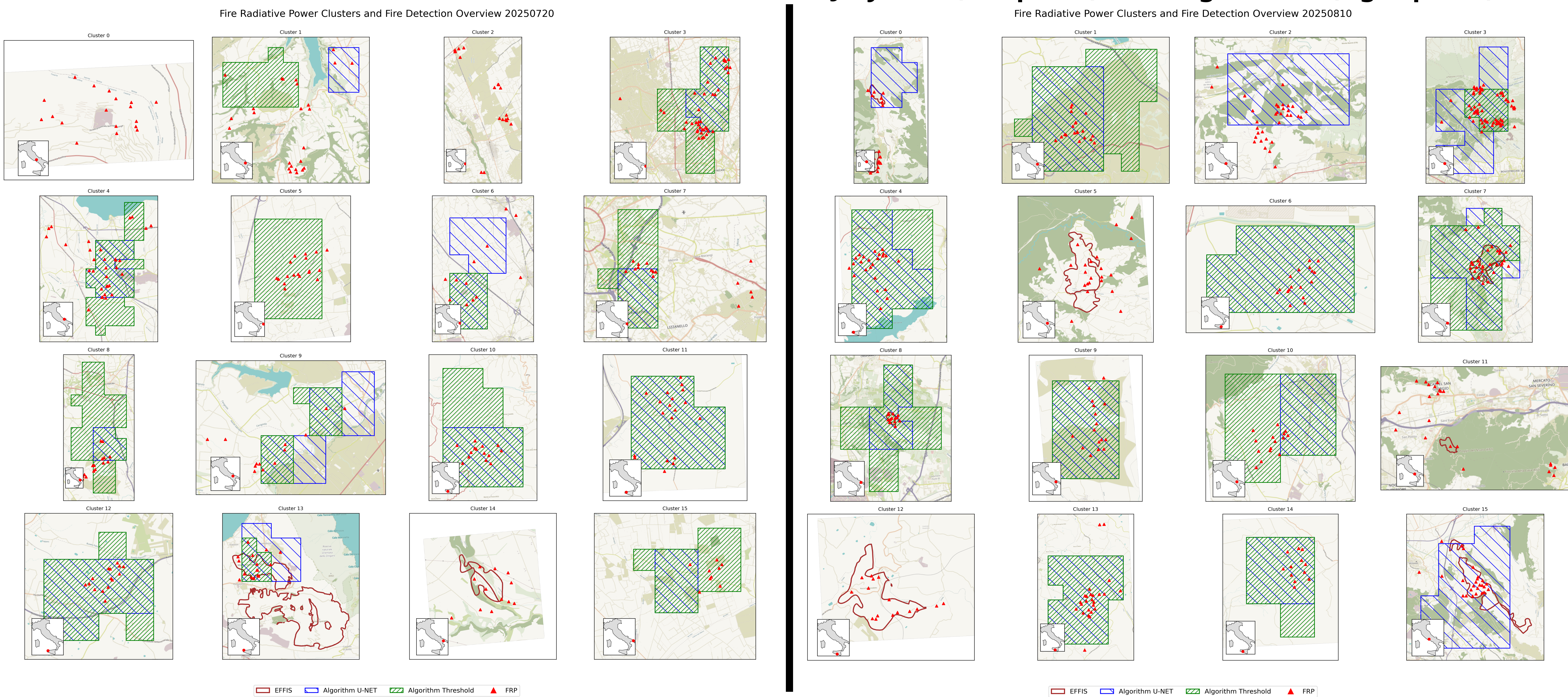


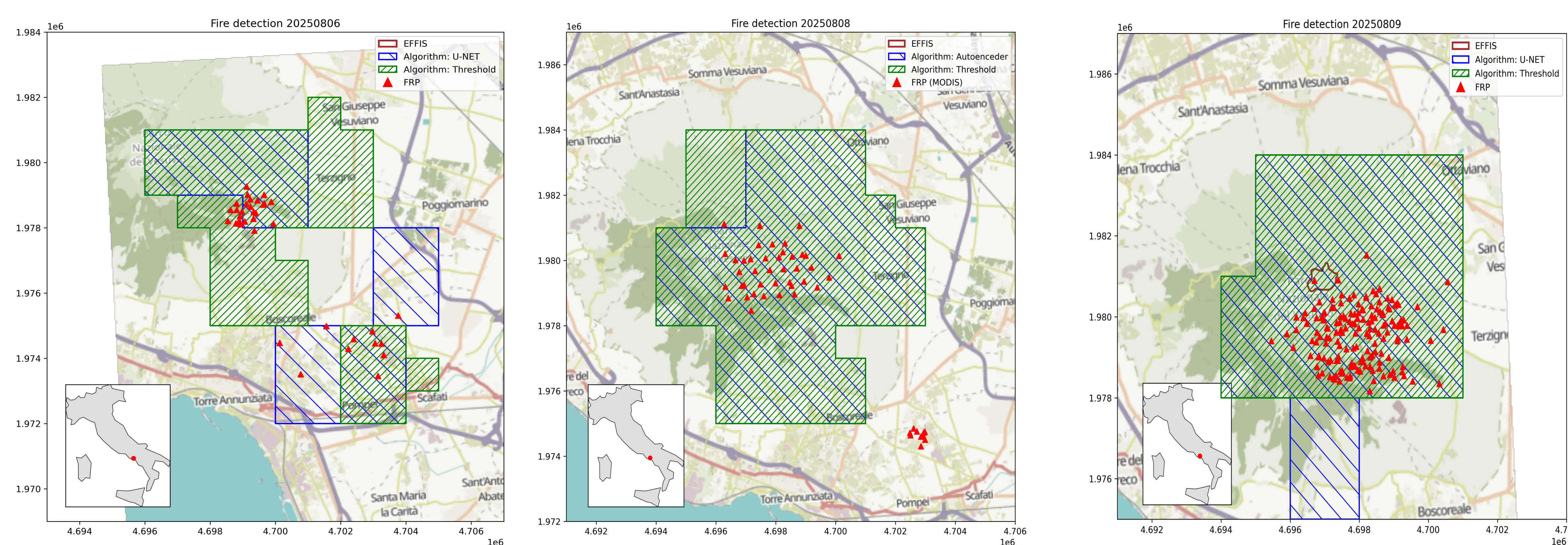
Bottleneck-Constrained Light U-Net for Unsupervised Wildfire Detection: We present a lightweight U-Net autoencoder designed for unsupervised wildfire detection from MTG-FCI data. The model is trained exclusively on fire-free images, learning to reconstruct the nominal structure of the landscape. By constraining the latent space to a very narrow bottleneck (4 channels), the network is forced to encode only the most stable spatial and spectral patterns of the terrain. When a fire occurs, its features can not be properly compressed within this restricted representation, resulting in a significantly increased reconstruction error. The anomaly signal is combined with the local thermal excess from the 3.8 μm band through a dual-scale statistical normalization strategy.

Threshold Algorithm Detection. Check whether absolute brightness 3.8 μm band > a global threshold (GT), and difference 3.8 - 10.5 μm bands > threshold difference (TD). GT= max(322 K and 99.99 percentile). TD =12 K

Some results chosen on Fire Radiative Power clusters on July 20th (left panel) and August 10th (right panel)

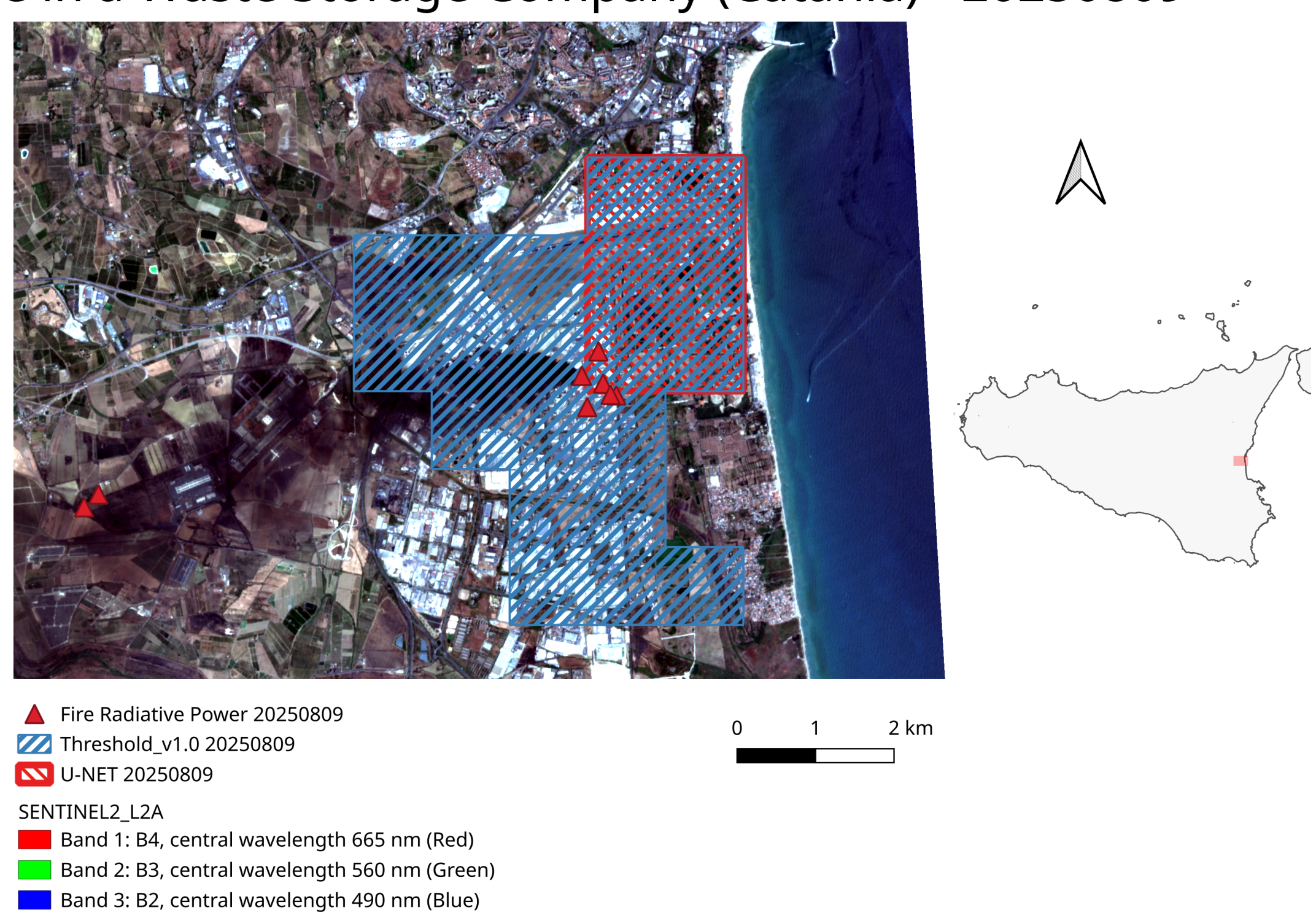


VESUVIUS WILDFIRE OCCURRED BETWEEN 5 and 12 AUGUST 2025



The Vesuvius fire was one of the largest and most devastating fires of 2025 in Italy. It initially developed on August 5th and after an initial phase that affected the 5th and 6th of August, the fire was not completely extinguished and it regained strength on the 8th. Here we show the fire radiative power signals (red triangles) together with the detection areas according to our algorithms for 6th, 8th and 9th August. EFFIS date of Vesuvius wildfire is August 7th and for this reason is not shown.

Fire in a Waste Storage Company (Catania) - 20250809



Unlike the case of the Vesuvius fire, which was large, our algorithms were able to observe a fire in the industrial area of Catania that occurred on August 9, 2025. This is an important result that shows the ability of the MTG to observe even small-scale fires. **MTG data processed by ISPRA. Sentinel-2 True Color. Fire Radiative Power cleaned by using a time-space clustering algorithm.**

CONCLUSIONS

Algorithms developed to detect fire with MTG data were able to observe many of wildfires occurred during the last fire season in Italy. Our present analysis is focused on daily observations. However, the future development will be focused on the detection of fires at a finer temporal scale.