

Discrepancy in Satellite Data on Farm Fires and Air Pollution Explained

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Why in News?

The air quality in Delhi remains severely compromised post-Deepavali, despite stringent measures like GRAP Stage IV, Supreme Court intervention, and efforts by the Delhi government.

The issue has drawn significant attention to farm fires in nearby states, where farmers burn paddy stubble to prepare for wheat sowing. While not the sole cause of Delhi's pollution, these fires have sparked a controversy over their extent, reflecting the scrutiny they face as a contributing factor.

Counting of farm fires

• Monitoring of farm fires

- Given the widespread occurrence of these fires, satellite monitoring is deemed most effective. India relies on data from two NASA satellites: **Aqua and Suomi-NPP**.
- **Aqua (Launched 2002)**: Equipped with the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument, it tracks changes in the lower atmosphere, especially over land, through time.
- **Suomi-NPP (Launched 2011)**: Features the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument, and the Ozone Mapping and Profiler Suite, which tracks aerosols and smoke contributions to pollution.

• Operational Details

- Aqua's and Suomi-NPP's overpass at each location happens at 1.30 pm local time in the day and at 1.30 am local time at night.
- Their MODIS and VIIRS instruments collect visible and infrared images of the earth at around these intervals and are capable of spotting fires and smoke in a small window centred on the overpass time.
- The Ozone Mapping and Profiler Suite onboard Suomi NPP can also identify aerosol loads in the atmosphere, which is useful to track smoke from fires and their eventual contribution to air pollution.

Controversy around counting method

• NASA Scientist Observations on Farm Fires

- On October 2, a senior scientist at NASA's Goddard Space Flight Centre, reported a 40% reduction in farm fires for 2023 and expressed optimism for a continuing decline in 2024.
- By October 24, he noted that fires in 2024 appeared to be the "lowest in the last decade."
- He suggested this could be due to successful anti-burning efforts or fires being lit after the Aqua and Suomi-NPP satellites' overpass at 1:30 pm.

• Investigation Using Additional Satellite Data

- To verify this, he compared data from Aqua and Suomi-NPP with South Korea's GEO-KOMPSAT 2A (Cheollian 2A) satellite, a geostationary weather satellite launched in 2018.
- This satellite offers continuous monitoring from its fixed position at 128.2° E.

• Findings of Late-Day Stubble Burning

- Visuals from the three satellites showed a thicker smoke cover over Punjab and Haryana croplands after Aqua and Suomi-NPP's overpass, suggesting an increase in fires later in the day.
- This supports the hypothesis that farmers may be burning stubble outside the observation windows of the NASA satellites.

- **Contradiction in Aerosol Data**

- Despite Aqua and Suomi-NPP indicating fewer fires, experts found that aerosol levels in the atmosphere were comparable to previous years.
- This anomaly implies that more ground-level validation is necessary to reconcile satellite data with actual burning activities.

- **Not a foolproof method**

- NASA satellites only capture instances of farm fires during the limited period when they are passing over the region, which takes them 90 seconds.
- They therefore only capture any blaze visible at that time or lit in the previous half hour.
- Experts suspect that farmers have, over time, become aware of this surveillance period and shifted the time of burning their crop waste to evade the NASA satellites.

Controversial role of Commission for Air Quality Management (CAQM)

- **Creation and Mandate of the CAQM**

- The CAQM is tasked with identifying and resolving air quality issues in the NCR and adjoining areas.
- Various media reports indicated that the CAQM knew farmers were burning paddy stubble after the overpass of NASA satellites to evade detection.

- **Disputed Decline in Farm Fires**

- Despite evidence of post-overpass burning, the CAQM publicly maintains that the number of farm fires has decreased.
- It defends this claim with alternate formulae, despite contradictions from other data sources.

Can Indian satellites help?

- **CAQM's Satellite Data Evaluation Initiative**

- Recently, in an affidavit to the Supreme Court, CAQM revealed ISRO is assessing the utility of various satellites for identifying farm fires.
- These include INSAT-3DR (India), GEO-KOMPSAT 2-AMI (South Korea), Meteosat-9, Feng Yun-4A/4B (China), and HIMAWARI-8 (Japan).
- However, ISRO experts believe these satellites can't accurately count fires, with final assessments expected in a month.

- **Limitations of INSAT-3DR**

- The INSAT-3DR satellite has coarse resolution:
 - **1 km** in visible and short-wave infrared.
 - **4 km** in middle and thermal infrared.
 - **8 km** for water vapor.
- This resolution is insufficient for precise fire detection.

- **GISAT-1 Mission Failure**

- In August 2021, **ISRO** attempted to launch GISAT-1, which could have enhanced monitoring capabilities, but the GSLV-F10 mission failed when the rocket's upper stage malfunctioned.

- **RESOURCESAT Satellites**

- ISRO operates three RESOURCESAT satellites (launched in 2003, 2011, and 2016), with RESOURCESAT-2A offering superior features:
- **LISS-4 Camera**: 5.8 m spatial resolution for visible and near-infrared radiation.
- **LISS-3 Camera**: 23.5 m spatial resolution for similar radiation.
- **AWiFS Camera**: 56 m resolution for wide-area monitoring.

- **Conclusion**

- These instruments provide improved capabilities for observing farmland but are still less optimal for detecting individual fires.
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Q.1. Why do satellite data on farm fires sometimes not match actual air pollution levels?

Satellite data, like from Aqua and Suomi-NPP, only captures farm fires during specific overpass windows, often missing late-day burning. Despite fewer detected fires, aerosol levels remain high, indicating more widespread burning that is not captured during satellite passes.

Q.2. Can ISRO satellites accurately track farm fires in India?

ISRO satellites like INSAT-3DR have low resolution, making them less effective for precise fire detection. While ISRO is assessing other satellite options, current data suggests limitations in accurately monitoring farm fires compared to NASA's system.

News: [The discrepancy between satellite data of farm fires and air pollution | Explained | The Hindu](#)

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