

ANTALYA (KUMLUCA – ADRASAN) – TURKEY (24 – 29.06.2016)

FOREST FIRE REMOTE SENSING REPORT

On June 24 - 29, two separate wildfires were started in Antalya Province Kumluca District of Turkey within 2 days apart. Fires burned together approximately 15 km² area. The fires threatened some several structures in Adrasan, Yazır, Erentepe, Toptaş, Beşikçi and Belen neighborhoods. Different data sources was tried to be used for mapping the affected / burned area. Following summary is the result of analyses and mapping activities by the help of APSCO DSSP data source. (AFAD is obligated to protect the intellectual property rights involved in the data supplied under APSCO DSSP service, and the data will not be transferred to any third party, will only be used in intranet of Disaster Management and Decision Support System of Turkey)

APSCO DSSP DATA

- Republic of Turkey, Prime Ministry Disaster and Emergency Management Authority (AFAD) is the certified user of APSCO DSSP (The Asia-Pacific Space Cooperation Organization Data Sharing Service Platform) since 4 May 2016.
- AFAD submitted a request for forest fire occurring in Antalya, Turkey on 27.06.2016 by TUBITAK UZAY. The application form of AFAD was sent by e-mail to the DSSP.
- DSSP informed that the data was ready to download from the FTP links on 05.07.2016.
- Data was downloaded and preliminary analyzed.

Preliminary Analysis Results:

- Data could be successfully opened by some software like Qgis, ENVI on the fly projection but could be opened with fake coordinates by Global Mapper, Viskon RS, SNAP.
- The images were received with orbital control points as Level 1A data and scene “GF1_PMS1_E30.3_N36.4_20160702_L1A0001678587” includes the region of interest / burned region.
- Data from xml file includes:
 - *Image receive date is 02.07.2016 and production date is 03.07.2016.*
 - *Images belong to Gaofen-1 high-resolution optical Earth observation satellites of CNSA (China National Space Administration).*
 - *Multispectral image (R,G,B,INF) at 8m resolution and panchromatic image at 2m resolution.*
- It was decided to perform NIR band filtering / masking, NDVI and BAI analyses to recognize and map the affected area by fire.

Pre Processing:

- Orthorectification: Because the data was registered only with orbital control points (frame coordinates), its horizontal accuracy was low. A further processing was applied to improve the georeferencing and multitemporal matching so orthorectification process was performed by 10 m DEM data without GCP.

- There was no information related with pixel values within the data but they were accepted as DN. It is not necessary to convert DN to reflectance values for NDVI analysis or NIR band masking but it is necessary for Burning Area Index (BAI), so the data was converted from DN to reflectance.
- IAR Reflectance Correction (Internal Average Relative Reflectance) was performed to normalize images to a scene average spectrum. This process is particularly effective for reducing multispectral data to relative reflectance in an area where no ground measurements exist and little is known about the scene. An average spectrum is calculated from the entire scene and is used as the reference spectrum, which is then divided into the spectrum at each pixel of the image.
- Then the data was analyzed in AYDES RS (Disaster Management and Decision Support System Remote Sensing Software of AFAD)

AYDES RS Analyses

- Burned area was generally recognized by 4,2,1 (NIR, Green, Blue) band combination.
- A spatial subset and vector ROI from view were created from the main product and used to perform different analyses / masking operations (Figures 1-4):

- *NIR Band Filtering and Masking: For the discrimination between burned and unburned areas, bands in the near infrared (NIR) spectral region demonstrate the highest discriminatory power, followed by short wave infrared (SWIR) bands. Visible wavelengths performed considerably poorer. By this purpose, NIR band was tried to be filtered and a mask was created to determine the burned area.*
- *NDVI analysis and masking: Although NDVI is mostly used to determine healthy green vegetation, because the fire was effective in a mostly forest area, to calculate NDVI (Normalized Difference Vegetation Index) can be useful to recognize the burned area. By this purpose, NDVI analysis was performed and a mask was created to determine the burned area. The NDVI is calculated from these individual measurements as follows:*

$$NDVI = (NIR - RED) / (NIR + RED)$$

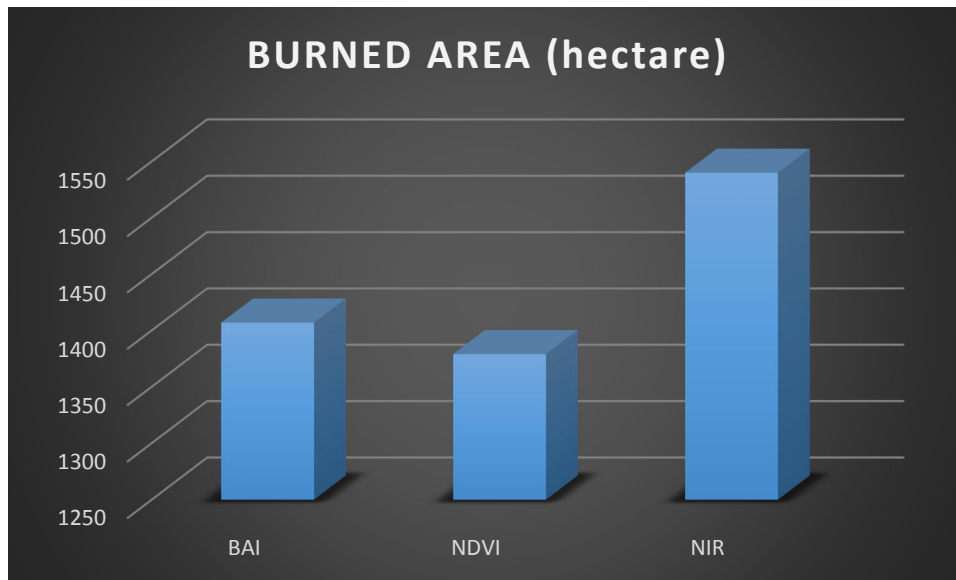
- *The Burn Area Index (BAI) highlights burned land in the red to near-infrared (NIR) spectrum, by emphasizing the charcoal signal in post-fire images. The index is computed from the spectral distance from each pixel to a reference spectral point, where recently burned areas converge. Brighter pixels indicate burned areas. BAI is computed as follows (Martín, 1998):*

$$BAI = 1 / [(0.1 - RED)^2 + (0.06 - NIR)^2]$$

- According to the results of different type of approaches, the most comprehensive result is belong to NIR band filtering / masking according to visual interpretation although there is no field control.

- The result was exported as a shape file and entered into AYDES (Disaster Management and Decision Support System WEB Platform for Post Disaster Responses) web system as the affected area of the disaster. (Figure 5)

METHOD	BURNED AREA (hectare)
BAI	1407
NDVI	1379
NIR	1540



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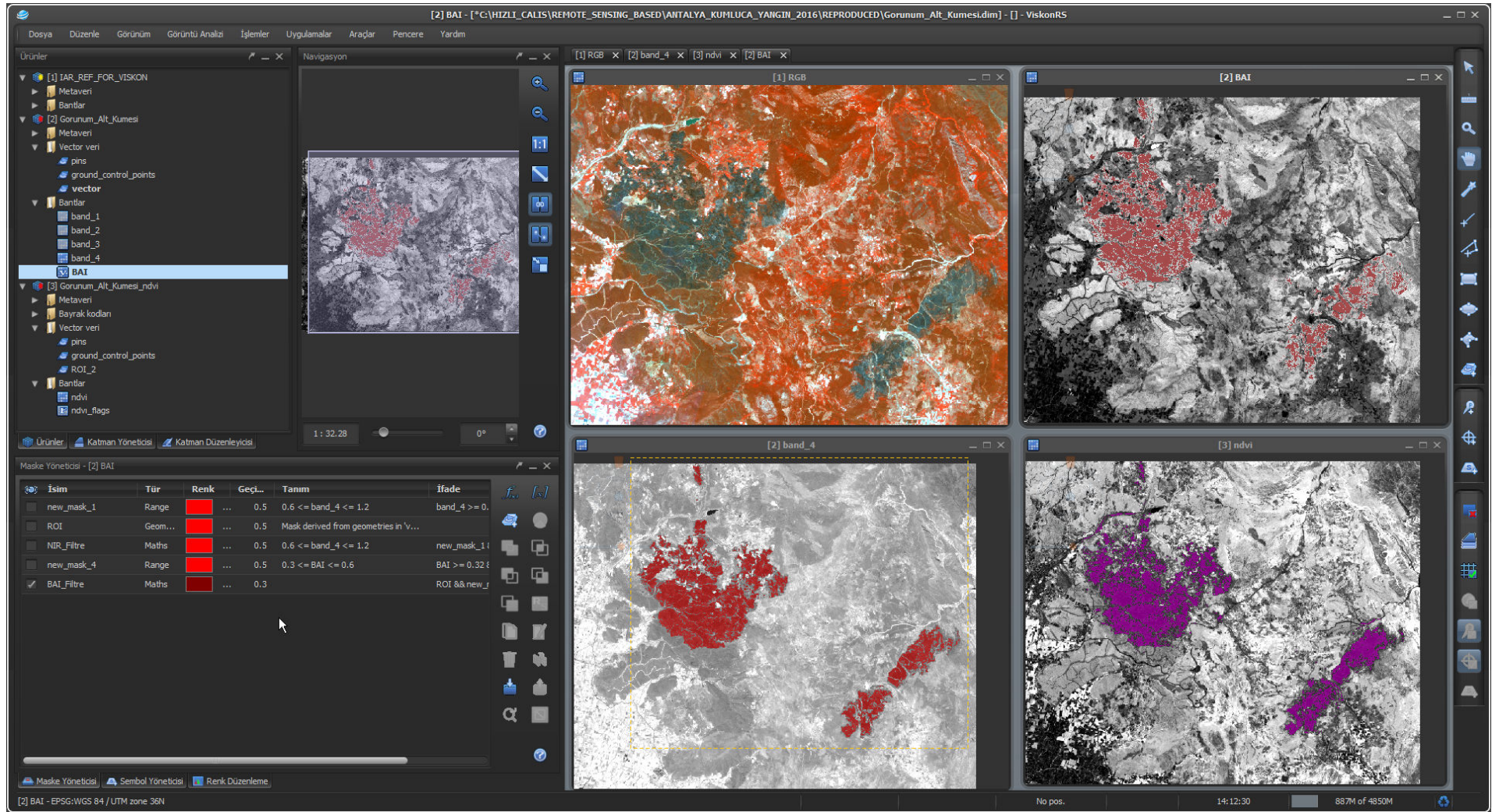


Figure 1. Burned area was recognized by different methods.

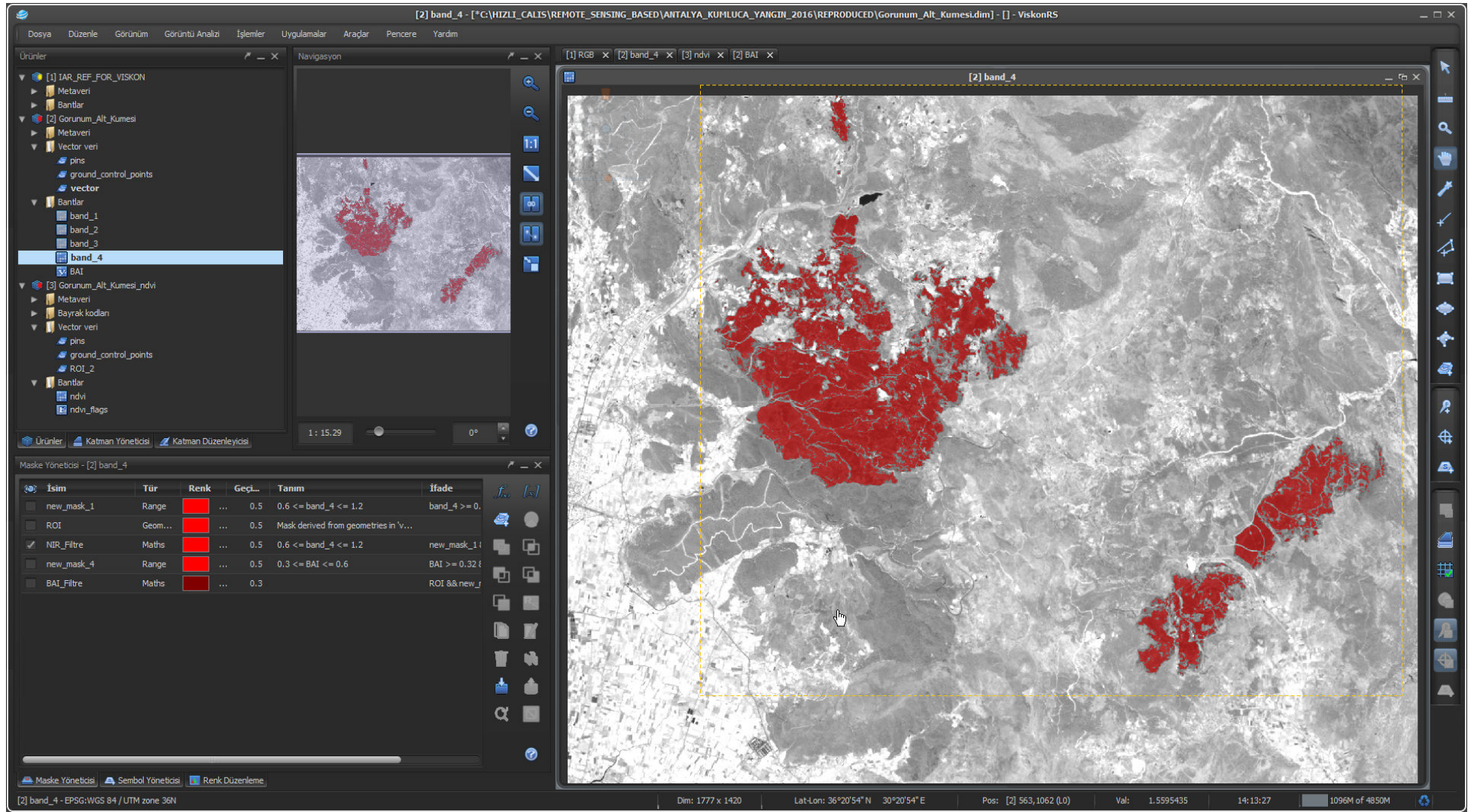


Figure 2. NIR band filtering / masking.

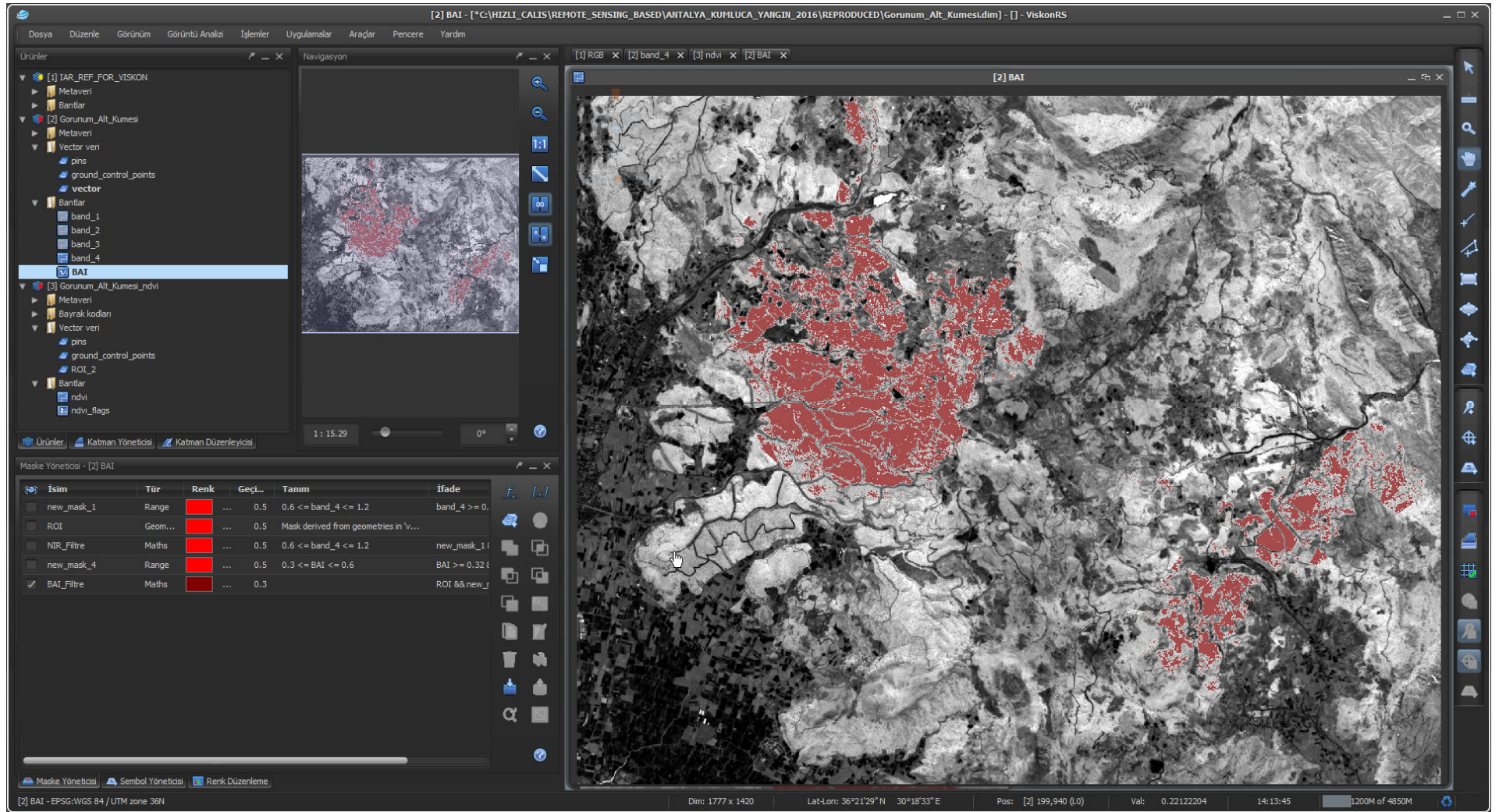


Figure 3. BAI analysis result.

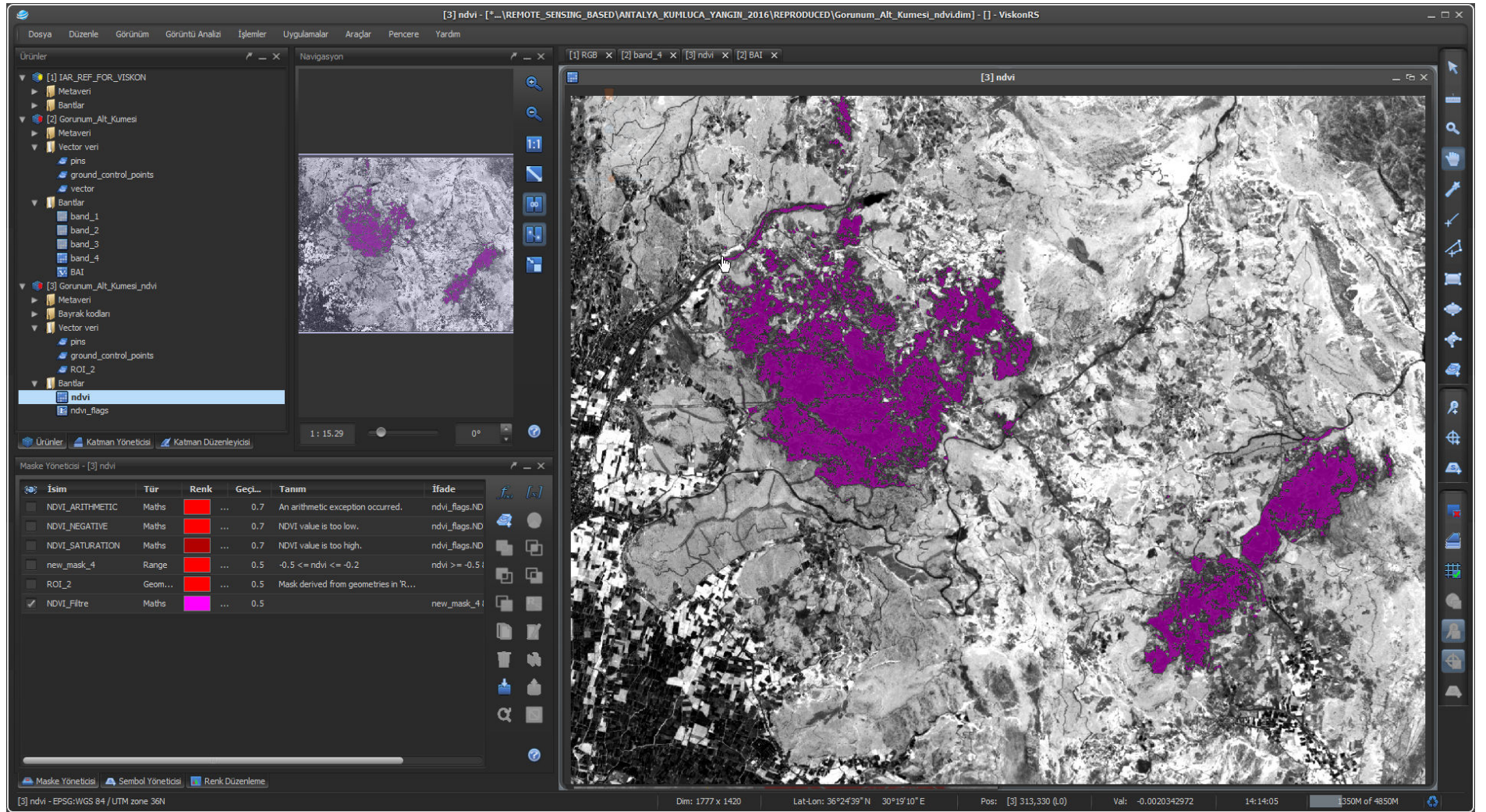


Figure 4. NDVI analysis / masking.

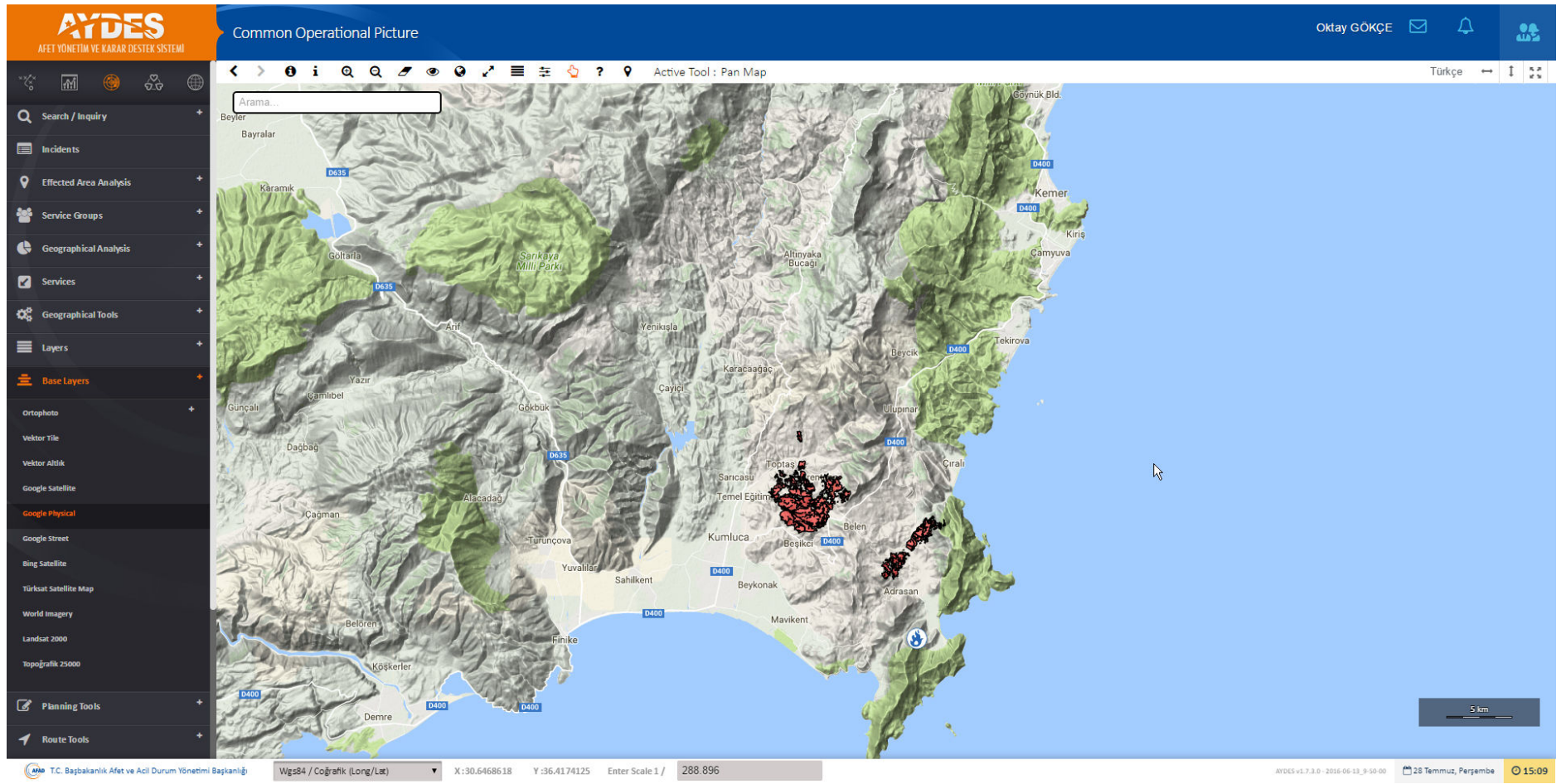


Figure 5. AYDES Common Operational Picture incident / event viewer.

