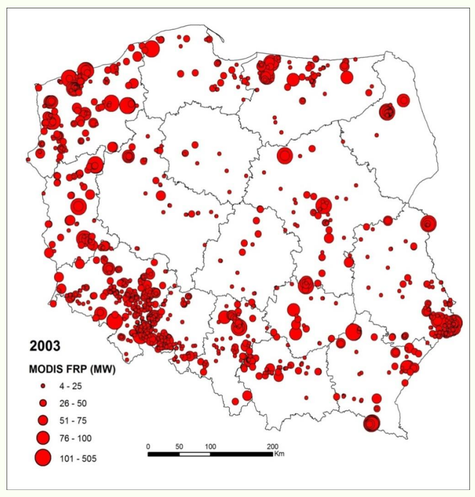
## Fires by land cover type

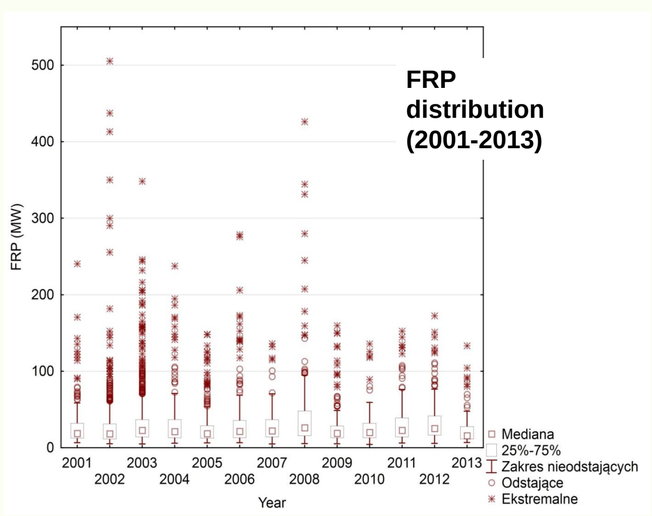



Total number of fires and burned area observed on the ground in Poland for the period 1990-2012 (source: JRC technical reports: Forest Fire in Europe 2012)

**Fire Radiative Power (FRP)** provides information on the measured radiant heat output of detected fires. The amount of radiant heat energy liberated per unit time (Fire Radiative Power) is thought to be related to the rate at which fuel is being consumed. **FRP** is measured in MW (MegaWatts).



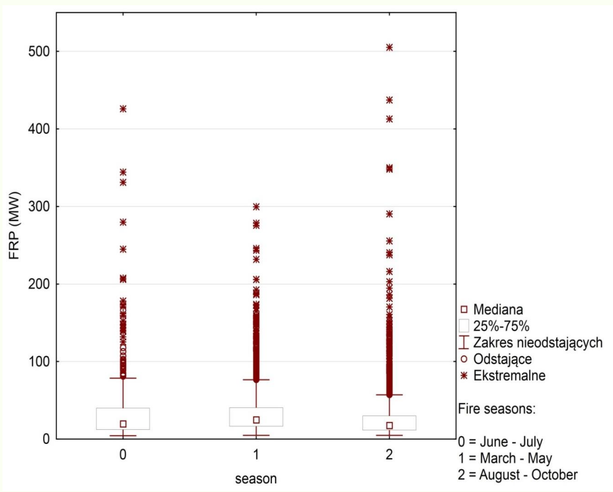

## FRP by land cover type

| LC type | No of cases | Mean | Sum | SD | Min | Max | Q25 | Median | Q75 |
|---|---|---|---|---|---|---|---|---|---|
| Discontinuous urban area | 399 | 27,6 | 11029 | 30,0 | 4,4 | 344,4 | 10,9 | 18,3 | 32,1 |
| Arable land | 2471 | 27,9 | 68954 | 31,1 | 4,9 | 437,3 | 12,4 | 19,2 | 31,2 |
| Grassland | 658 | 36,3 | 23859 | 39,4 | 4,9 | 505,2 | 15,9 | 24,8 | 40,9 |
| Heterogeneous agricultural area | 215 | 30,9 | 6644 | 31,5 | 5,7 | 240,4 | 14,2 | 21,5 | 33,2 |
| Forest | 511 | 35,1 | 17932 | 35,4 | 6,0 | 299,8 | 14,2 | 23,4 | 40,4 |
| Wetlands | 142 | 45,1 | 6407 | 30,7 | 8,1 | 231,8 | 24,7 | 39,7 | 53,8 |

## FRP by fire seasons

| | No of cases | Mean | Sum | SD | Min | Max | Q25 | Median | Q75 |
|---|---|---|---|---|---|---|---|---|---|
| Spring fires | 1802 | 34,5 | 62232 | 30,9 | 4,9 | 299,8 | 16,5 | 25,0 | 40,6 |
| Autumn fires | 2135 | 26,5 | 56613 | 31,4 | 4,9 | 505,2 | 11,6 | 17,8 | 29,9 |
| Summer fires | 459 | 34,8 | 15979 | 45,0 | 4,4 | 426,0 | 12,2 | 19,7 | 39,8 |

### FRP grouped per fire seasons

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