BULGARIAN ACADEMY OF SCIENCES
SPACE RESEARCH AND TECHNOLOGY INSTITUTE
SES 2025
Twenty-first International Scientific Conference
SPACE, ECOLOGY, SAFETY
21 – 25 October 2023, Sofia, Bulgaria

FOREST FIRE DATABASE ON THE TERRITORY OF BULGARIA FOR THE PERIOD 2020–2024 BASED ON SATELLITE DATA

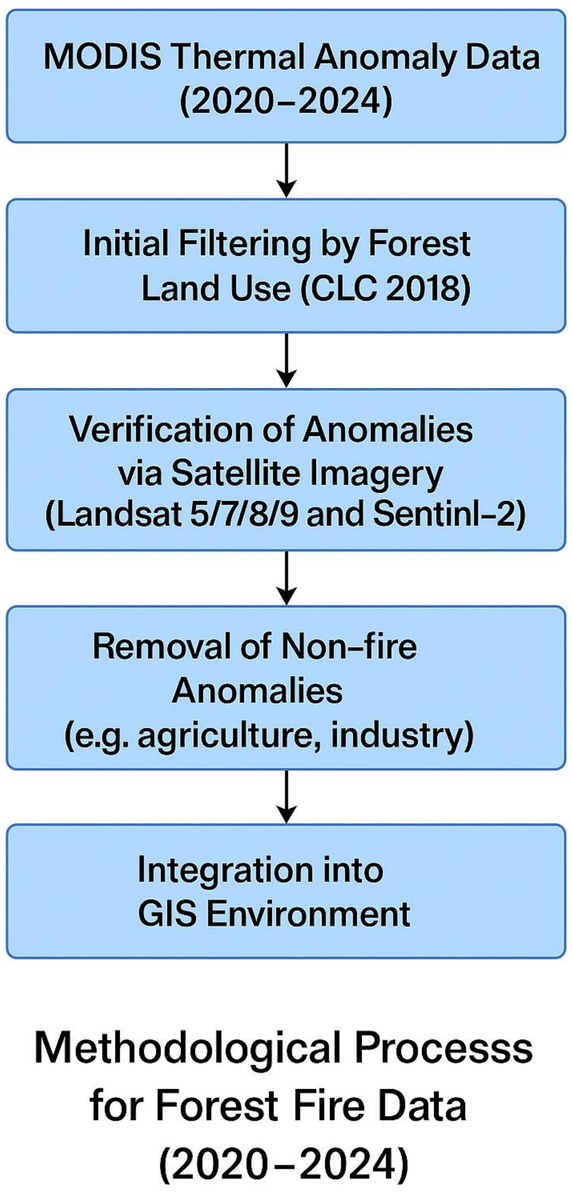
Nataliya Stankova, Daniela Avetisyan
Department of Aerospace Information, Space Research and Technology Institute – Bulgarian Academy of Sciences
e-mail: natalia_hs@space.bas.bg

Abstract: *This study presents the development and analysis of a geospatial database of forest fire events across the territory of Bulgaria for the period 2020–2024. The database was compiled from satellite-derived active fire detections, incorporating geographic coordinates, acquisition date and time, signal intensity, and satellite platform of origin (Terra or Aqua). Organized in shapefile format, it enables direct integration into Geographic Information Systems (GIS) for spatial analysis, visualization, and correlation with other geospatial datasets. The results include both spatial and temporal assessments, with statistical summaries revealing interannual variability and a notable increase in recorded events in 2024. Kernel Density estimation was applied to identify high-density clusters of fire occurrences, providing insights into spatial patterns and potential hotspots. The dataset offers a robust foundation for risk assessment, supports targeted forest fire prevention and mitigation strategies, and contributes to data-driven decision-making for sustainable forest management in Bulgaria.*

DATA AND METHODS

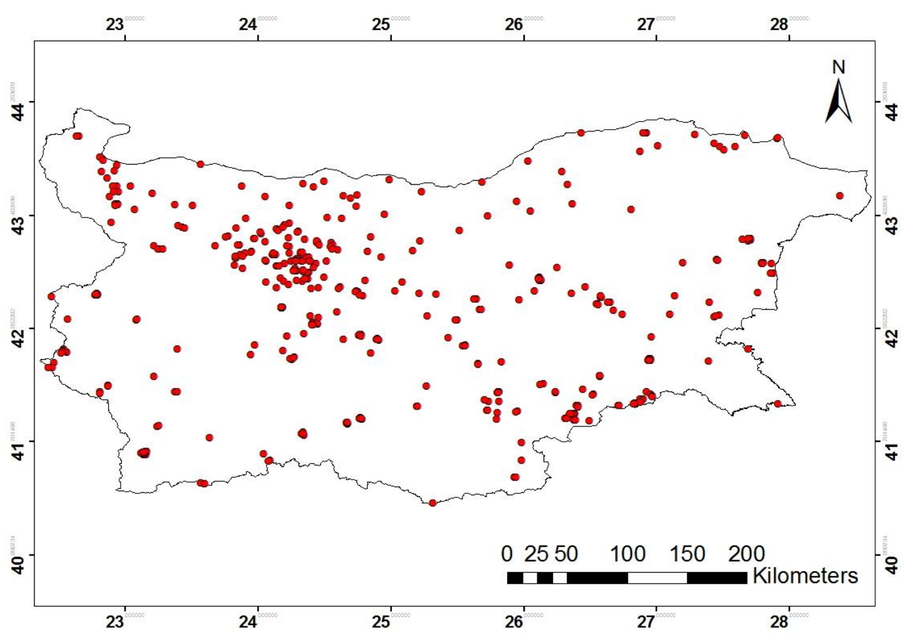
- **Thermal anomaly data selection** — for the entire territory of Bulgaria over a five-year period (2020–2024) — MODIS-detected hotspots
- **Filtering the forest vegetation** — Corine Land Cover 2018 (CLC 2018) classification was applied
- **Verification of the thermal anomalies** — optical satellite imageries were utilized from Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI, and Landsat 9 OLI-2 sensors
- **Verification process effectively filtered out false positives** — thermal anomalies not associated with wildfires

Workflow diagram of the methodological framework for Forest Fire Database development (2020–2024)



Methodological Processs for Forest Fire Data (2020–2024)

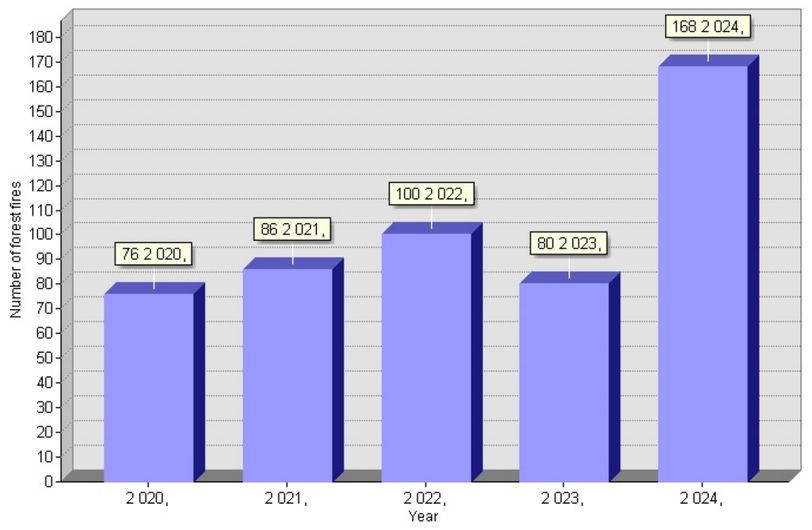
RESULTS



Forest Fire Database in Bulgaria (2020–2024) organized as a shapefile format

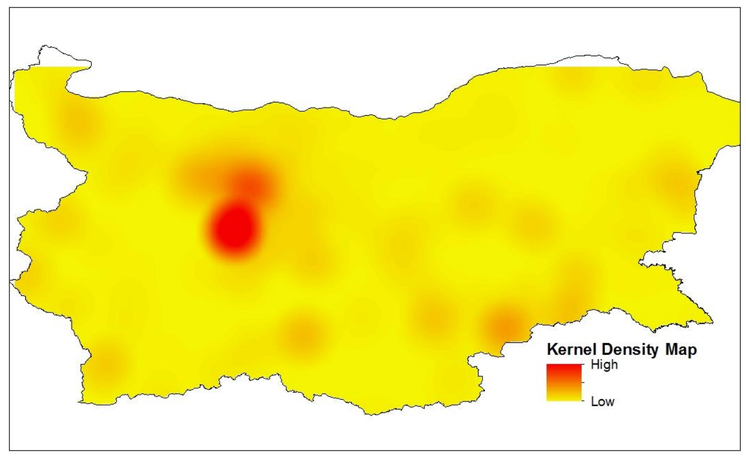
The attribute data: geographic coordinates, acquisition date, acquisition time, signal intensity, and the satellite platform of origin (Terra or Aqua) for the Forest Fire Database in Bulgaria

FID	LATITUDE	LONGITUDE	BRIGHTNESS	ACQ_DATE	ACQ_TIME	SATELLITE
0	42.7166	24.1776	300.5	4.1.2020 г.	0920	Terra
1	43.5883	22.9505	301.4	23.1.2020 г.	1133	Aqua
2	43.6425	26.3309	304.6	25.1.2020 г.	0939	Terra
3	41.877	25.7948	303.4	1.2.2020 г.	1126	Aqua
4	42.3056	25.8349	303.4	1.2.2020 г.	1126	Aqua
5	43.2189	25.2204	316.2	1.2.2020 г.	1127	Aqua
6	43.6591	25.6878	300.8	1.2.2020 г.	1127	Aqua
7	43.6883	22.865	308.5	1.2.2020 г.	1127	Aqua
8	42.6823	24.5977	302.6	3.2.2020 г.	1114	Aqua
9	43.0481	24.4408	309.7	3.2.2020 г.	1114	Aqua
10	43.0817	24.33	312.5	18.2.2020 г.	1210	Aqua
11	43.4971	22.9269	300.7	18.2.2020 г.	1210	Aqua
12	43.4955	22.9441	311.3	24.2.2020 г.	1133	Aqua
13	42.9758	27.8753	307.1	11.3.2020 г.	1133	Aqua
14	42.9741	27.8584	308.2	11.3.2020 г.	1133	Aqua
15	42.7178	24.1786	306.7	12.3.2020 г.	0857	Terra
16	43.6313	22.9399	317.9	13.3.2020 г.	1121	Aqua
17	42.7173	24.1801	308	17.3.2020 г.	0915	Terra
18	42.9414	24.5003	308	20.3.2020 г.	1127	Aqua
19	42.9296	24.3786	304.1	21.3.2020 г.	0850	Terra
20	42.8391	24.7386	306	21.3.2020 г.	0850	Terra
21	42.8343	24.7538	307.1	21.3.2020 г.	0850	Terra



The total number of recorded forest fire events in Bulgaria for the period 2020–2024

Kernel Density estimation of forest fire events for the period 2020–2024, displayed using a stretched yellow-to-red color ramp to indicate a continuous increase in density values (events/km²)



ACKNOWLEDGMENTS

This study was supported by a project № ПВУ- 06 from 03.04.2025 /BG-RRP-2.018-0009-C01/ “Development of an Integrated System for Assessing Disturbances and Recovery Processes in Forest Ecosystems after Fires Based on Multispectral Satellite Data” from the Recovery and Resilience Mechanism for the implementation of an investment under C2I2 "Enhancing the innovation capacity of the Bulgarian Academy of Sciences (BAS) in the field of green and digital technologies" from the Recovery and Resilience Plan.

Финансирано от Европейския съюз
Next Generation EU

План за възстановяване и устойчивост