Path to Clean Air in Sri Lanka: Challenges & Solutions

Existing Challenges and Support Needed from Regional Stakeholders

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Central Environmental Authority (CEA) Sri Lanka

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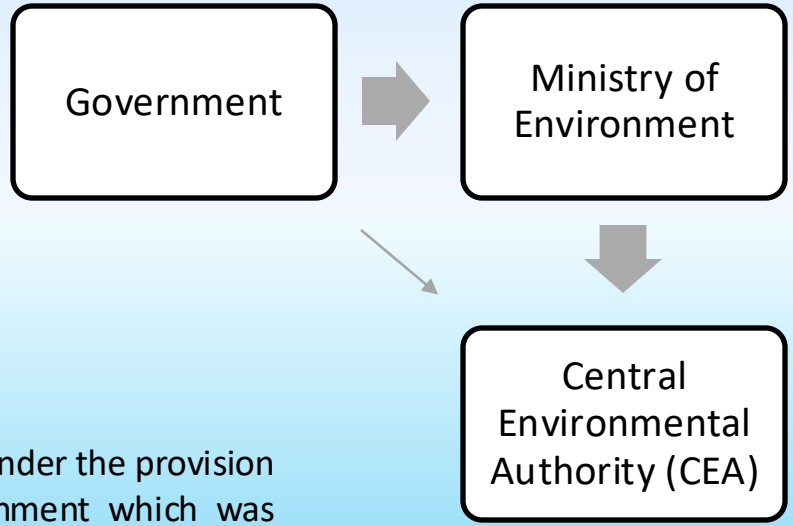
மத்திய சுற்றாடல் அதிகாரசபை
Central Environmental Authority



About

Central Environmental Authority (CEA) was established on 12th August 1981, under the provision of the National Environmental Act No:47 of 1980. The Ministry of Environment which was established in December 2001 has the overall responsibility in the affairs of the CEA with the objective of integrating environmental considerations into the development process of the country. The CEA was given wider regulatory powers under the National Environment (Amendment) Acts No:56 of 1988 and No:53 of 2000.

https://cea.lk/web/en/about-us

Overall Situation of Air Quality in Sri Lanka

- Air quality is regulated through the Environmental Act, along with relevant Regulations, Standards, and Guidelines.
- Air quality monitoring is carried out by both Government and Non-Governmental Organizations.
- Air Quality Levels:
  - Generally, meet national standards *(WHO IT 2, For PM)*, with occasional exceedances.
  - Usually do not meet WHO Air Quality Guideline levels.

Satisfactory

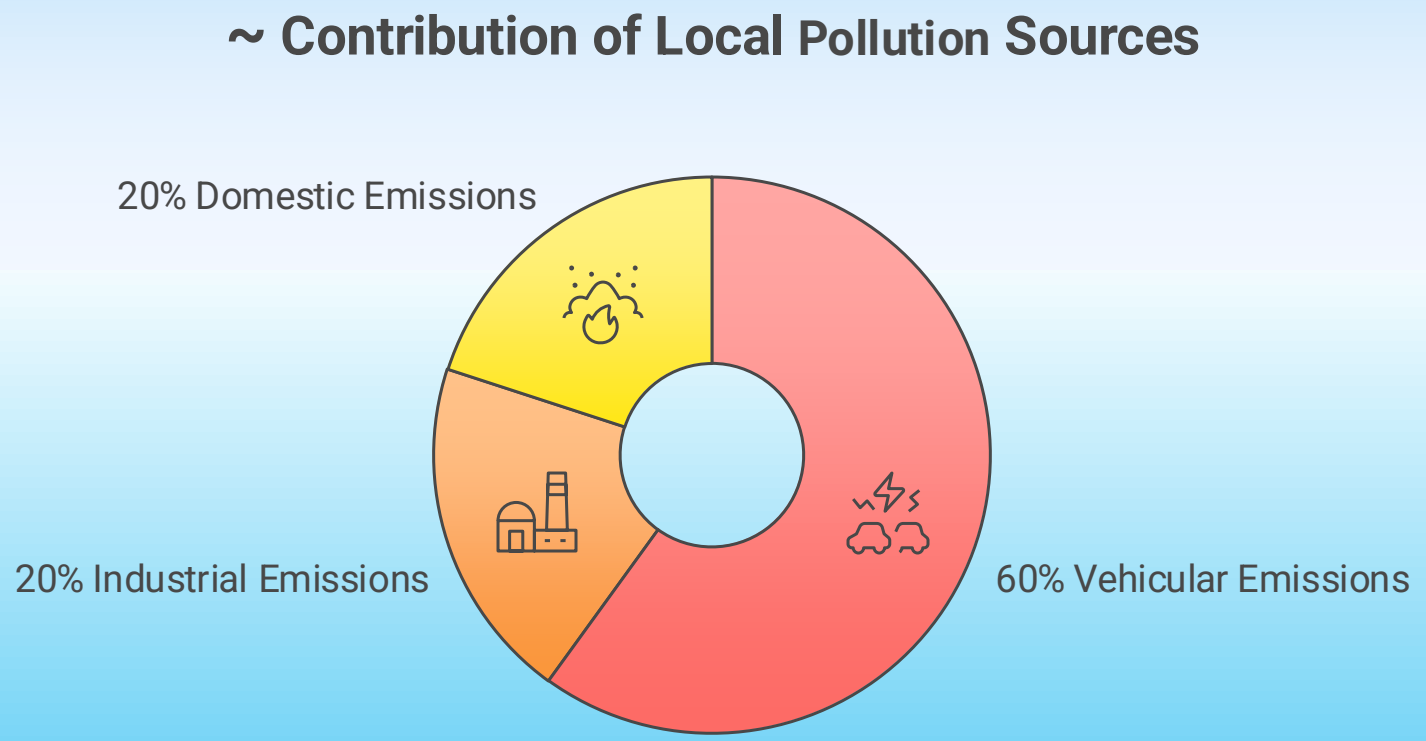
Less coverage

Satisfactory

Need to improve

Key Drivers of Air Pollution in Sri Lanka

- Local Sources
  - Vehicular
  - Industrial
  - Domestic
- Transboundary Pollution

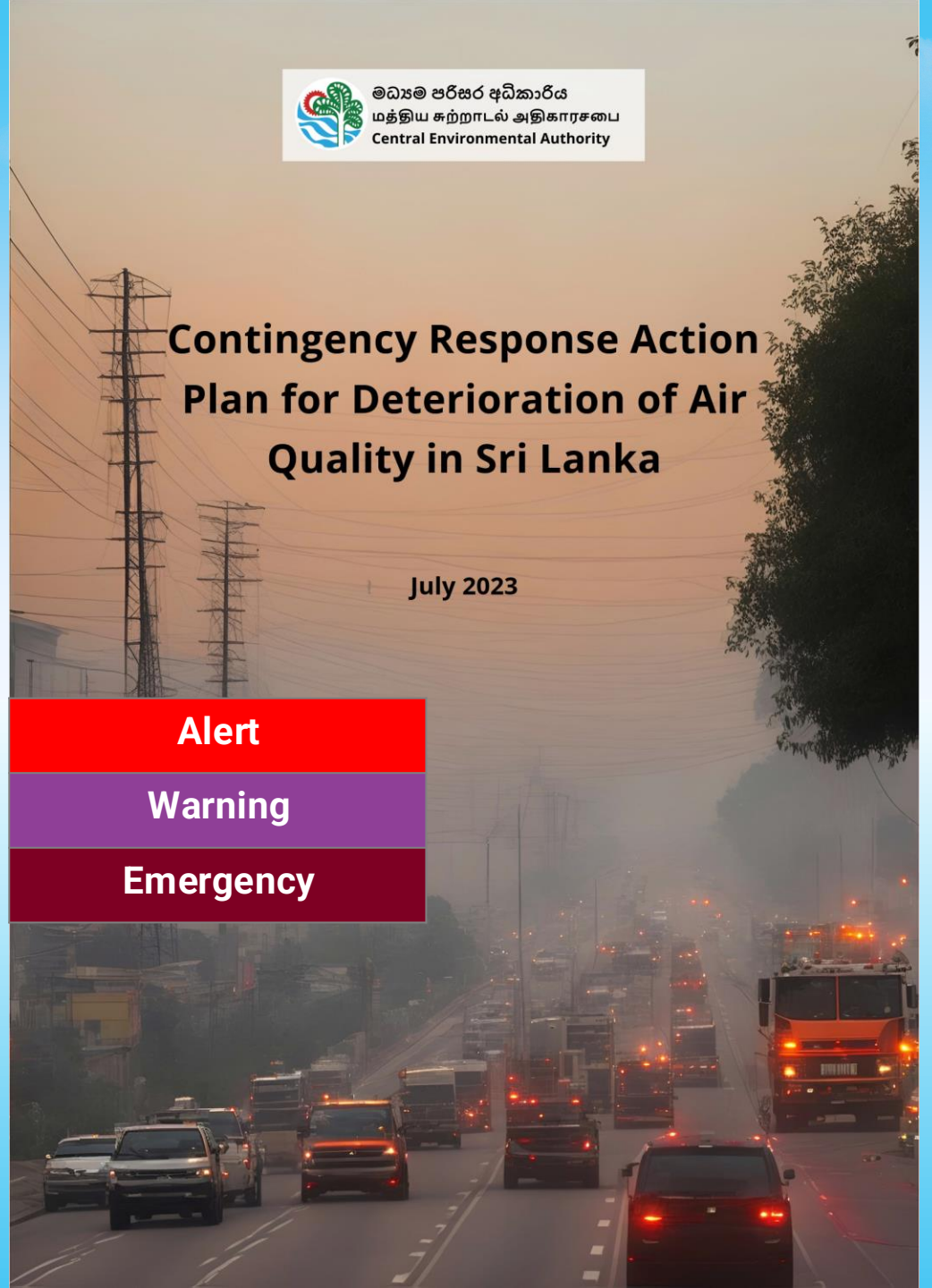


Key Actions or Initiatives: Control & Manage

- Local Sources
  - Vehicular ➤ Mobile / Vehicle Emission, Fuel & Importation Standards & Regulations
  - Industrial ➤ Stationary & Fugitive Sources Emission Standards & Regulations
  - Domestic ➤ Regulation to Control Open Burning, Indoor Air Quality Guideline
- Transboundary ➤ **Contingency Response Action Plan for Deterioration of Air Quality in Sri Lanka**
- Common ➤ **Air Quality Index for Sri Lanka (AQI-SL)**

AQI-SL

CRAP-DAQ-SL



Key Actions or Initiatives: Joint Actions

Local Joint Actions

- AirMAC: Air Resource Management Centre
- Clean Air Action Plan
- VET (Vehicular Emission Test) Trust Fund
- NEAP: National Environmental Action Plan, 2022–2030
- Haritha Lanka Programme – Mission 1 “Clean Air – Everywhere”
- National Air Quality Network, Sri Lanka
- more…

International Joint Actions

- UNEP: United Nations Environment Programme
- ESCAP: United Nations Economic and Social Commission for Asia and the Pacific
- AIT: Asian Institute of Technology
- SACEP: South Asia Co-operative Environment Programme
- CSE: Centre for Science and Environment (India)
- AFD: Agence Française de Développement
- Airparif: France
- WHO (World Health Organization)
- JICA: Japan International Cooperation Agency
- JRDC: China-Sri Lanka Joint Research & Demonstration Center
- RCEES / UCAS / CAS / HKEPD
- more…

Challenges or Needs

Limited Monitoring

Monitoring coverage is insufficient across the nation.

Indoor Air Quality

Indoor air quality remains an under-addressed area.

High Pollution Episodes

Managing and responding to seasonal episodes of high air pollution.

Financial State

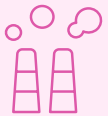
Financial constraints and funding limitations.

Emission Inventory

A comprehensive inventory of emissions is currently unavailable.

Limited Technology

Pollution control technologies are inadequate.



Modelling

Lack of air quality modelling and forecasting.

Human Resources

A shortage of human resources poses a significant challenge.

Prioritized Challenges or Needs

- **Limited monitoring coverage nationwide**
- No comprehensive emission inventory
- Indoor air quality still under-addressed
- Insufficient industrial pollution control technologies
- **High pollution episodes**
- **Lack of modelling and forecasting capability**
- **Financial problems / funding constraints**
- Lack of human resources

Limited Monitoring Coverage

The National Air Quality Network, Sri Lanka, currently includes:

- 2 Regulatory Reference-Grade Monitoring Stations
- Supplementary Low-Cost Microsensors

Microsensors are operated by Central Environmental Authority (CEA) and National Building Research Organisation (NBRO).

- CEA: 10 microsensors donated by UNEP (IQAir), and a mini station donated by AFD (Ellona)
- NBRO: Network of 30+ sensors

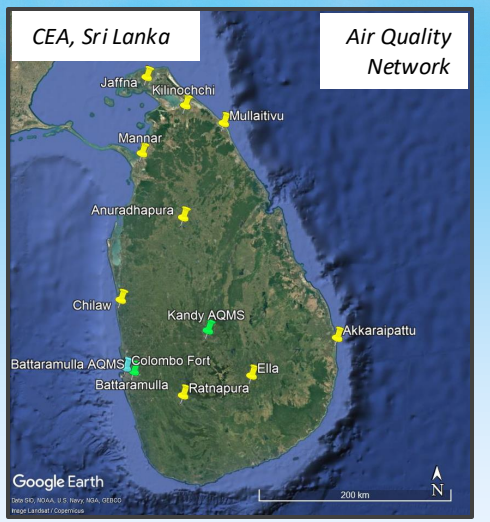
⚠️ *Note: Due to power or internet interruptions, some sensors may not appear on the live map. The screenshot of the live data map shows only devices with recent data.*

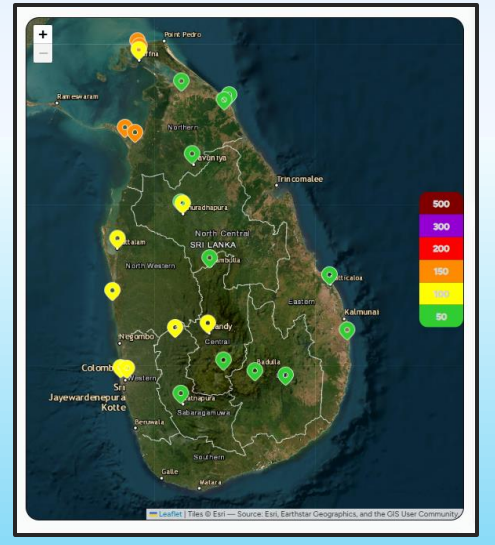
Additional Data Sources

🌐 Other public/private institutions and government-related institutes also contribute air quality measurements. (FECT, CleanCo, US-Embassy, etc)

📊 Some universities and research organizations, such as University of Peradeniya, run multi-country projects using low-cost sensors (TSI) to study particulate matter with the collaboration of Duke University, USA.

Data from such research projects is primarily used for research rather than public reporting.





A Screenshot of the Live Data Map of The National Air Quality Network, Sri Lanka

High Pollution Episodes

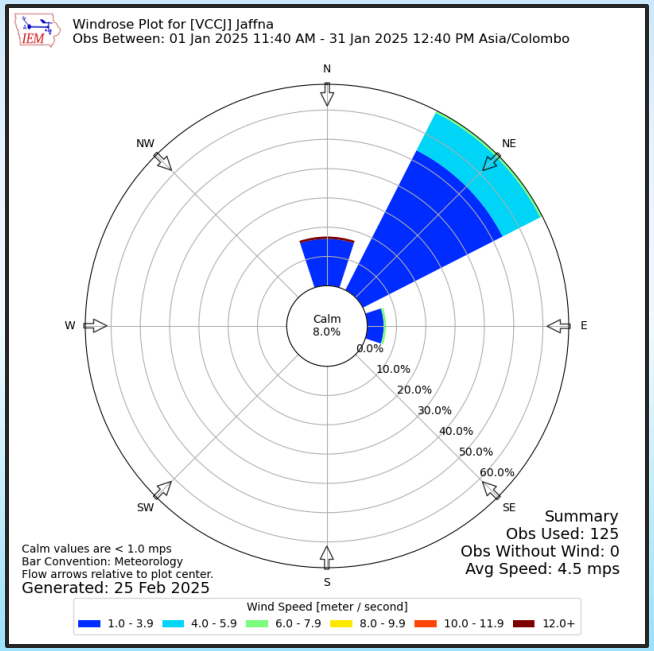
High Pollution Episodes usually occurs during the north-east monsoon periods, in between October and March (mostly in Nov-Dec-Jan-Feb). Usually, the whole country affects.

Date	S-A	S-B	S-C	S-D	S-E	S-F	S-G	S-H	S-I	S-J	S-K	S-L	S-M	S-N	S-O
2025-02-01	36	41	41	29	151	23	43	36	22	27	38	43	68	51	61
2025-02-02	46	47	46	33	32	29	45	41	31	29	43	47	71	58	64
2025-02-03	48	47		31	27	27	49	56	23	38	42	49	60	63	72
2025-02-04	104	85		80	88	81	112	130	77	85	92	54	72	69	55
2025-02-05	155	122	117	132	131	125	154	152	132	135	150	98	130	141	
2025-02-06	153	119		127	129	126	154	151	115	127	142	134	137	154	
2025-02-07	138	105	94	106	111	97	148	125	103	104	110	96	105	116	92
2025-02-08	155	125	114	132	133	126	157	152	126	138	140	102	106	109	102
2025-02-09	157	128	125	141	150	136	162	156	135	142	156	151	139	154	150
2025-02-10	94	76	84	64	69	54	97	77	66	48	87	132	85	100	102
2025-02-11	86	73	74	74	78	71	99	91	63	61	84	111	72	77	82
2025-02-12	81	69	71	60	58	54	82	81	58	52	72	95	90	94	93

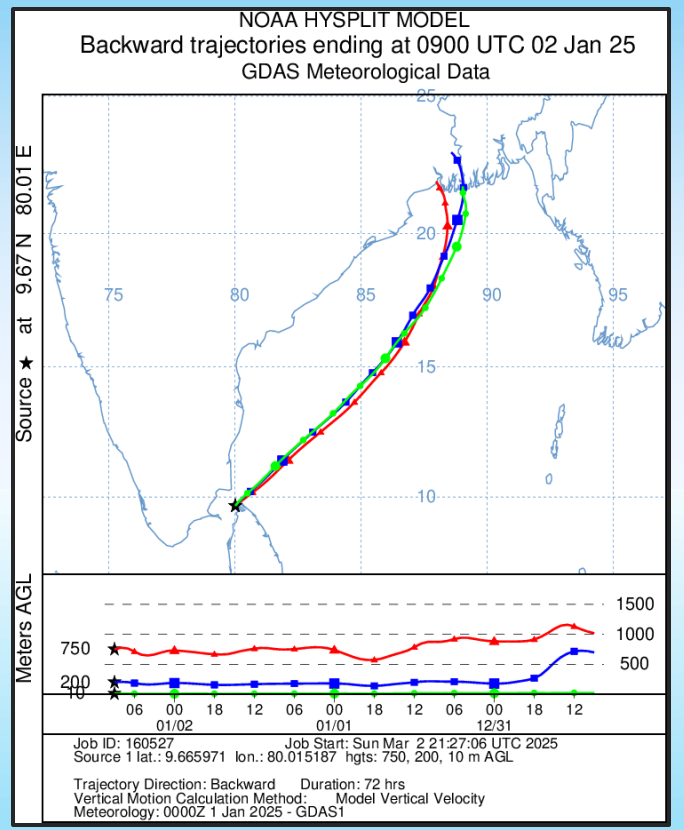
Daily AQI (AQI-SL) of 15 Sites in Sri Lanka, From 2025-02-01 to 12 (Heatmap)

Weather / Wind During the Season where High Pollution Episodes Occur

- Elevated pollutant levels are typically observed from October to March (mostly Nov-Dec-Jan-Feb), when winds flow from the **NE** (northeast). During other seasons, the predominant wind direction is **SW** (southwest).
- Backward trajectory analysis and multiple air-quality models can be used to get the approximate pathways of incoming air parcels.



Windrose. January 2025
(Courtesy: mesonet.agron.iastate.edu)

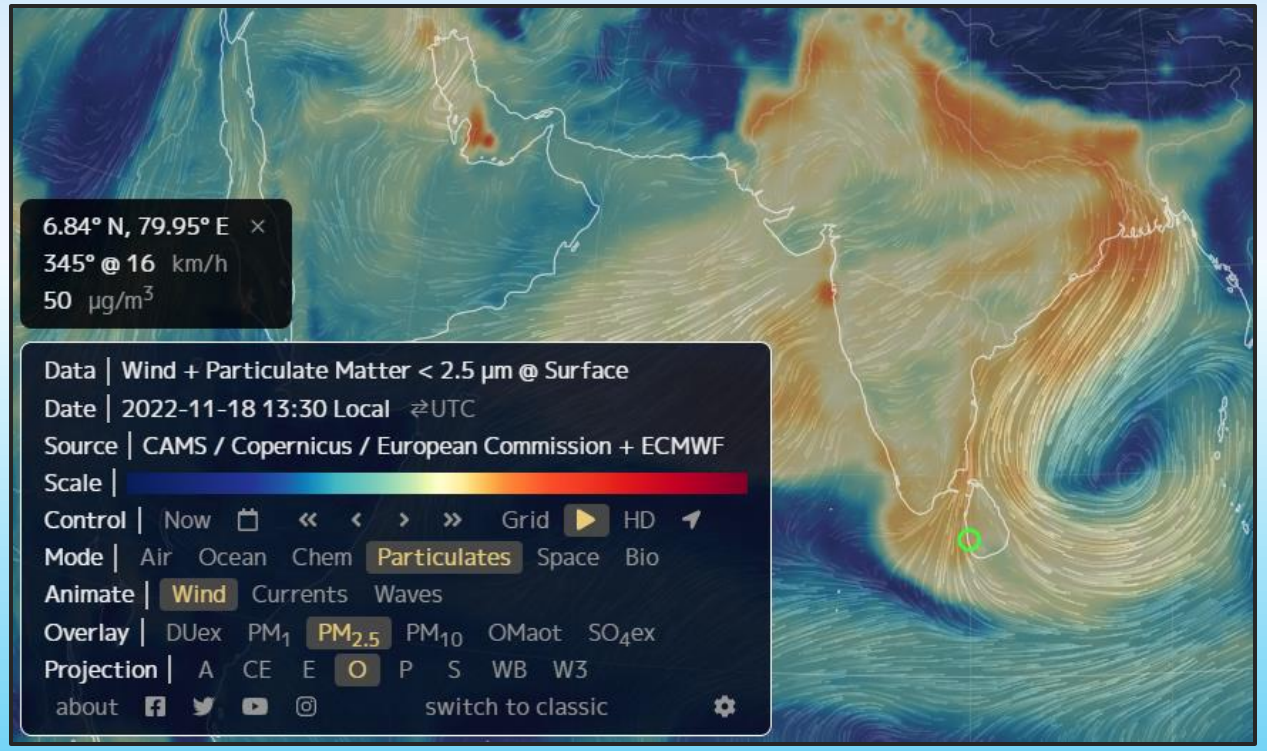


Backward Trajectory, Jan 02, 2025
(Courtesy: NOAA HYSPLIT)

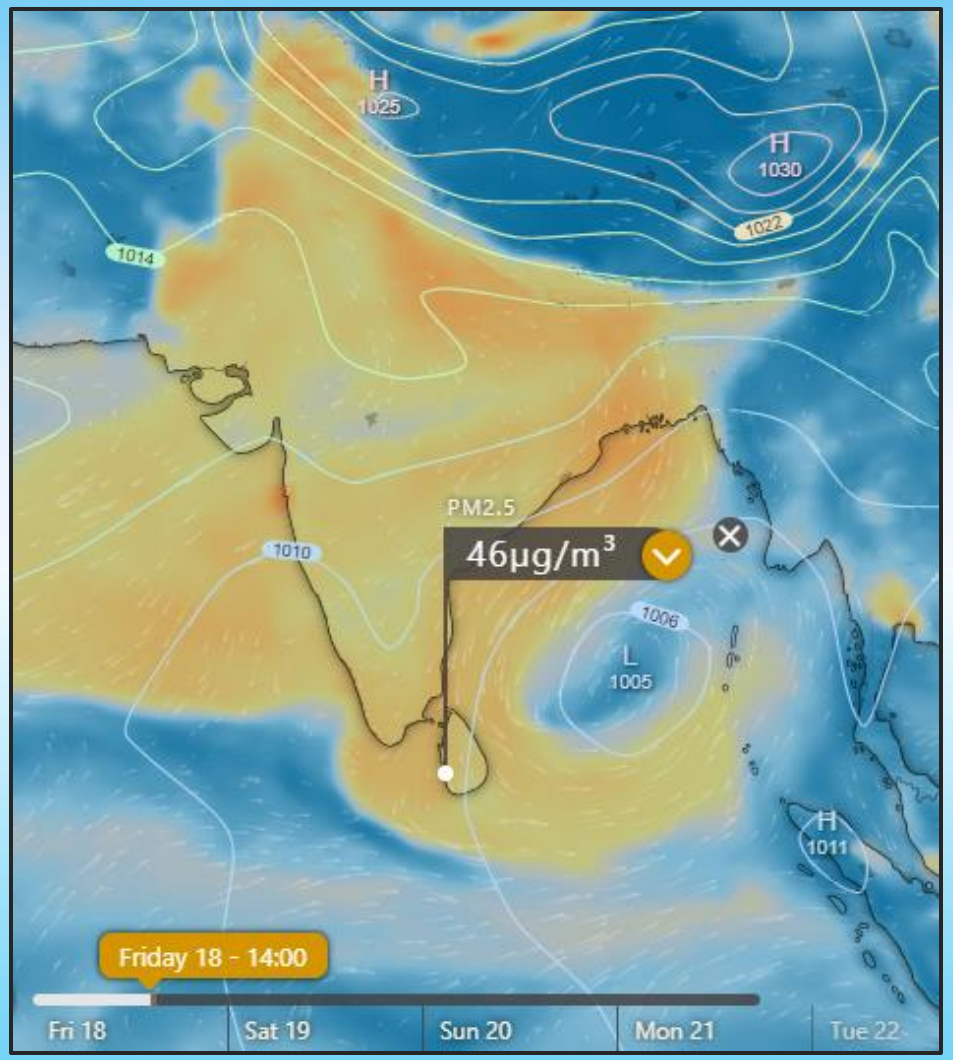
Seasonal Air Quality Pattern in Air Quality Earth Models

Regional (Around Sri Lanka) $PM_{2.5}$ Distribution seen in two different Air Quality Models.

Date: 2022-11-18



NullSchool Earth



Windy Earth

Transboundary Air Pollution

Key Considerations When Discussing Transboundary Air Pollution

🌎 **Air pollutants come from both human and natural causes**
- Industrial, agriculture, domestic, natural dust, and wild fires. etc.

🌬️ **Weather, climate, and seasonal winds play a major role**
- Wind direction/speed, temperature, and mixing heights strongly influence transport.

🎯 **Source identification and contribution estimation are difficult**
- Hard to find the origin/source, very hard to find the contribution percentage of it.

🙌 **No entity intentionally emits pollutants**
- Emissions arise from development needs and daily living conditions, and natural causes.

⚖️ **Practical priorities differ across populations**
- Basic needs and livelihoods may take precedence over cleaner options.

⚠️ **The most vulnerable groups are affected the most**
- Sub-regions with the highest pollution levels need support the most.

🌐 **Transboundary pollution is best addressed collaboratively**
- Joint discussions, shared data, shared ideas, shared solutions, and technical cooperation helps.

Transboundary Air Pollution: A Hypothetical Scenario

A Map of Middle Earth (LotR).
Source: Wikipedia

- **Z** may initially think **Y** is the source.
- But more data could show that **X** is the origin.
- Further investigation might also reveal **W** as a contributor.
- Yet the **level of contribution** of each, or all the root causes may remain unknown!

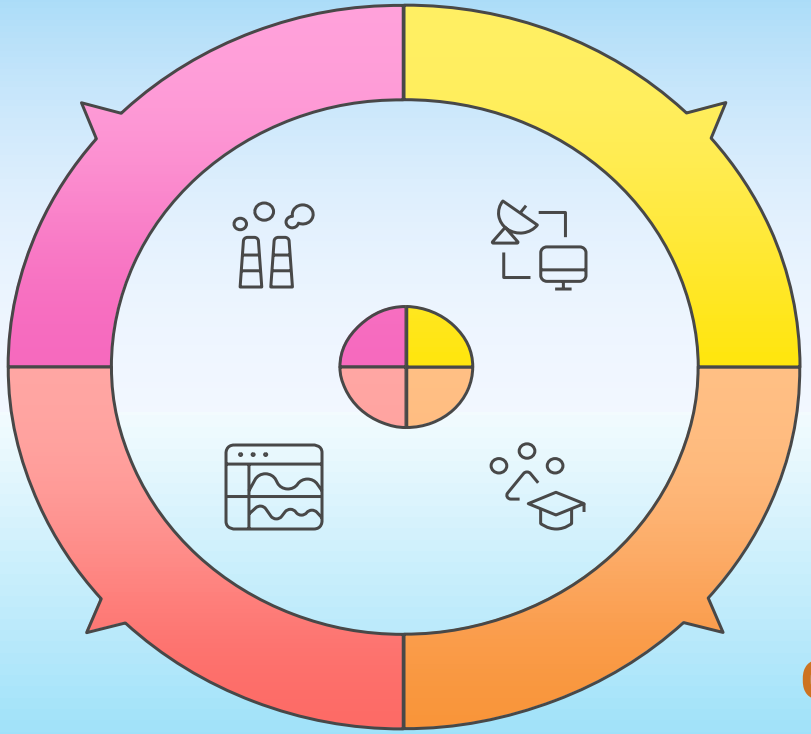
Specific Support Required from Regional and Multilateral Partners

Collaborative Pollution Control

Collaborative regional pollution control **strategy development**.

Regional Monitoring Network

Strengthened monitoring **network** across the **region**.



Shared Model

Shared **regional air quality modelling** and **forecasting** system.

Capacity Development

Focus on capacity development and **knowledge exchange**.

Shared Regional Air Quality Modelling and Forecasting System

- Unified Collaborative Regional Monitoring Data Hub
- Shared Regional Modeling & Forecasting Hub
- Shared Regional Infrastructure for Advanced Analytics & Decision Support

If possible, merging existing initiatives to establish a single, comprehensive, and fully operational regional air-quality management system, with shared infrastructure, predictive modelling, and coordinated policy enforcement, would be ideal. If such full consolidation is not feasible or practicable, then a **collaborative regional air-quality modelling and forecasting framework**, supported by active stakeholder engagement, would still offer significant regional benefits.

Collaborative Regional Pollution Control Strategy Development

🌀🔍🤝 Integrated Problem Cycle

Joint approach to problem identification, cause analysis, solution design, and strategic mitigation.

🛠️💰⚡ Feasible Emission Control

Enables practical, cost-effective, and technically achievable emission reduction measures through shared successful solutions.

🌏📍🎯 Region-Specific Solutions

Supports solutions tailored to local conditions, economic realities, and regional characteristics, ensuring actions are realistic and region-friendly.

🔬📚🤝 Shared Research & Evidence Base

Facilitates coordinated studies, investigations, and observations across agencies, sectors, and countries to identify root causes and inform mitigation.

Collaborative Regional Pollution Control Strategy Development, cont.

Balanced Development

Reduce emissions while minimizing negative impacts on economic growth, essential development activities, and regional priorities.

Evidence & Result-Based Decision-Making

Enables decisions supported by best-practice exchanges, integrated data, research outputs, and measurable results, improving effectiveness and accountability.

Low-cost + high-quality validation + innovation

Use, promote, introduce or innovate affordable devices, technologies, and methods, combined with novel calibration, correction, validation, and verification approaches (e.g. with machine-learning / AI), to deliver highly accurate and locally relevant data, even for very low cost.

Tackling Local & Transboundary Pollution

Enhances collective capacity to identify causes, diagnose regional problems, and develop practical, economical, and feasible solutions through shared ideas, coordinated action, and strengthened collaboration.

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PS. More Things!...

Data Capturing, Presenting, Interpretation Concerns

A Common Standard, Practices or Guideline or Considerations :

- **Data Capturing Device/Technology (When doing temporal & special comparisons)**
  - **For PM: Gravimetric, Beta-Attenuation, Optical-Scattering, Particle-Counting …**
- **Pollution Control Cost vs Benefit Assessment (Accuracy, Public Awareness)**
  - **Convincing the public & governments. Long-term benefits, assessments with accurate information.**
- **Averaging**
  - **Data Completeness/Availability**
  - **Averaging Methodology/Approach**
- **Uncertainty**
- **Composition (For PM)**
  - **Particle Type**
  - **Size Distribution**

Closing Notes: Sri Lanka’s Contribution & Call to Action

- **Sri Lanka’s Contribution (Current & Potential)**
  - 🌐 Sharing air quality monitoring data
  - 🔬 Participating in regional research
  - 📣 Conducting awareness campaigns & regulatory revisions
  - 📊 Supporting regional modeling
  - 🤝 Attending collaborative workshops & technical exchanges
  - 🎓 Capacity building / training programs
  - 💡 Promoting clean energy adoption

- **Closing / Call to Action**
  - 🤝 Strengthen regional partnerships for shared data & interventions
  - 🔬 Implement science-based, context-appropriate solutions
  - 🌍 Recognize shared responsibility for cleaner air across borders
  - 📈 Scale up indoor air quality initiatives
  - 🧩 Foster multi-sector collaboration (government, industry, academia, civil society)
  - 📡 Implementing advanced monitoring & early-warning system

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Summary: What can be done?

- **Understanding Each Other's Capabilities & Needs**
- **Get Something, Give Something**
- **Give Something, Get Something!**

Each other means public, private, commercial, non-commercial, etc. Any entity!

Let’s hope *Everywhere,*
there will be *Clean Air.*
Take care!

Thank You!

CLEAN AIR WEEK 2025

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