Impacts of summer 2021 wildfire events in Southwestern Turkey on air quality with multi-pollutant satellite retrievals

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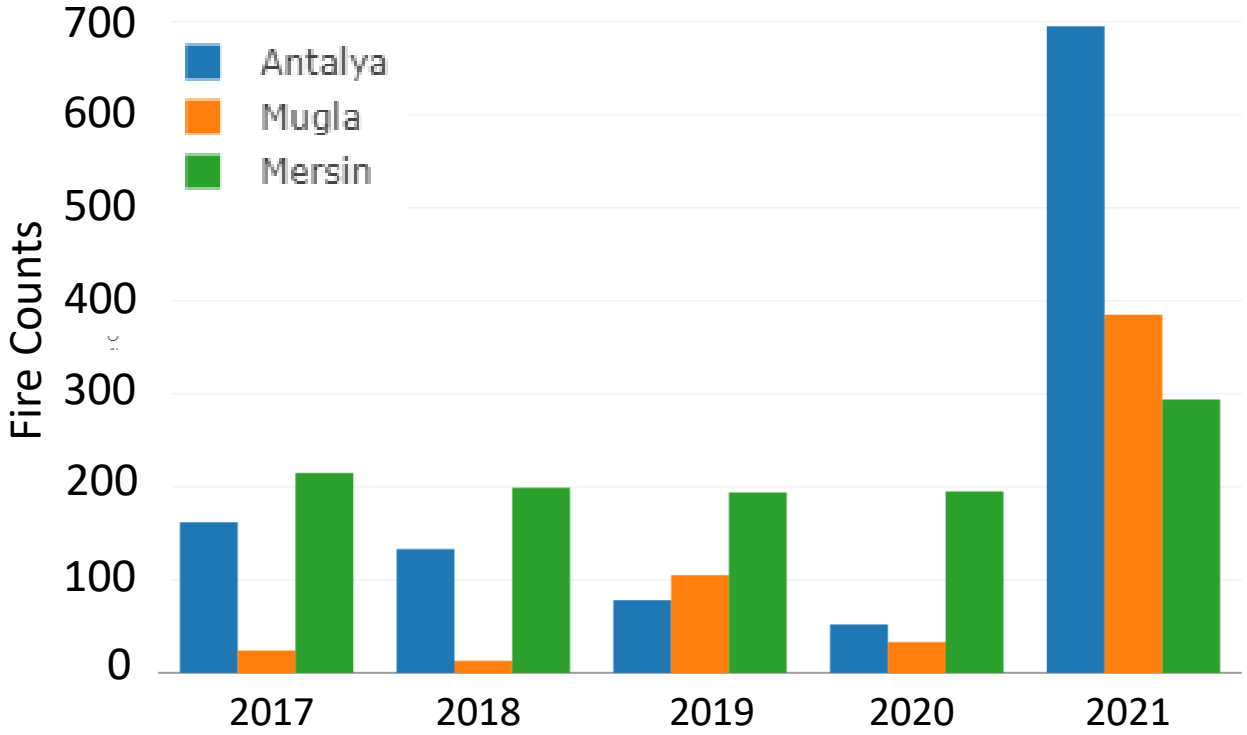


Global Forest Watch, 2022

Motivation: Significant increase in uncontrollable fires in Southeastern Turkey

Aim: Understanding the impacts of 2021 wildfires on air quality in the region

MODIS Corrected Reflectance (August 2nd, 2021)

NASA, Worldwide Snaphots, 2022

Fire Regions	Districts	Fire Intervals	Air Quality Stations	Meteorology Stations
Antalya1 **(An1)**	Manavgat	28 July-6 August	Manavgat	18839
	Akseki			17917
	Ibradi			17954
				18013
Antalya2 **(An2)**	Gundogmus	29 July-13 August	Alanya	18012
	Alanya			19154
Mugla1 **(Mu1)**	Bodrum	1-7 August	Milas	17293
	Milas		Milas-Oren	17921
Mugla2 **(Mu2)**	Mentese	4-7 August	Musluhittin	18629
	Kavaklidere		Yatagan	18022
	Yatagan			17886
				17292
Mugla3 **(Mu3)**	Marmaris	29 July-5 August		17298
				17470
Mugla4 **(Mu4)**	Koycegiz	29 July-12 August		18019
				18627
				17924
Mersin1 **(Me1)**	Aydincik	15-17 July 29-31 July		18061
				18284
Mersin2 **(Me2)**	Silifke	29-31 July	Tasucu	18870
				17479

VIIRS FRP

- FRP dataset taken from NASA archive [1]
- Monthly total fire radiative power (FRP) estimated
- Spatial allocation to 1×1 km^2 gridded domain
- 8 fire regions selected for investigation (high FRP)

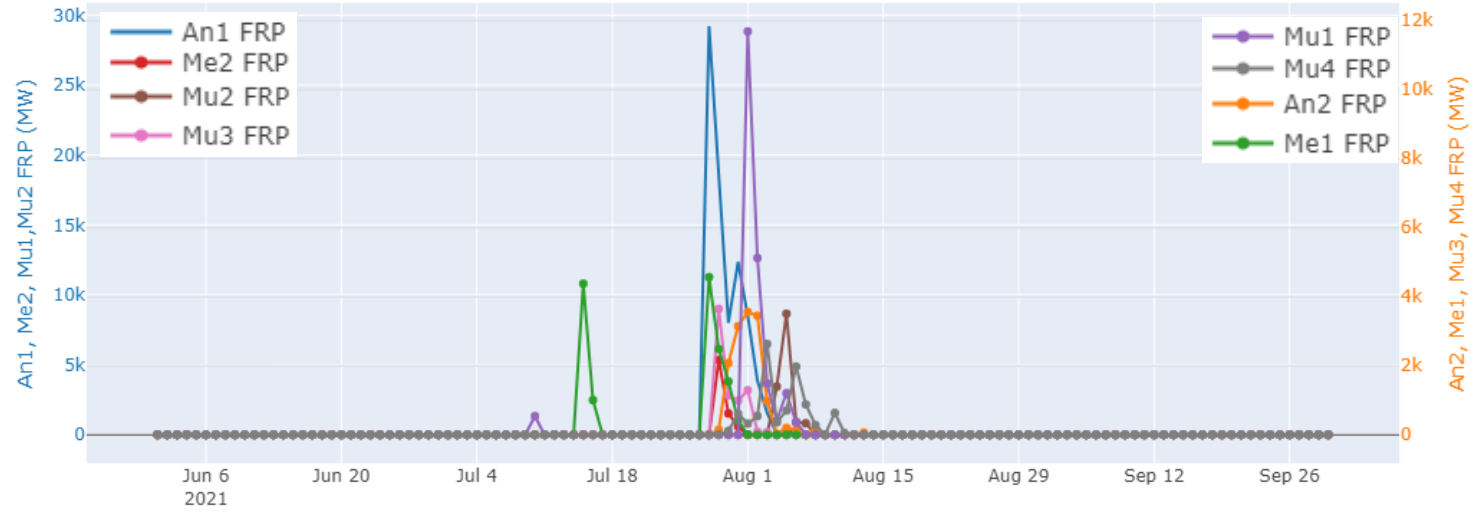
TROPOMI retrievals

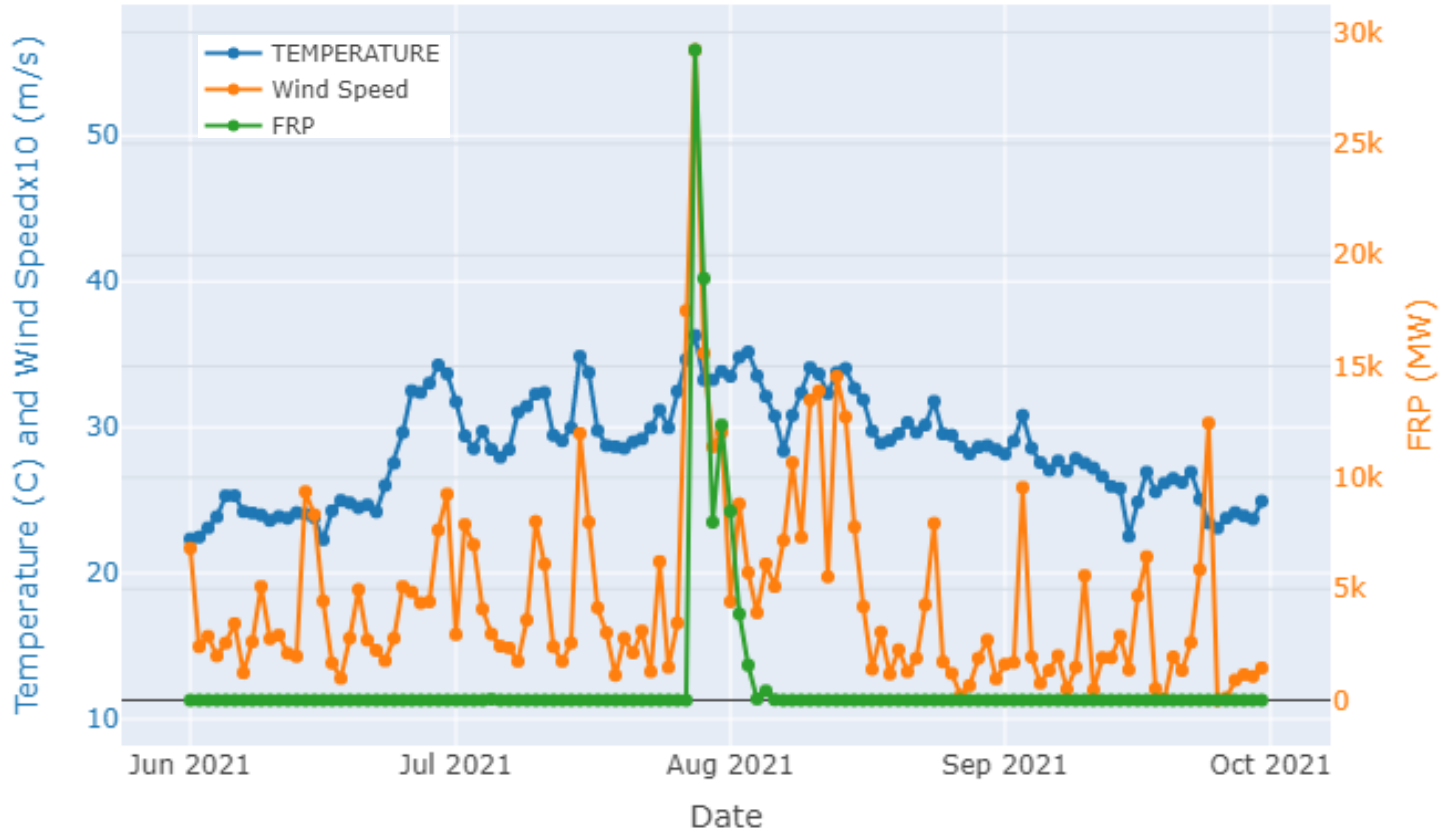
- TROPOMI Level-2 HCHO, CO and NO_2 retrievals from NASA [2]
- Initial processing according to data quality criteria and study region
- Monthly averaging for 1×1 km^2 gridded domain for 8 fire regions
- Data over fire regions and ground stations were assessed

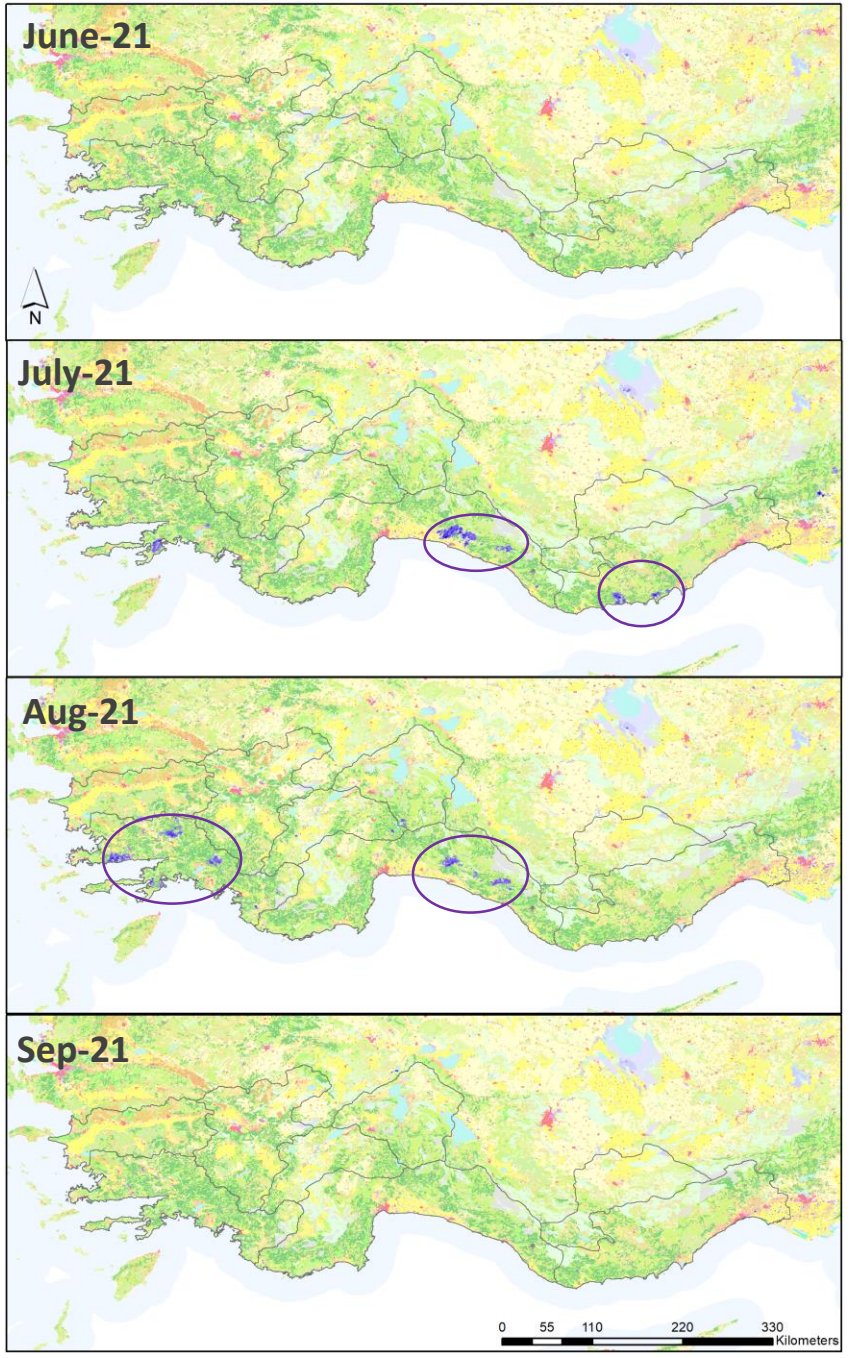
Meteorology

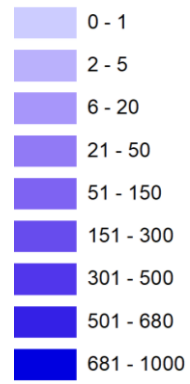
- Wind direction and wind speed
- Temperature

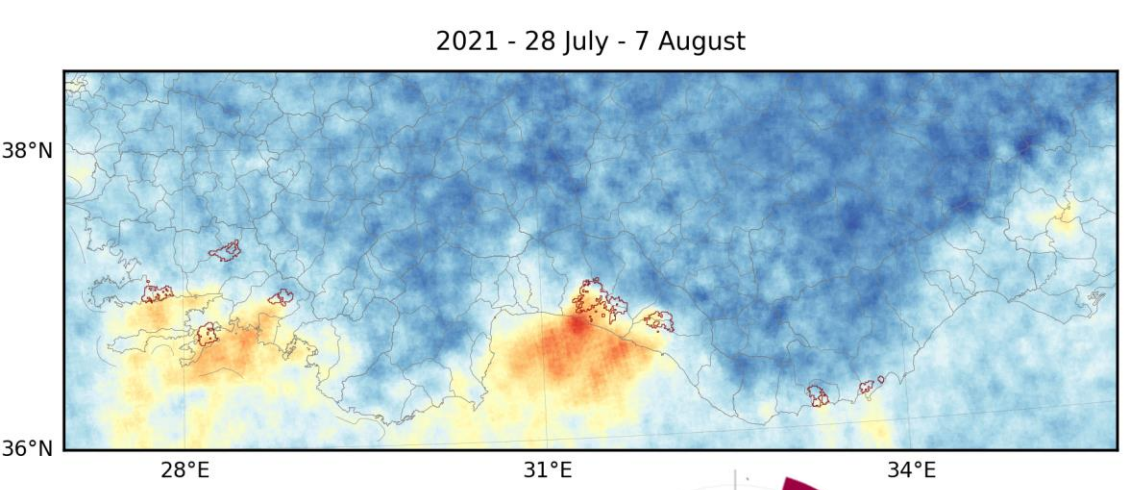
[1] NASA FIRMS, 2022
[2] GES DISC, 2022

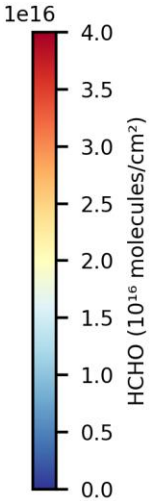

An1 FRP
Me2 FRP
Mu2 FRP
Mu3 FRP
Mu1 FRP
Mu4 FRP
An2 FRP
Me1 FRP
An1, Me2, Mu1,Mu2 FRP (MW)
An2, Me1, Mu3, Mu4 FRP (MW)
30k
25k
20k
15k
10k
5k
0
12k
10k
8k
6k
4k
2k
0
Jun 6
2021
Jun 20
Jul 4
Jul 18
Aug 1
Aug 15
Aug 29
Sep 12
Sep 26

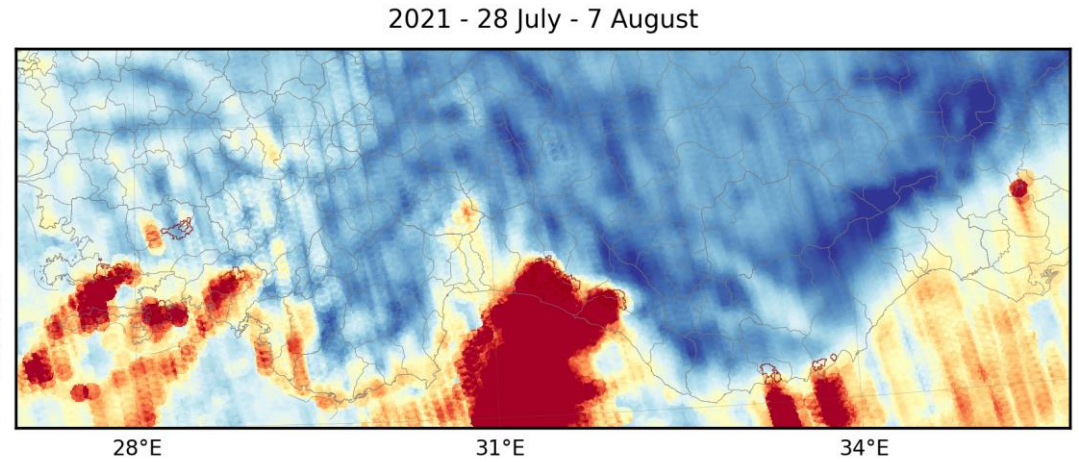

TEMPERATURE
Wind Speed
FRP
Temperature (C) and Wind Speedx10 (m/s)
FRP (MW)
50
40
30
20
10
30k
25k
20k
15k
10k
5k
0
Jun 2021
Jul 2021
Aug 2021
Sep 2021
Oct 2021
Date

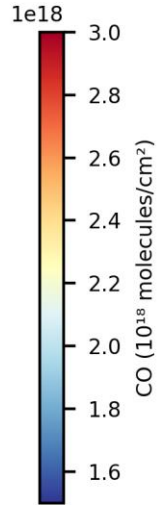

June-21
July-21
Aug-21
Sep-21
N
0 55 110 220 330
Kilometers

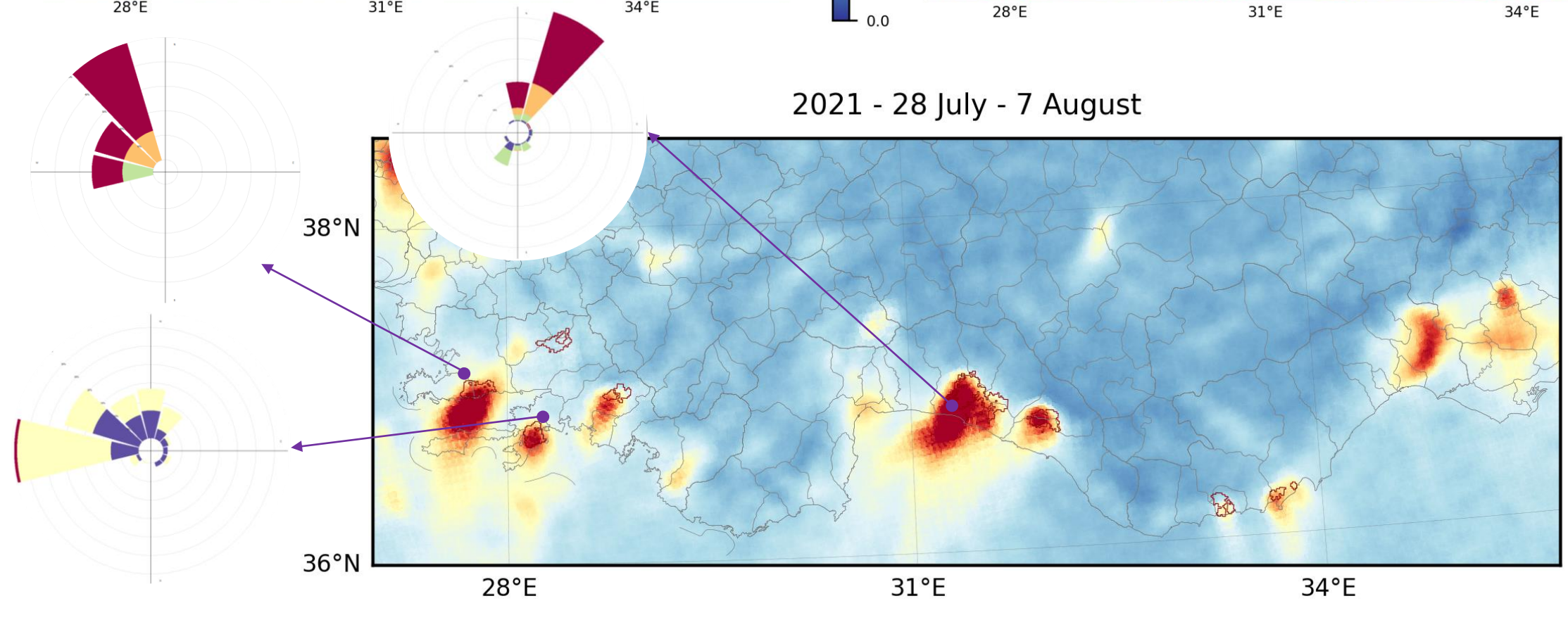

VIIRS Fire Radiative Power
(MW)
0 - 1
2 - 5
6 - 20
21 - 50
51 - 150
151 - 300
301 - 500
501 - 680
681 - 1000

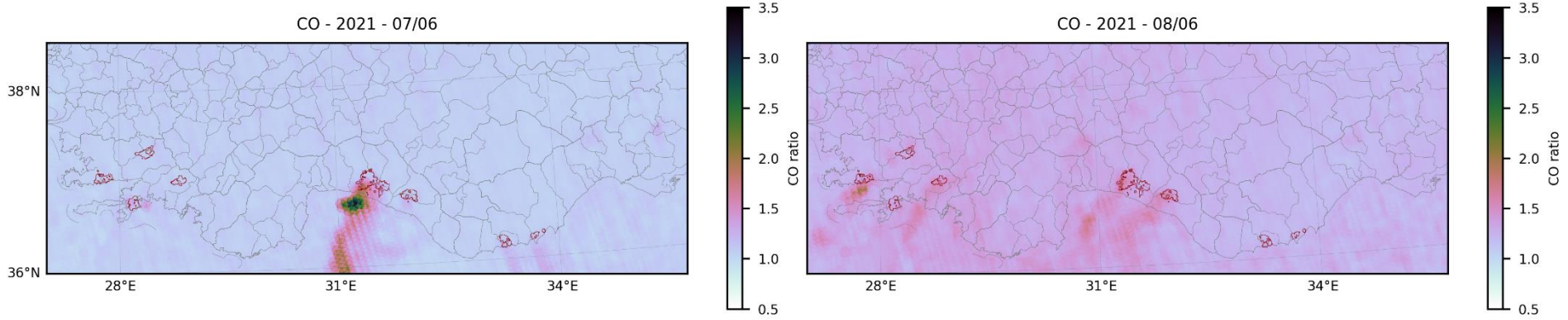

2021 - 28 July - 7 August
38°N
36°N
28°E
31°E
34°E

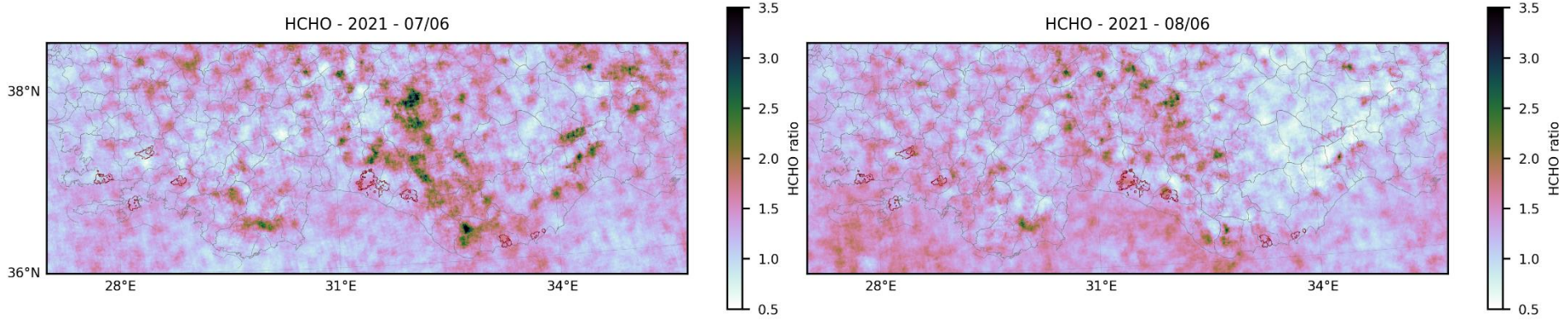

1e16
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
HCHO (10¹⁶ molecules/cm²)

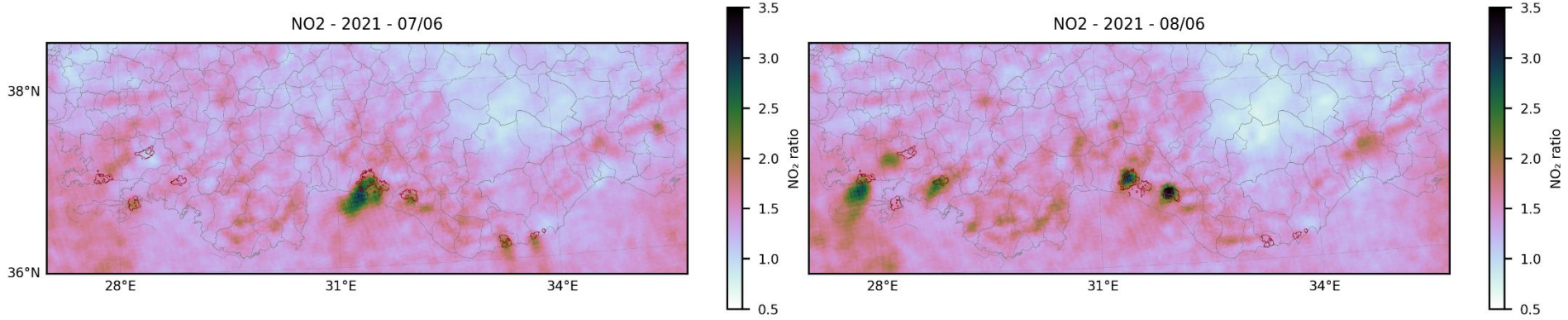

2021 - 28 July - 7 August
28°E
31°E
34°E


1e18
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
CO (10¹⁸ molecules/cm²)

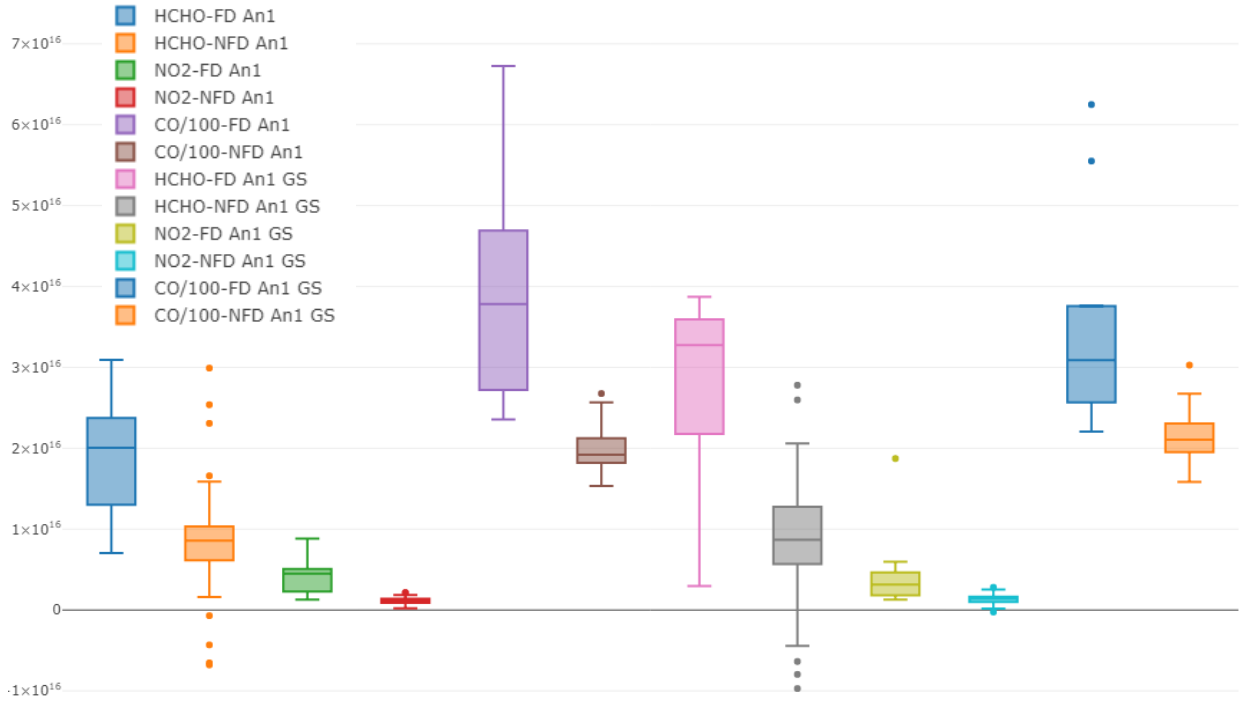

2021 - 28 July - 7 August
38°N
36°N
28°E
31°E
34°E
1e15
5
4
3
2
1
0
NO₂ (10¹⁵ molecules/cm²)

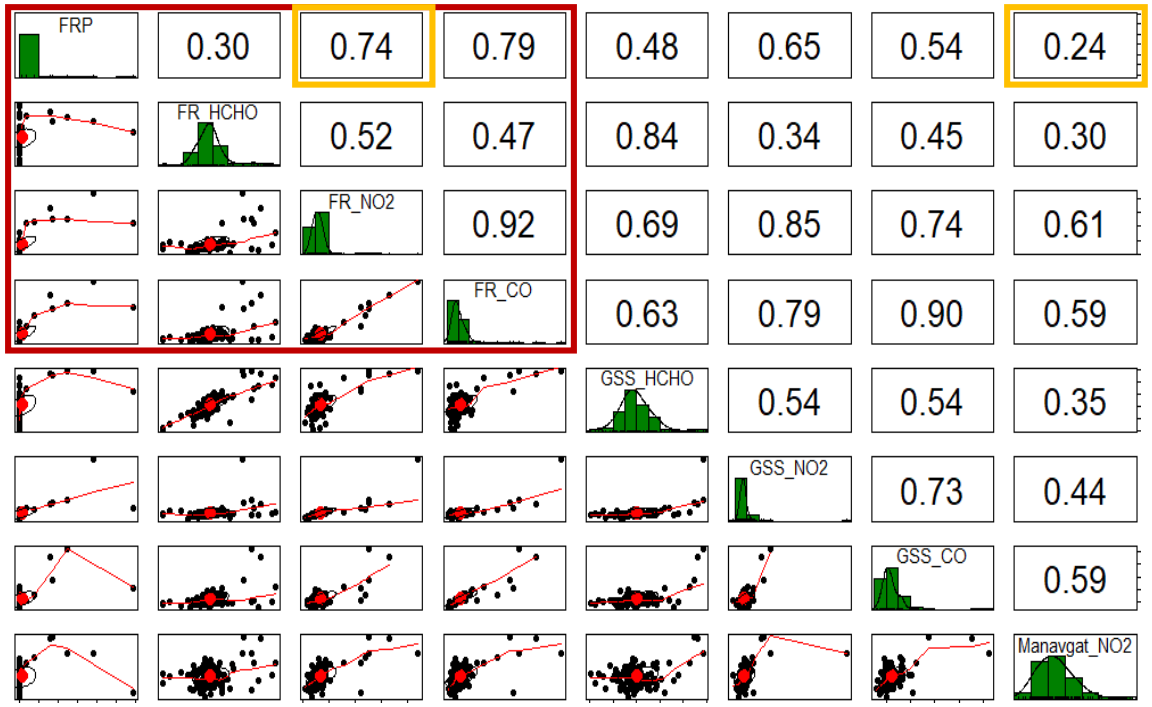


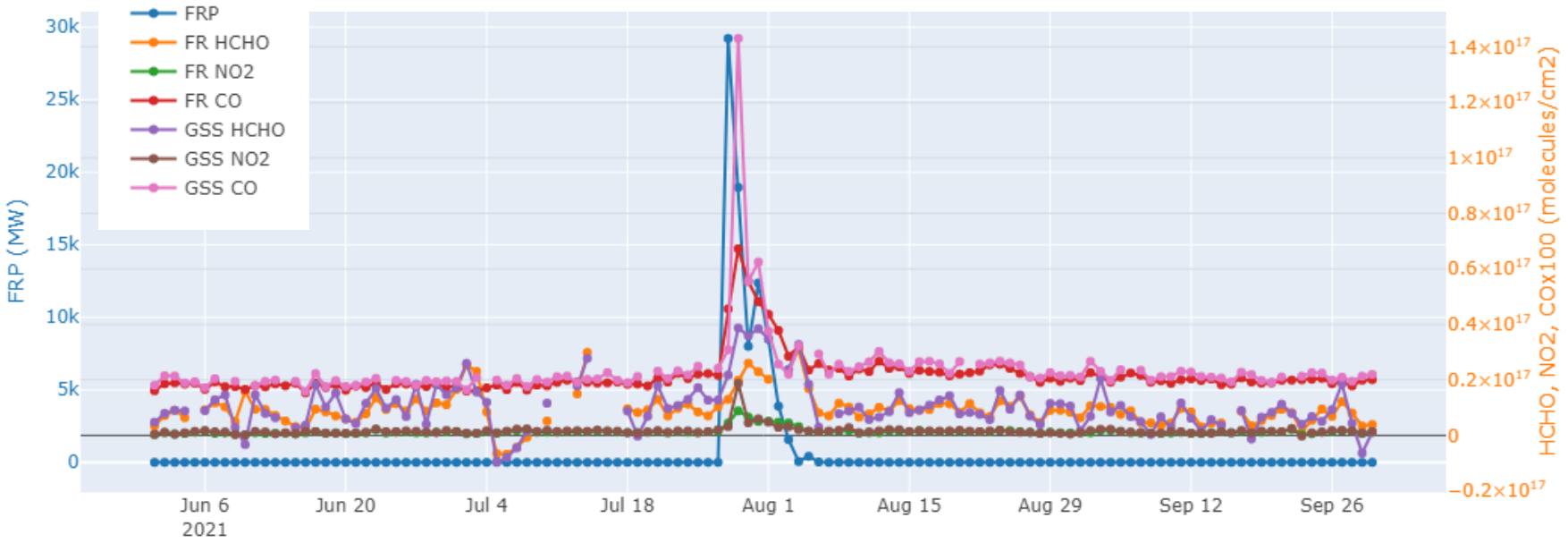




Monthly averaged columns of July-21 and Aug-21 compared to June-21







Antalya-1

FD: Fire days
NFD: Non-fire days
GS: at ground station locations

Column concentration changes of TROPOMI HCHO, NO_2 and CO over fire regions, over AQM stations, and NO_2 and CO ground measurements at available AQMS on fire (FD) and non fire days (NFD)

Fire Regions	Fire region									AQMS location									AQMS					
	HCHO (10^{15} molecules/cm^2)			NO_2 (10^{15} molecules/cm^2)			CO (10^{18} molecules/cm^2)			HCHO (10^{15} molecules/cm^2)			NO_2 (10^{15} molecules/cm^2)			CO (10^{18} molecules/cm^2)			NO_2 (μg/m^3)			CO (μg/m^3)		
	FD	NFD	Δ(%)	FD	NFD	Δ(%)	FD	NFD	Δ(%)	FD	NFD	Δ(%)	FD	NFD	Δ(%)	FD	NFD	Δ(%)	FD	NFD	Δ(%)	FD	NFD	Δ(%)
An-1	18.9	8.4	124.1	4.2	1.2	268.2	3.9	2.0	98.5	27.5	8.9	211.0	4.5	1.3	237.0	3.5	2.1	64.4	25.7	16.6	55.5			
An-2	16.5	7.6	117.9	3.6	0.9	314.3	3.2	1.8	80.0	19.2	1.0	92.0	2.0	1.2	70.3	2.8	2.1	35.5	44.2	25.6	72.5			
Mu-1	18.8	1.1	73.7	3.8	2.0	87.6	3.0	2.1	45.8										9.2	15.4	-40.4	437.1	566.0	-22.8
Mu-2	12.6	8.0	57.1	1.9	1.6	21.5	2.3	1.8	25.8	11.6	8.3	39.2	1.9	1.8	1.89	2.0	1.9	5.6						
Mu-3	21.8	1.1	95.5	3.9	1.7	131.9	3.6	2.1	71.7															
Mu-4	15.3	9.2	65.8	2.8	1.2	140.5	2.8	1.8	50.6															
Me-1	16.6	9.2	80.1	3.3	1.1	201.4	2.6	2.0	29.7															
Me-2	17.8	9.9	80.2	5.7	1.6	249.6	2.5	2.0	23.8										5.8	8.5	-31.0			

Δ(%) = (FD-NFD)/NFD*100

- Most intense fires were observed in Antalya-1 with highest FRP levels reached up 29217 MW and significant increases were found for levels of HCHO **(124%)**, NO_2 **(268%)**, and CO **(99%)** during the fire episode.
- AQM station for Mugla-1 and Mersin-2 had limited data availability, thus may not be representative for comparison.
- AQM station for Antalya-1 NO_2 measurements showed lower correlation **(0.24)** with FRP compared to TROPOMI NO_2 **(0.74)** and also lower increase in concentrations **(55%)** compared to TROPOMI NO_2 **(268%)**.
- Wind was transporting the pollutants to the south over Mediterranean Sea. Impact over that region should be investigated.
- Correlations with wind direction and speed should be investigated to understand the pollution levels.

Thank you for listening.
Any questions?