



TWO DAYS INTERNATIONAL WORKSHOP ON: DROUGHTS OVER PAKISTAN IN THE CHANGING CLIMATE



Unveiling the Impact of Poor Air Quality
on Winter Rainfall in Pakistan:
A Case Study of Inversion Capping and
its Consequences on Rainfall
Suppression and Drought

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WMO – Emerging Hazards

- **Extreme Weather Events:** Such as heatwaves, heavy rainfall, droughts, and tropical cyclones, which are becoming more frequent or intense due to climate change.
- **Air Quality:** Degradation due to pollutants, including fine particulate matter (PM2.5) and ground-level ozone, which can have adverse health effects.
- **Hydrological Extremes:** Such as floods, flash floods, GLOF and landslides, which can result from intense precipitation, snowmelt, or changes in land use.

Radiation fog is a very common type of fog throughout the Plains of Pakistan. It is most prevalent during the winter. It forms overnight as the air near the ground cools and stabilizes, isobarically. When this cooling causes the air to reach saturation, fog will form. Fog will first form at or near the surface, thickening as the air continues to cool.

In recent years, the matter is further complicated by the addition of *suspended ash particles* from the *burning of leftover rice stalks and straw* after harvest in the month of November each year, a practice known as stubble or paddy burning. Each year, this extensive agricultural burning lasts for more than 3 weeks

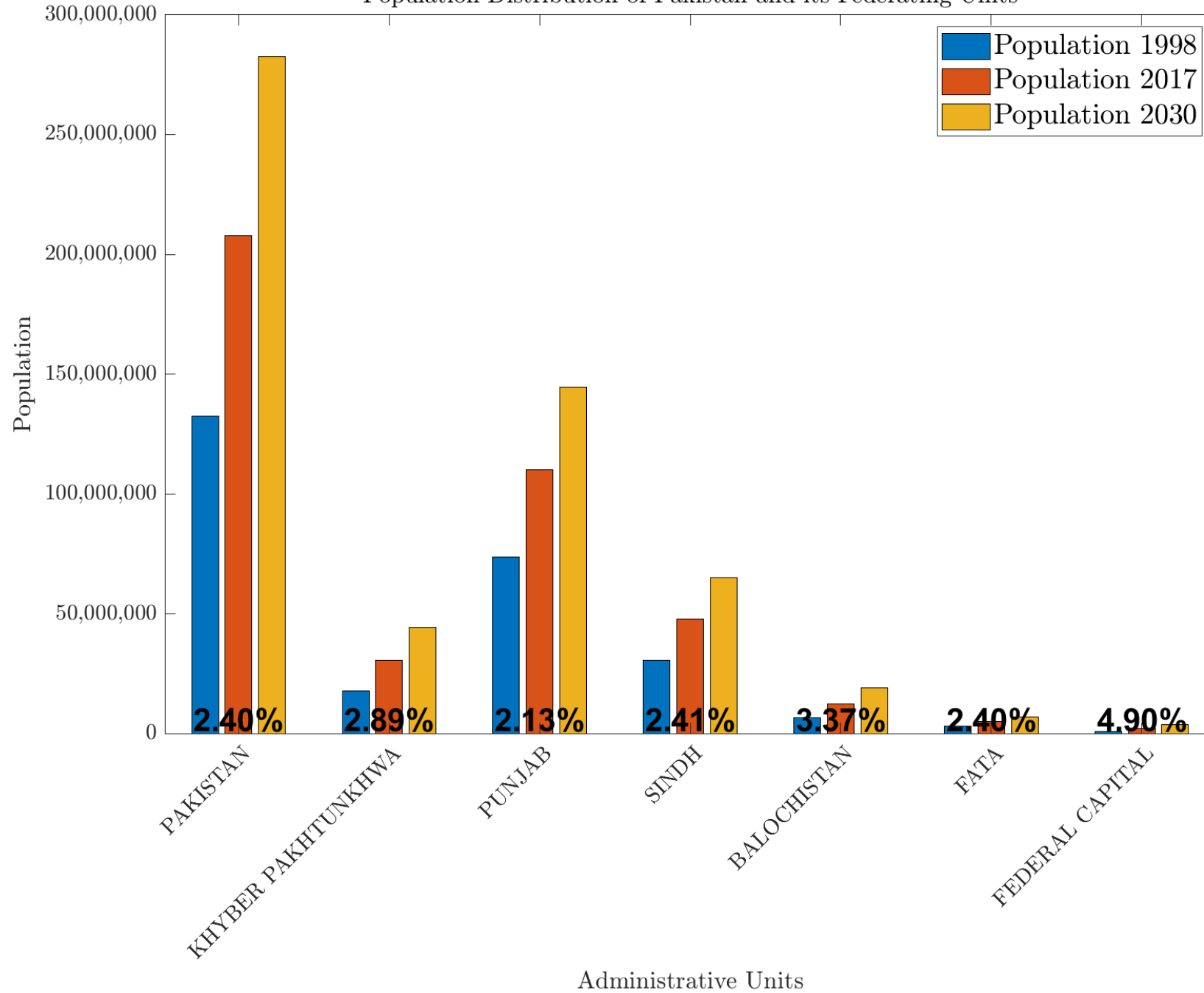


- **Disruption of Vehicular Traffic**
- **Flight operation halted**
- **Road accidents**
- **Human activities are severely affected**

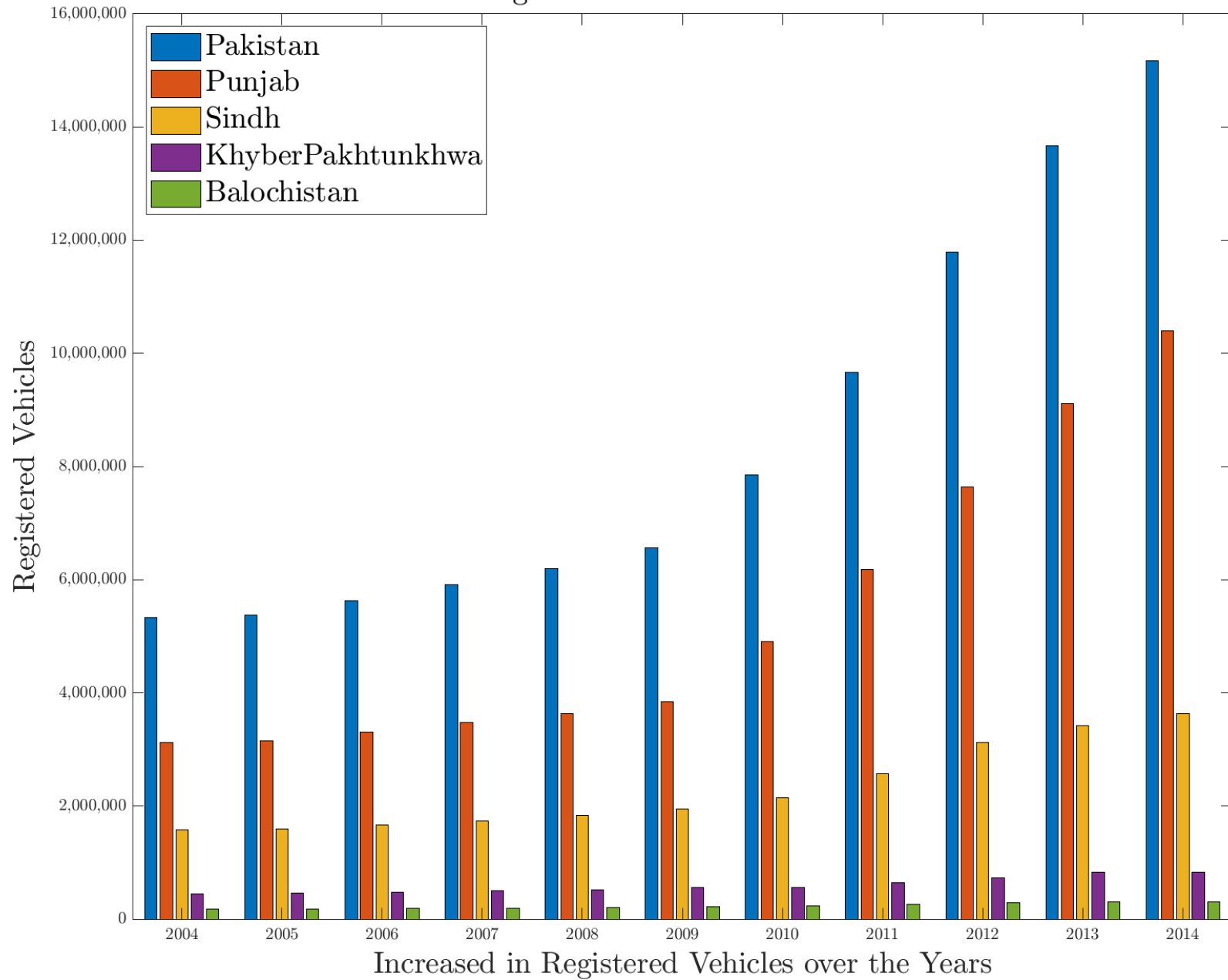


- **Low Visibility**
- **Prolonged Extreme Cold**
- **Increased hospitalizations for heart disease**
- **Pneumonia**
- **Chronic obstructive pulmonary disease**

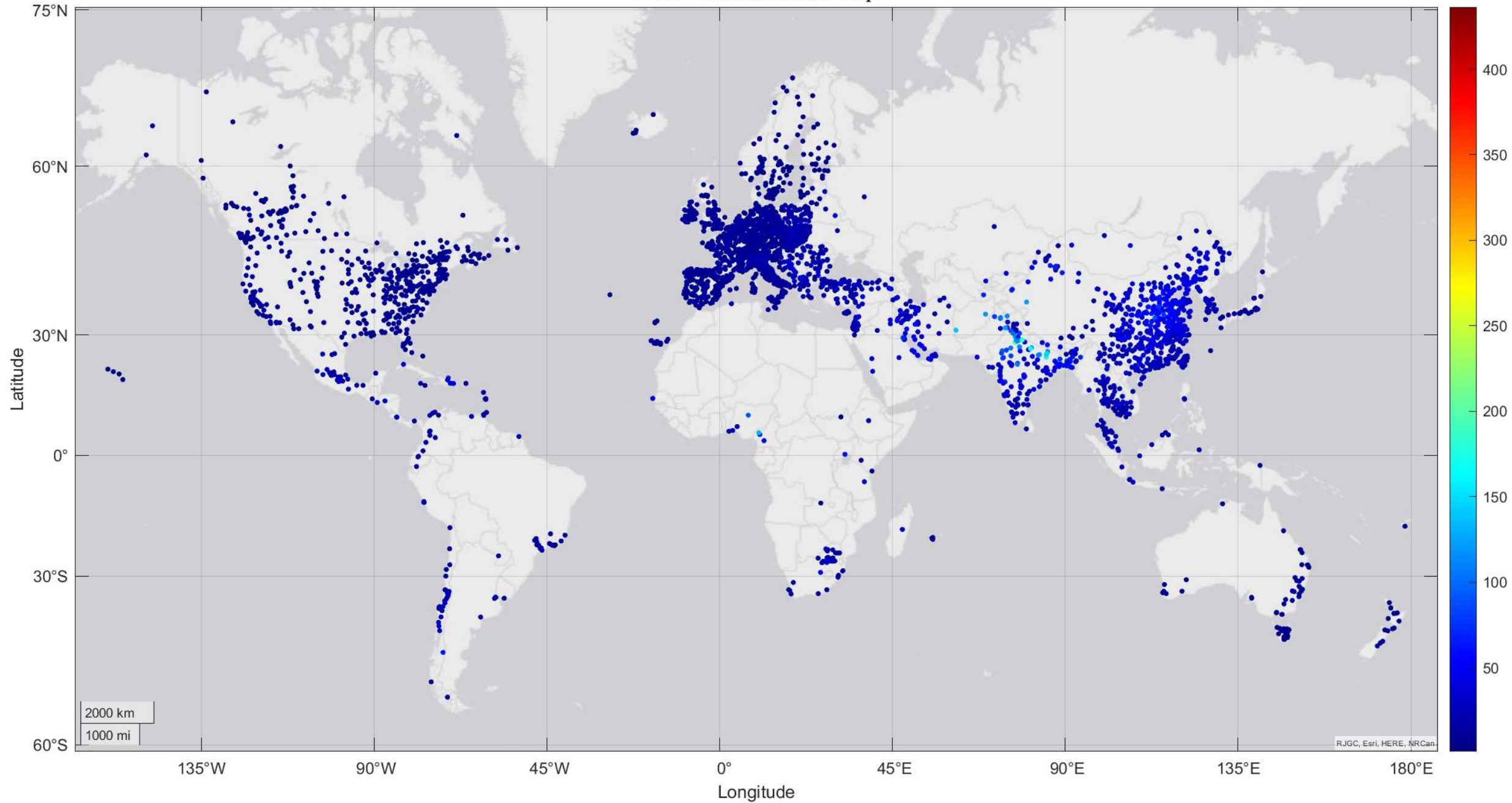
Population Distribution of Pakistan and its Federating Units

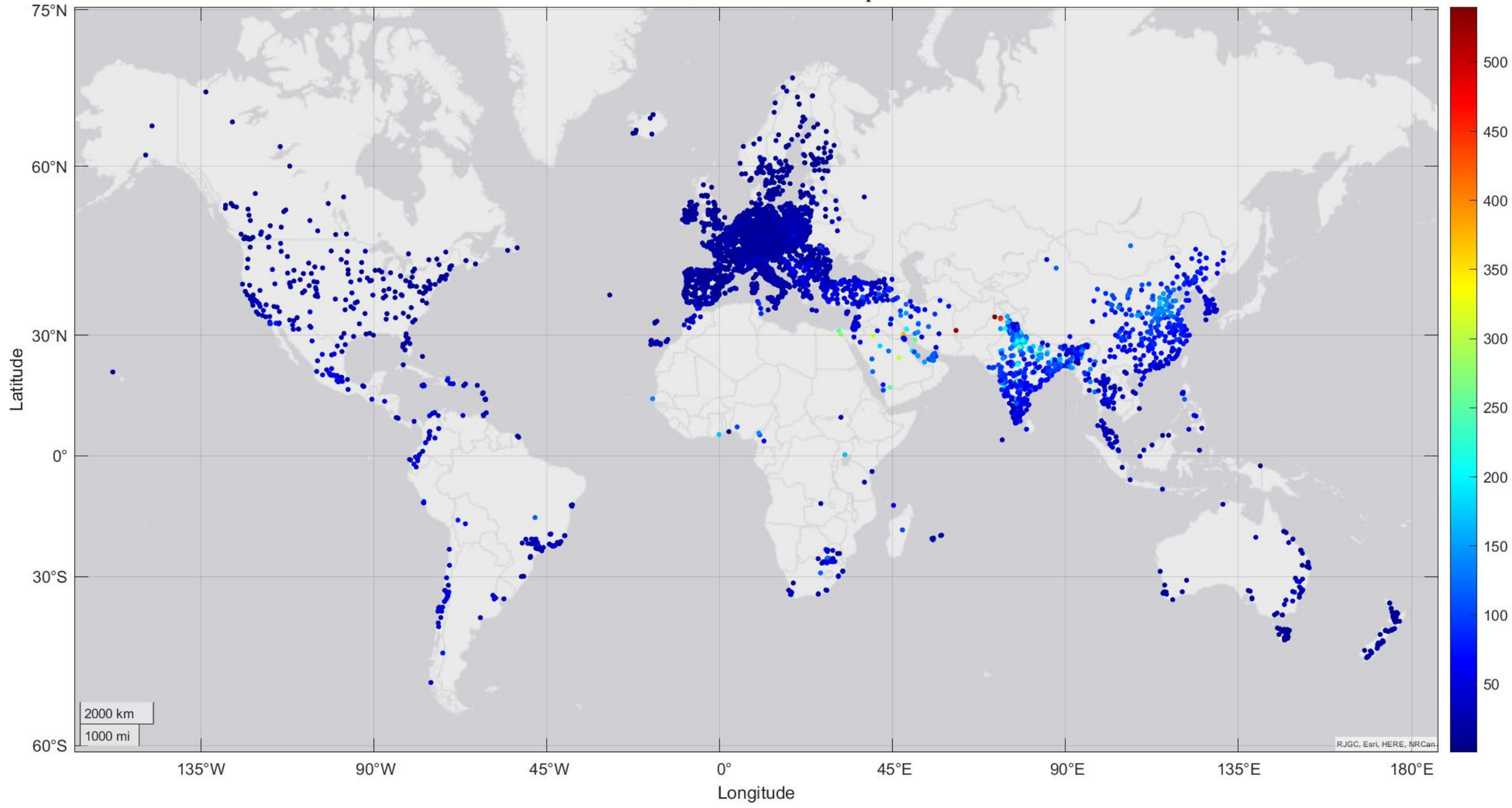


Registered Vehicles of Pakistan

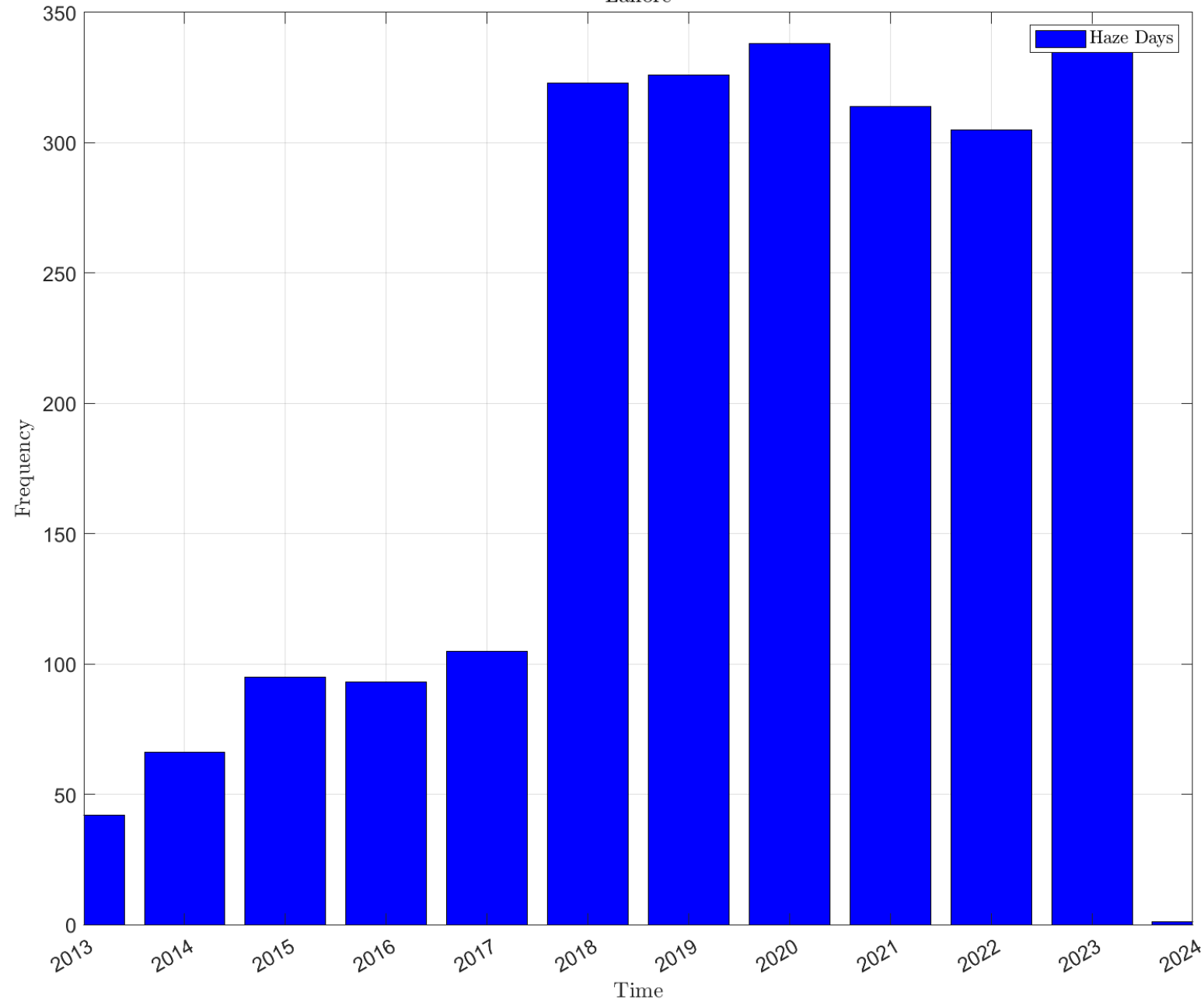


PM2.5 Concentration Map

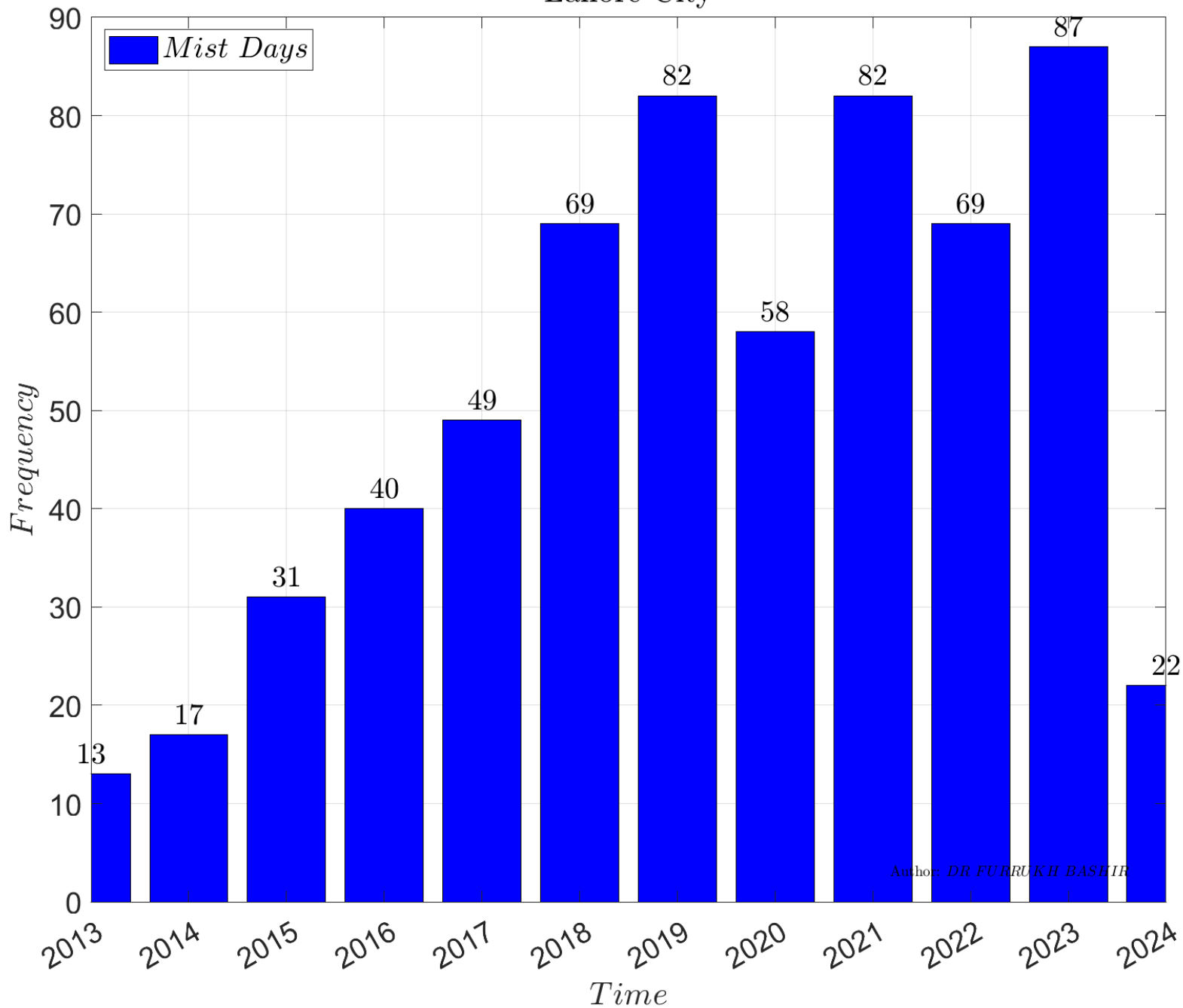


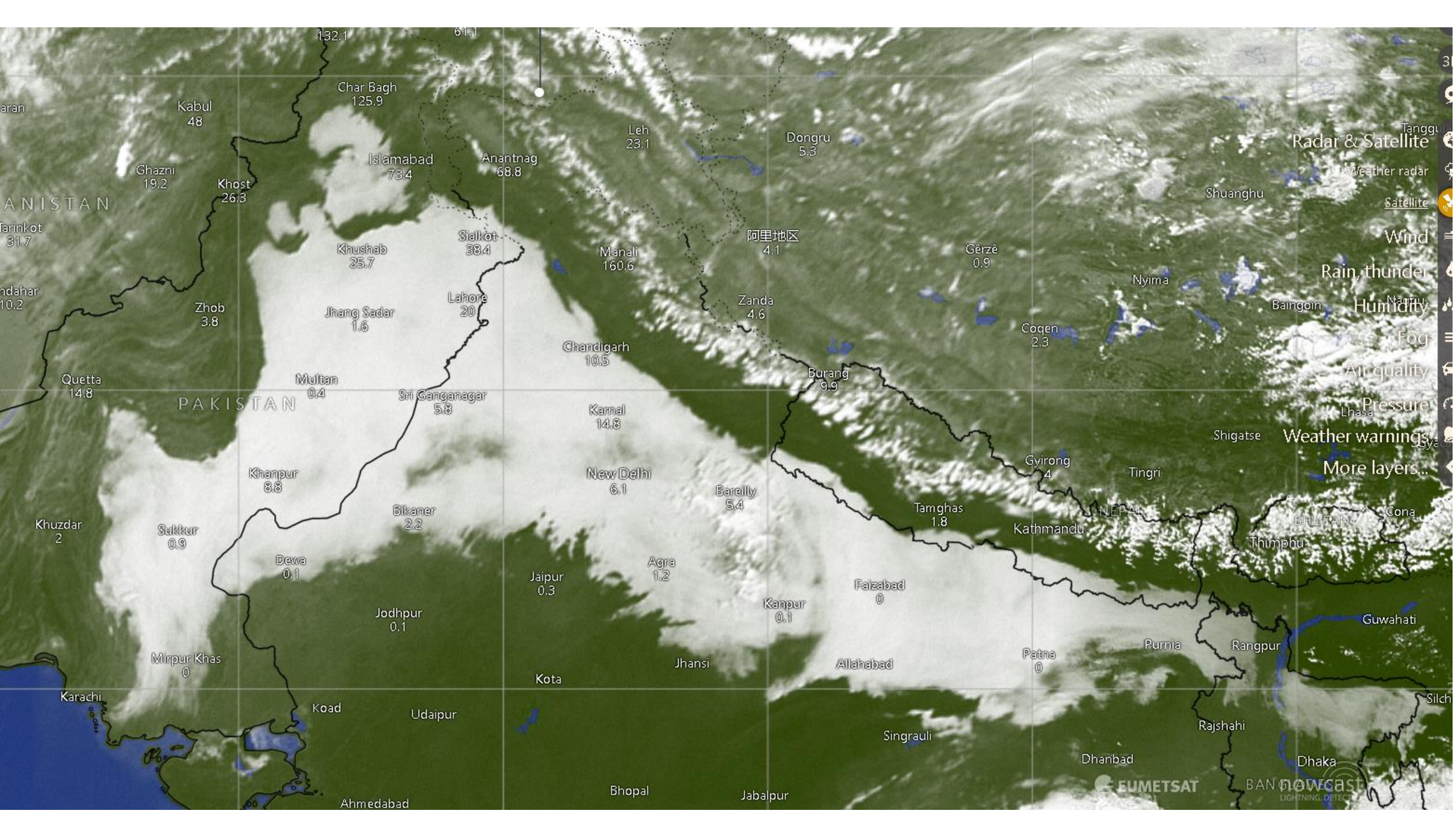


Annual Frequency of Haze with Low Visibility Days -
Lahore



*Annual Frequency of Misty Days—
Lahore City*





- Radar & Satellite
- Weather radar
- Satellite
- Wind
- Rain, thunder
- Humidity
- Fog
- Air quality
- Pressure
- Weather warnings
- More layers...

ANISTAN
Tarinkot 31.7
ndahar 10.2
Quetta 14.8
Khuzdar 2
Karachi

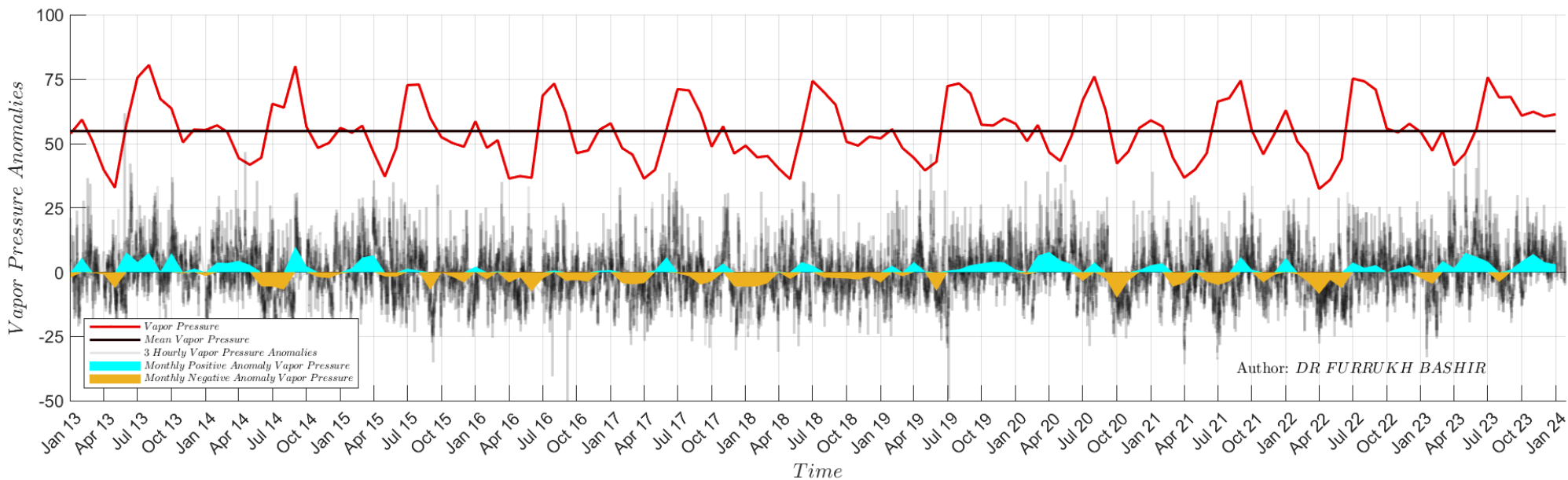
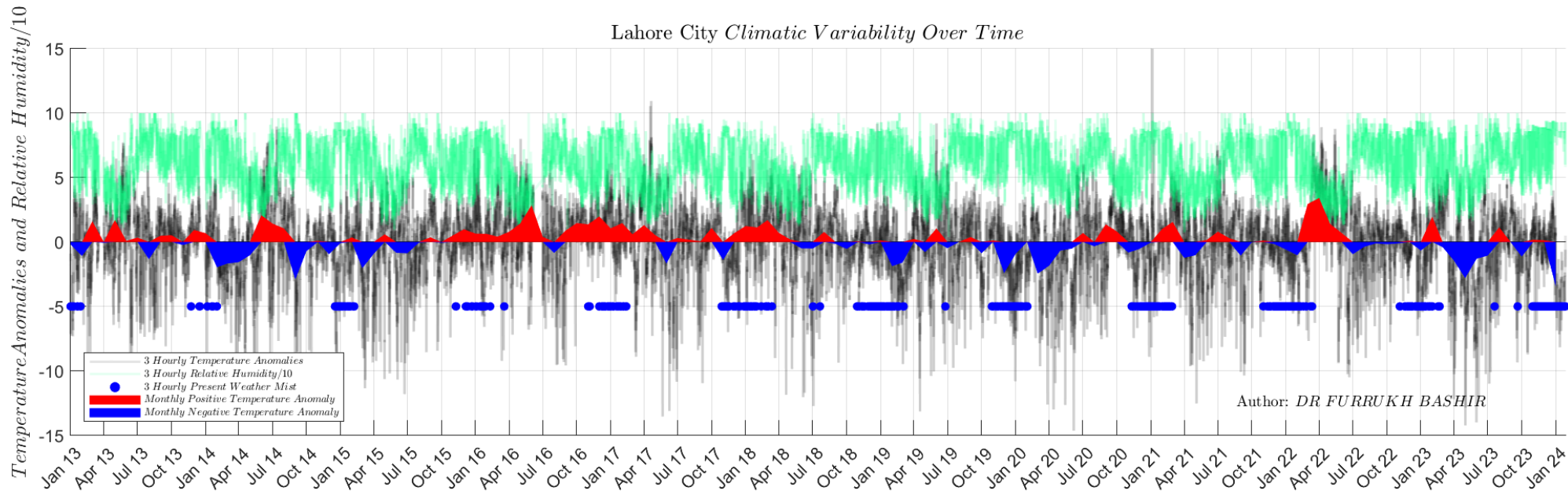
Kabul 48
Ghazni 19.2
Khost 26.3
Zhoab 3.8
Islamabad 73.4
Anantnag 68.8
Leh 23.1
Sialkot 38.4
Lahore 20
Jhang Sadar 1.6
Multan 0.4
Sri Ganganagar 5.8
Khanpur 8.8
Sukkur 0.9
Dewa 0.1
Mirpur Khas 0
Koad
Udaipur
Ahmedabad

Manali 160.6
Chandigarh 10.5
Karnal 14.8
New Delhi 6.1
Bareilly 5.4
Jaipur 0.3
Kota
Bhopal
Jabalpur

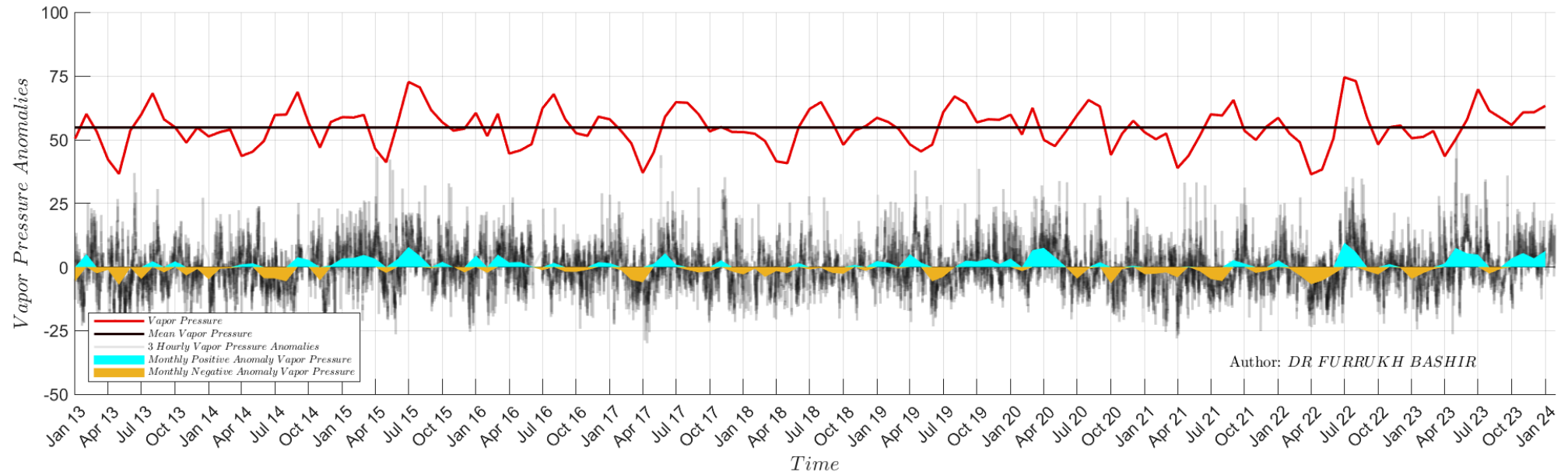
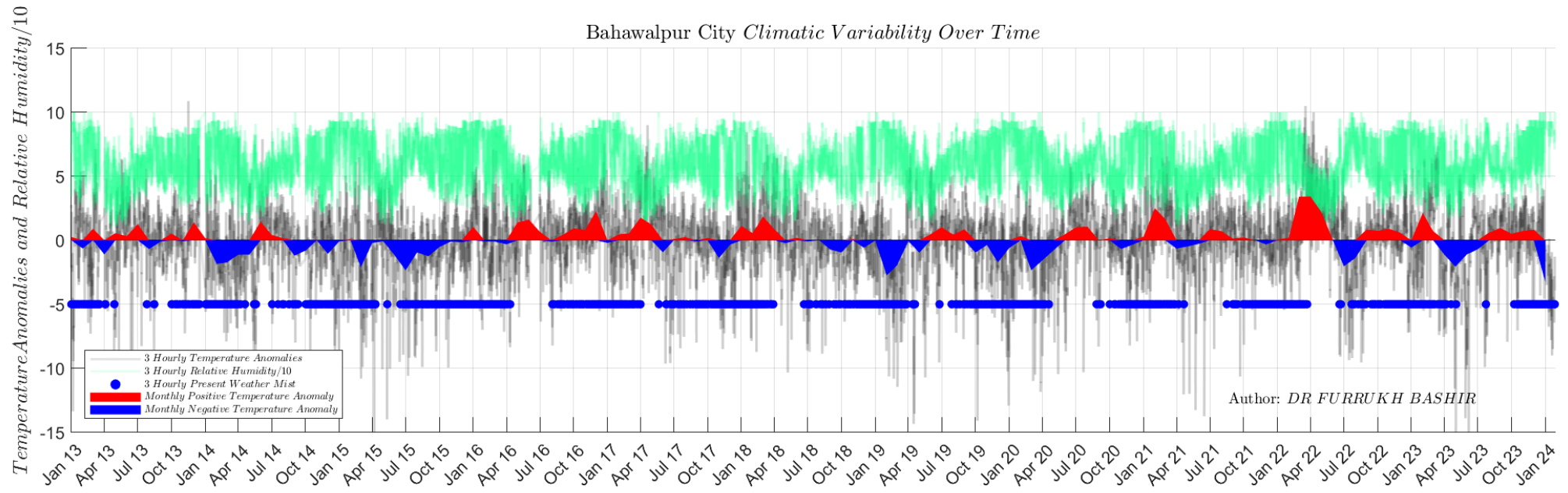
Dongru 5.3
阿里地区 4.1
Zanda 4.6
Burang 9.9
Gyirong 4
Tingri
Kathmandu
Patna 0
Purnia
Rangpur
Rajshahi
Dhanbad

Shuanghu
Nyima
Baingoin
Coqen 2.3
Gérzé 0.9
Shigatse
Lhasa
Cona
Thimphu
Guwahati
Dhaka

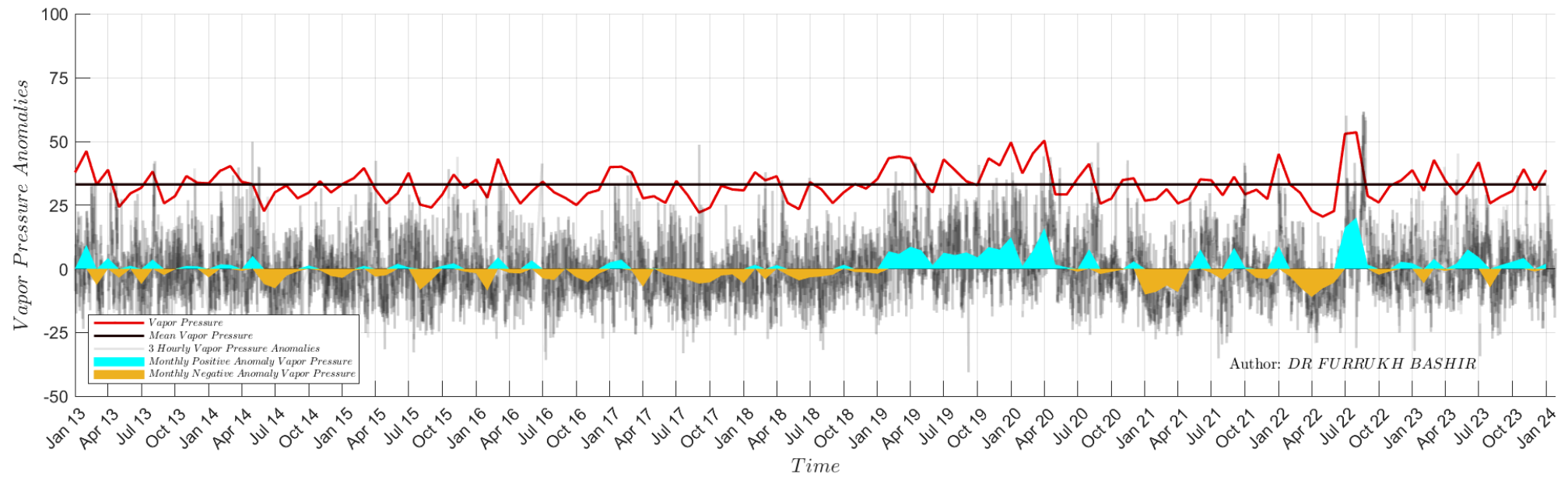
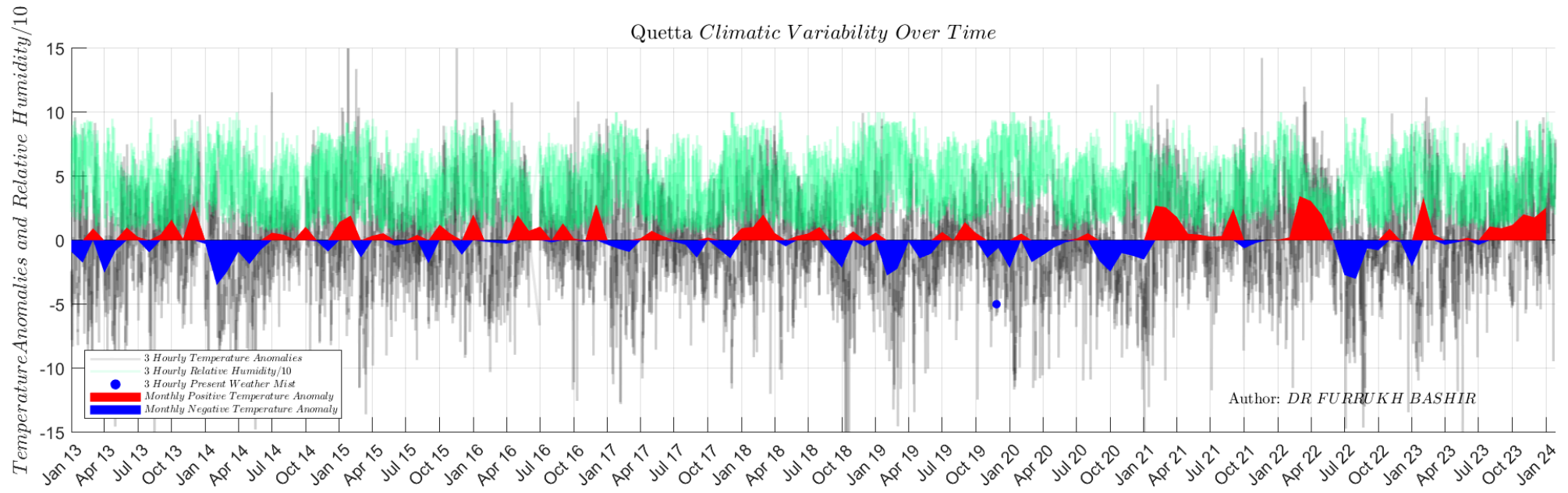
Lahore City Climatic Variability Over Time



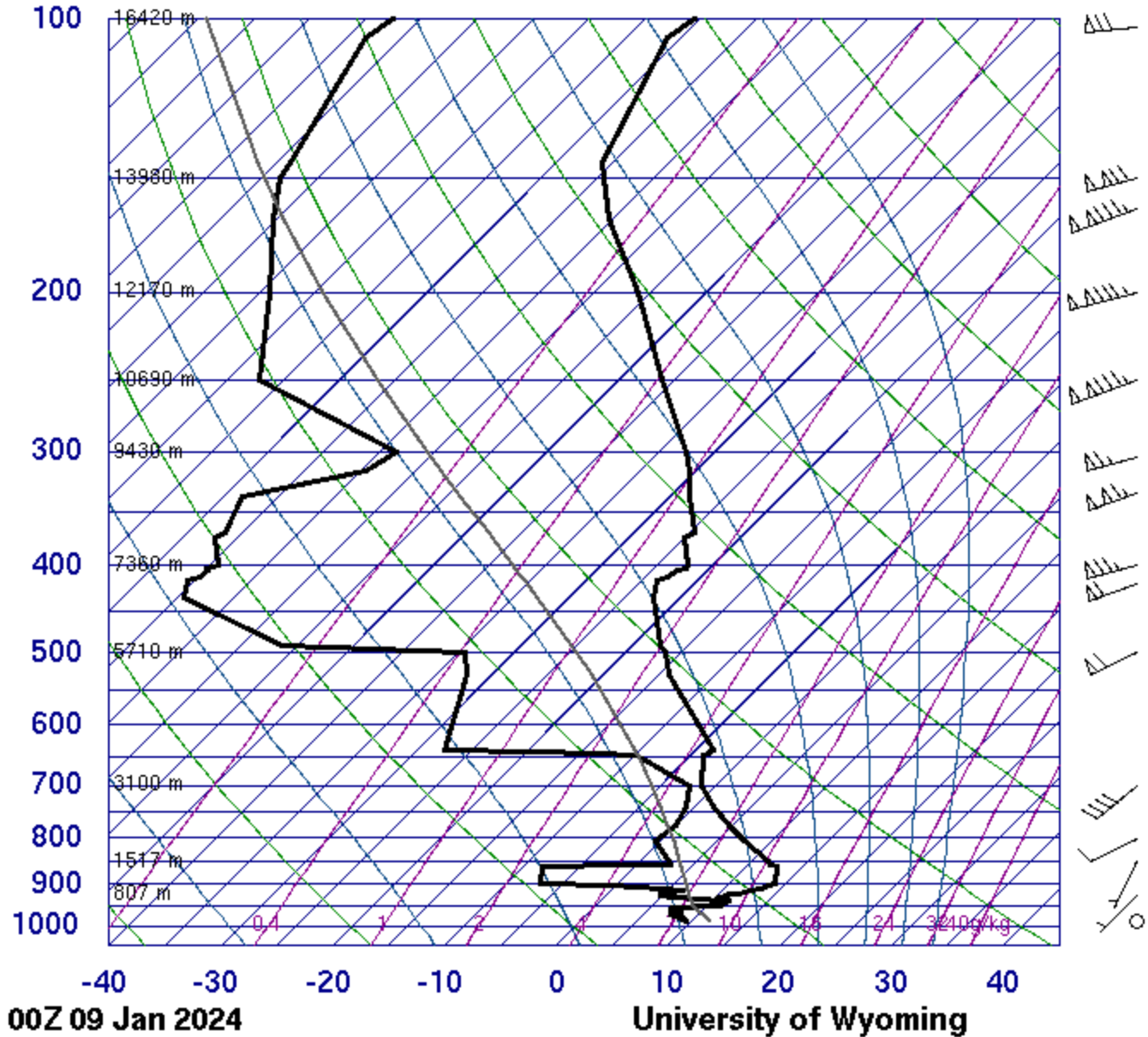
Bahawalpur City Climatic Variability Over Time



Quetta Climatic Variability Over Time

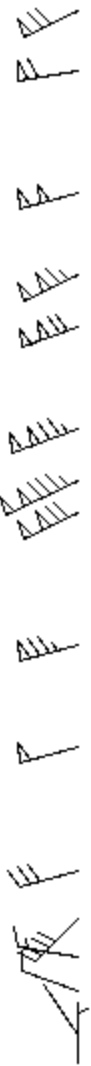
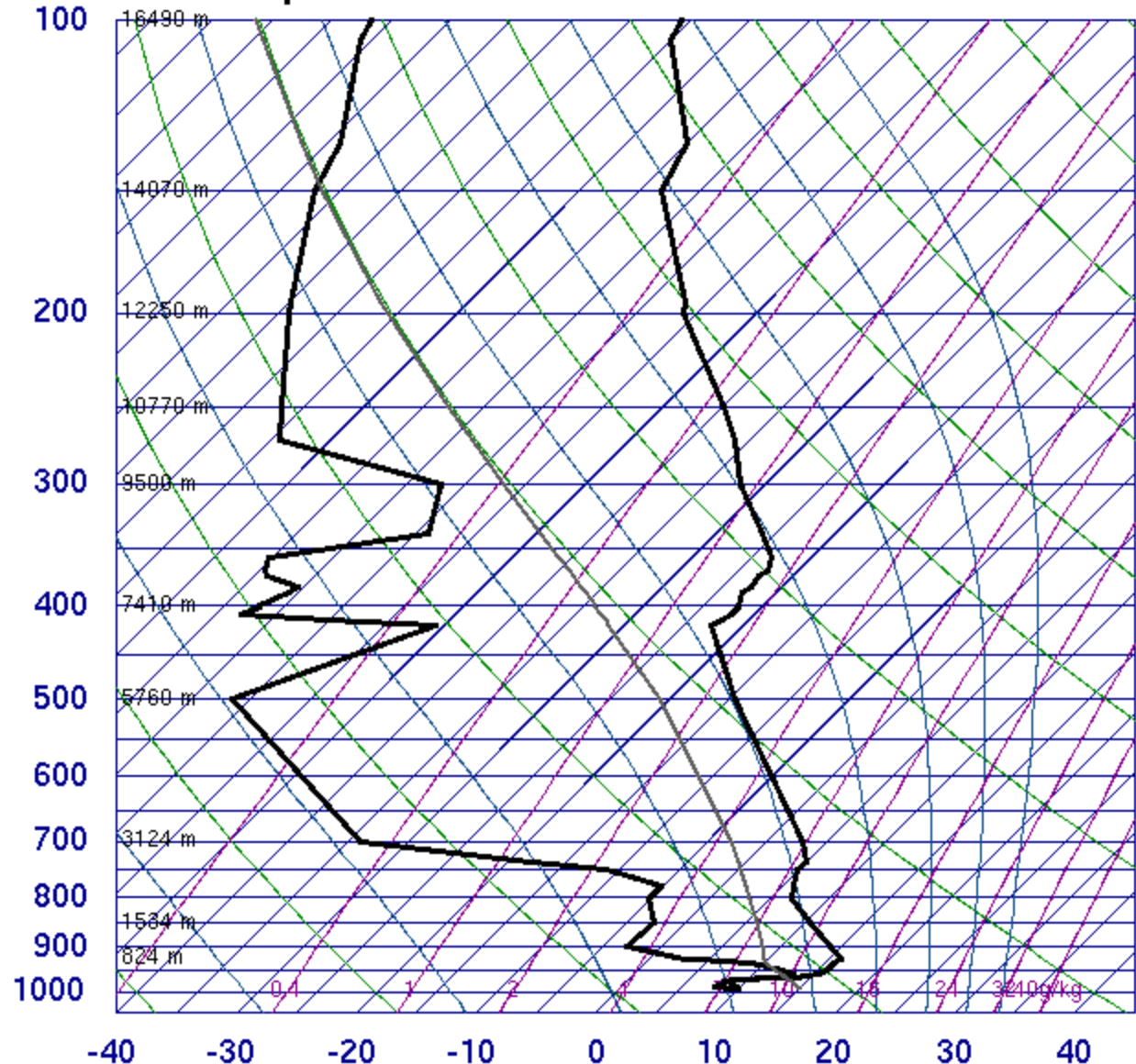


42182 VIDD New Delhi



SLAT	28.58
SLON	77.20
SELV	216.0
SHOW	3.19
LIFT	8.01
LFTV	7.91
SWET	101.2
KINX	29.40
CTOT	18.90
VTOT	27.90
TOTL	46.80
CAPE	0.00
CAPV	0.00
CINS	0.00
CINV	0.00
EQLV	-9999
EQTV	-9999
LFCT	-9999
LFCV	-9999
BRCH	0.00
BRCV	0.00
LCLT	281.9
LCLP	952.5
LCLE	306.9
MLTH	285.8
MLMR	7.54
THCK	-9999
PWAT	18.05

42339 VIJO Jodhpur



SLAT	26.30
SLON	73.01
SELV	224.0
SHOW	8.86
LIFT	6.32
LFTV	6.10
SWET	75.00
KINX	-14.7
CTOT	11.90
VTOT	24.90
TOTL	36.80
CAPE	0.00
CAPV	0.00
CINS	0.00
CINV	0.00
EQLV	-9999
EQTV	-9999
LFCT	-9999
LFCV	-9999
BRCH	0.00
BRCV	0.00
LCLT	283.1
LCLP	931.5
LCLE	312.4
MLTH	288.9
MLMR	8.40
THCK	-9999
PWAT	12.90

00Z 09 Jan 2024

University of Wyoming

Conclusion

- Sub-continent (India, Pakistan, Bangladesh) has turned into one of the most vulnerable location from environmental degradation viewpoint.
- Growing population and its technological needs are contributing in GHG.
- SMOG has caused radiation imbalance that caused boundary layer to colder than usual
- Inversion capping put a lid on the moisture that was trapped in the boundary layer
- In-spite of favorable conditions inversion capping **suppressed rainfall** causing **Meteorological Drought** for almost **two months**.

Way Forward

1. Holistic Approach:

Addressing the smog crisis in Pakistan requires a comprehensive strategy. By emphasizing sustained efforts, innovative agricultural practices, policy reforms, community engagement, and international collaboration, Pakistan can create a future where clean air is both a necessity and a collective commitment to environmental well-being.

2. Urgent Action Needed:

The smog crisis gripping Pakistan serves as a stark reminder of the urgent need for decisive action against air pollution. As cities like Lahore grapple with severe health issues and disruptions, the crisis extends beyond local borders, drawing international attention and necessitating a multi-faceted response.

3. Local Impact:

Lahore, once known for its rich history and vibrant culture, now faces distressing consequences. Tens of thousands of residents fall ill, schools and markets close, and Lahore ranks among the most polluted cities globally. Urgent measures, including face masks and indoor advisories, highlight the gravity of the public health emergency caused by elevated PM2.5 particle levels.

4. Root Causes:

The persistent problem lies in the agricultural practice of burning crop residue during the winter wheat-planting season. Despite efforts to shift farmers toward alternative methods, the crisis remains deeply entrenched⁸ Smoke from these agricultural fires crosses borders, affecting multiple states and demanding coordinated solutions.

5. Transcending Boundaries:

The crisis transcends national borders, prompting global concerns and discussions on international cooperation. Satellite imagery capturing a dense layer of toxic smog from Pakistan to the Bay of Bengal underscores the interconnected nature of environmental challenges.

QUESTIONS
COMMENTS
CONCERNS
PROBLEMS
COMPLAINTS

