



Detection of New NO₂ Hotspots in South Asia through Improved Retrievals of TROPOM

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ABSTRACT	INTRODUCTION	NO ₂ -SPECIFIC TROPOMI BAND		
 TROPOMI observed new NO₂ hotspots over South Asia. Comparison between TROPOMI and OMI has been made. The study period is from July, 2018 to September, 2021. Average NO₂ values are 6.67x10⁻⁵ moles/m² and 3.27x10¹⁵ molecules/cm² for TROPOMI and OMI sensors respectively. NO₂ highest value is in June and lowest value is in January. In, Afghanistan, Kabul and in Pakistan, Sahiwal are appearing as new hotspots. In India, eastern mining sides are showing many new 	 •NO₂ is a highly reactive gas •It mainly goes in the atmosphere through burning of fuel •High concentration of NO₂ in the environment can lead to respiratory problems. •It reacts with other chemicals in the air to form other harmful products •It also produce acid rain •Naturally it releases from the soil and lightning 	 The 4th band of TROPOMI is used for NO₂ retrieval. The range is 405–465nm, the range lies in the Blue region of the spectrum. The spatial resolution is 3.5 km×5.5 km, since 6 August 2019. The spectral resolution is 0.55nm. 		
 hotspots. However elevated Assam and Nagaland are showing no red 	 The dominant sink of NO₂ is its oxidation process with OH to produce secondary air pollutants 	NO ₂ PRODUCT DESCRIPTION FOR OMI		

NO₂-SPECIFIC OMI BAND

- The 3^{rd} band of OMI is used for NO₂ retrieval.
- The range is **402–465 nm**. •
- The spatial resolution is **13 km × 24 km**.
- The spectral resolution is **0.63nm**.

TOTAL-DURATION CLIMATOLOGY GRAPH FOR **TROPOMI-NO**₂



NO₂ PRODUCT DESCRIPTION FOR TROPOMI

- The proper name of the product is Sentinel-5P OFFL NO₂: Offline Nitrogen Dioxide.
- The latest version of NO₂ retrievals is 2.2.0 from 1st July • 2021.
- The level 2 product is changed to level 3 on Google Earth • Engine through binning the data with time not with latitude longitude.
- The product name is NO₂ Total Column (30% Cloud Screened).
- The product is globally binned to 0.25° x 0.25°. ullet
- The product is of Level 3 and Version 3. •

RESULTS AND DISCUSSION

- The total-duration average values of NO₂ over whole South Asia for TROPOMI and OMI are 6.67x10⁻⁵ moles/m² and 3.27x10¹⁵ molecules/cm² respectively
- The lowest and highest values for NO₂ TROPOMI occurred in January and June respectively.
- Kabul is appearing as new hotspot in Afghanistan.
- Sahiwal is also showing the new hotspot in Pakistan.
- Indian states Uttar Pradesh and Bihar are showing many new hotspots.
- Rajasthan region is showing the hotspots more clearly.
- Nagpur, Chandrapur and Ramagundam hotspots in the Indian central region are showing more clearly in TROPOMI than OMI.
- The other new refined hotspots are the **Neyveli** in Cuddalore district, Tamil Nadu and Bellary, Karnataka.

CONCLUTION

• This is the first study on South Asia with respect to the mentioned

SEASONAL MAPS OF TROPOMI-NO₂

Complete-Duration Map Of Nitrogen Dioxide

MONTHLY-CLIMATOLOGICAL STATISTICAL TABLE FOR NO₂-TROPOMI

Months	(%) Change	Trend Line Parameters a=slope b=y intercept (mol/m ²)	Average (mol/m ²) ± St. dev.	Median (mol/m ²)	Max. value (mol/m ²)	Min. value (mol/m ²)
Jan	-1.6%	a=-5E-07 b=6E-05 R ² =0.0174	6.0E-05± 3.8E-06	6.2E-05	6.3E-05	5.6E-05
Feb	1.5%	a=5E-07 b=6E-05 R ² =0.0174	6.3E-05± 3.8E-06	6.5E-05	6.6E-05	5.9E-05
Mar	5.8%	a=2E-06 b=6E-05 R ² =0.1579	6.8E-05± 5.0E-06	6.9E-05	7.3E-05	6.3E-05
Apr	0.0%	a=-4E-20 b=7E-05 R ² =5E-29	7.2E-05± 5.2E-06	7.5E-05	7.5E-05	6.6E-05
May	-6.3%	a=-3E-06 b=8E-05 R ² =0.3827	7.5E-05± 4.0E-06	7.4E-05	7.9E-05	7.1E-05
Jun	-5.0%	a=-2E-06 b=8E-05 R ² =0.1967	7.6E-05± 4.5E-06	7.6E-05	8.0E-05	7.1E-05
Jul	4.3%	a=5E-07 b=7E-05 R ² =0.0847	7.1E-05± 2.2E-06	7.1E-05	7.3E-05	6.8E-05
Aug	3.0%	a=4E-07 b=7E-05 R ² =0.04	6.6E-05± 2.6E-06	6.6E-05	6.9E-05	6.3E-05
Sep	-4.5%	a=-1E-06 b=7E-05 R ² =0.3553	6.3E-05± 2.5E-06	6.3E-05	6.6E-05	6.1E-05
Oct	-6.1%	a=-2E-06 b=7E-05 R ² =0.4286	6.3E-05± 3.1E-06	6.2E-05	6.6E-05	6.0E-05
Nov	-9.1%	a=-3E-06 b=7E-05 R ² =0.5192	6.1E-05± 4.2E-06	6.0E-05	6.6E-05	5.8E-05
Dec	-3.1%	a=-1E-06 b=6E-05 R ² =0.0577	6.1E-05± 4.2E-06	6.2E-05	6.4E-05	5.6E-05

TOTAL-DURATION OMI-RETRIEVED NO₂ MAP



time duration for NO₂ TROPOMI.

- Sentinel 5 Precursor's sensor TROPOMI is showing us a clear significance over Aura OMI sensor for separating the NO₂ hotspots due to its high spatial resolution.
- The highest value in June is due to high NO₂ emissions from the soil due to high temperatures, use of fertilizers and crop residue burning by farmers.
- Lowest value in January is due to low temperatures for NO₂ emissions from the soil and less cloud cover which in return gives more solar ultraviolet radiation for breaking of NO₂ molecules.
- The basic reason for NO₂ hotspots is the power plants, crop residue burning and other fuel consumption activities in the mega cities and industrial areas.

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30°

20°

Ζ

30° N

20°

Ζ



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