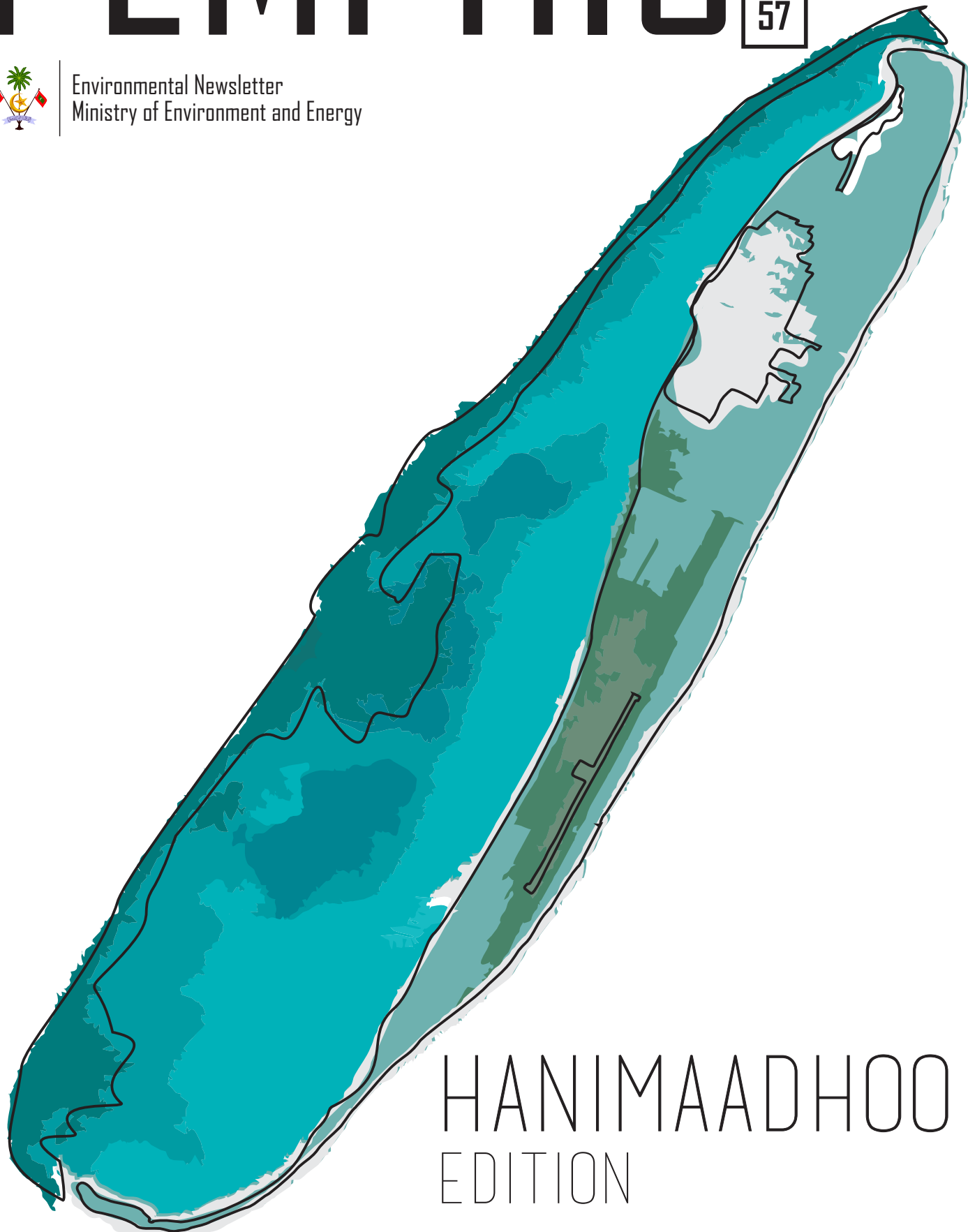


PEMPHIS

57



Environmental Newsletter
Ministry of Environment and Energy



HANIMAADHOO
EDITION

MINISTER'S NOTE



As we are excelling towards developmental milestones, it is important to preserve the natural status of the islands. It is essential to equip the citizens with the correct instruments to decouple economic development from environmental degradation.

Many of our islands are challenged with the effects of climate change, from coastal erosion to extreme weather events. Furthermore, sustainable utilization of coastal and marine resources is a major challenge, not only to Maldives but for SIDS as well.

These issues must be addressed collectively to mitigate the issues, in favour of building safe, resilient and sustainable communities.





Located in the South Thiladumathee (Haa Dhaalu) Atoll, Hanimadhoo with 3.11 km² of land area is one of the biggest natural islands in the Maldives. The island of Hanimaadhoo lies on the eastern atoll rim of the Greater Thiladhumaathi atoll. The natural environment of the island composed of terrestrial and marine components can be further categorised into four distinct components; the coral reef system, the lagoon, the beach and its terrestrial vegetation.

THE MALDIVES CLIMATE OBSERVATORY HANIMADHOO (MCOH)

The MCOH, was established through the joint collaboration by the Government of the Maldives, UNEP, and an international group of scientists led by Prof. Ramanathan of the Scripps Institution of Oceanography, University of California, San Diego.

The MCOH provides measurements of the composition of atmosphere over the Indian Ocean. It is a receptor site of long range transport of pollutants (the atmospheric brown cloud) from emission regions of South Asia, Middle East and Africa.



Radiation:

Pyranometers, Pyrhemometers, High-speed Ground-based UV Radiometer, Sun Photometer

Aerosol Physics:

Nephelometers (3 and 1 wavelength), 7-wavelength Aethalometers, Aerodynamic Particle Size Spectrometer (APS), Condensation Particle Counter (CPC), Differential Mobility Particle Sizer (DMPS).

Aerosol and Gas Chemistry:

High-volume TSP, PM10 and PM2.5 filter Samplers, Automatic Rain Water Collector (Glass and Plastic), CO analyzer and Weather station [filter samples subject to multiple post-collection chemical and optical analyses].

A tropical beach scene with palm trees and a thatched roof in the foreground. The image shows a sandy beach with a thatched roof structure in the foreground, likely a traditional building. In the background, there are several tall palm trees and a body of water. The sky is overcast with grey clouds. The text is overlaid on the left side of the image.

COASTAL ENVIRONMENT

Hanimaadhoo is an island characterised with a dynamic beach in terms of seasonal beach sediment movement.

Coastal erosion is continuous and seasonal in the island, while the erosion process has been intensified with the construction of the main harbour of the island which can be attributed to the alterations to the hydrodynamics of the area from the harbour. The coastal environment of the southern side of the harbour has been experiencing severe erosion causing loss of vegetation in the area.



Krishnakant Budhavant

Resident Scientist,
Maldives Climate
Observatory Hanimaadhoo MCOH

What is the Maldives Climate
Observatory at Hanimaadhoo (MCOH)
currently researching?

The Maldives Climate Observatory Hanimaadhoo (MCOH) is equipped with state-of-the-art equipment and is the key background site in South Asia and the Indian Ocean for atmospheric and climate studies in general and particularly for monitoring how human activities in the South Asian region are modifying regional air quality and climate. The continuous measurements and studies program at MCOH include characterization of aerosols and rainwater, including their content of black carbon, key gas species such as carbon monoxide (CO), aerosol optical properties in the entire column and various aspects of solar radiation reaching the surface, a critical parameter determining the impact of pollution aerosols in brown clouds on regional climate. Key contributions of the MCOH have included improved understanding of aerosol and rainwater chemistry and transport, aerosol effects on the climate, quantification of the geographical and combustion sources of aerosols.

Have you observed any changes to Maldivian climate in the recent history that may be due to global warming?

Climate change is one of the major global challenges of this century, and is particularly relevant to the Maldives. The climate change is not just a scientific problem anymore, but includes a number of issues including, but not limited to, international policy, insurance, health, economics and law. Understanding of climate change is essential for this country from the perspectives of sea-level rise, changing storm patterns, water security, food security, clean air, health and ultimately the economy. Recent important research observations show:

- Emissions of climate-perturbing gases and particles are strongly affecting the climate over South Asia, northern Indian Ocean and the Maldives.
- Effects include a warming of black carbon (soot) particles alone that can be up to 10 times that of anthropogenic CO₂. (10–20 W/m²).
- Effects also include changes in the monsoon system, including rain and storm frequencies.

How significant are the implications of trans-boundary air pollution on a local level?

Although most air pollution problems are caused by local or regional sources of emissions, air pollution does not stop at national borders. Transboundary air pollution (generated in one country and impacting on others) makes a major contribution to acidification and summer smog (caused by tropospheric ozone), and also to eutrophication of soil and water and dispersion of hazardous substances. Some air pollutants are known to circulate globally and deposit on land and water bodies far from their sources. So it is very important to prevent and monitor transboundary haze pollution, through concerted national efforts and intensified regional and international co-operation. When the transboundary haze pollution originates from within their territories, respond promptly to a request for relevant information or consultations sought by a State or States that are or may be affected by such transboundary haze pollution, with a view to minimizing the consequences of the transboundary haze pollution.

Following instruments are operating continuously at Maldives Climate Observatory in Hanimaadhoo

| Name of Instrument | Parameter Measures |
|--------------------------------------|---|
| Pm ₁₀ Sampler | Physical and chemical properties of aerosols |
| PM _{2.5} Sampler | Physical and chemical properties of aerosols |
| Total suspended particulate (TSP) | Physical and chemical properties of aerosols |
| Aethalometer | Black carbon |
| Nephelometer | Physical properties of aerosols |
| Condensation Particle Counter | Total aerosol particle number |
| Differential Mobility Particle Sizer | Number and size distribution of aerosol |
| Aerosol Optical Depth | Aerosol Optical Depth (AOD), water vapour |
| CO Monitor | Ambient CO |
| Rain water | Inorganic ions, black carbon |
| Weather station | Temperature, Humidity, pressure, Wind speed & direction, and rain |

A study published by MCOH titled "Chemical composition of rainwater at MCOH", examined the water soluble inorganic components in rain to determine seasonality and possible source region and were classified into various trajectories based on marine, Arabian Sea, Indian Ocean and mixed trajectories. What are the main findings of this study and how are the chemical compositions different from each group?

This paper summarizes the results of around 3 years of data on the chemical composition of rainwater at the MCOH. Based on air mass back trajectory analysis, it concluded that for non-sea salt (nss) sulfate (SO₄), nitrate (NO₃) and ammonia (NH₄) concentrations in the south Asian group were more than four times higher than in the Marine group, indicating a strong anthropogenic influence in the South Asian group. Rainwater pH was substantially lower in the air coming from the Indian subcontinent (pH=4.7) than in the monsoon air (6). This indicates that the climate of the Maldives is affected by pollution sources on the Asian continent during the winter season. The atmospheric deposition of nitrogen is likely to represent an important input of nutrients to marine and terrestrial ecosystems in the Maldives.



In the study "Apportioned contributions of PM_{2.5} fine aerosol particles over the Maldives (northern Indian Ocean) from local sources vs long-range transport", which you have jointly published, it is stated that air quality in Maldives is influenced by long range transport of distant pollutant sources. What are the source points and what are the particulates composed of?

Our reported study suggests that the air quality in Malé is influenced by both Long-range transport and local sources. The World Health Organization 24-hour health guideline for PM_{2.5} was surpassed for 75% of the sampling time in Malé, suggesting influence from long-range transport. For Malé, an annual average $70 \pm 20\%$ PM_{2.5} level is imported by long-range transport and this impact is greater in the dry season (90%) compared to in the wet season (50%). This indicates that the climate of the Maldives is affected by pollution sources on the Asian continent during the winter season. A recent study based on carbon 14-EC also shows that during the monsoon season (June–October) biomass burning in South East Africa and Madagascar could also have contributed to ambient carbonaceous aerosols in the Maldives.

Furthermore, in the study it was stated total carbon concentrations in Male' were relatively high when compared to MCOH, suggesting strong local emissions. What are the contributing factors, and how can we improve the situation?

The concentrations of total carbon in Malé were on average twice the levels observed at the regional receptor site at Hanimaadhoo (MCOH), corresponding to ~50% of the total carbon loadings over Malé being due to local emissions from incomplete combustion (e.g. Traffic, shipping and waste burning). High levels were particularly observed in Malé during westerly winds, indicating a putative influence from the nearby Thilafushi garbage burning island and/or from the commercial harbour.

Given that the herein reported PM_{2.5} levels may affect human respiratory health throughout the Maldives, it is recommended that monitoring programs are able to be initiated to assess the risk for the general population and to communicate when levels are particularly high. An action plan for reducing PM_{2.5} levels in Malé may also be considered.





AGRICULTURAL PRACTICES

Agriculture is one of the main three economic activities of the island of Hanimaadhoo. Agricultural products such as banana, tomato, lettuce, papaya, and chilli are among the local cultivates of the island.

Ministry of Fisheries and Agriculture has an agricultural centre established on the island for human development of the sector. The centre was initially established to serve the poultry industry and later extended to cater agricultural activities which include research, training and demonstration, especially targeting on hydroponics.



Ficus banyana Oken

Family: Moraceae

Local name: Nika, Kirigas

English Name: Banyan Tree

The Island of Hanimaadhoo houses many protected Banyan trees of the Maldives, out of which several are over 100 years old.

Ecosystem services provided by the tree includes refuge for bats and serves as a nesting place for some birds.

Number of Protected Trees in Hanimaadhoo: 39

Average Height of Protected Trees in Hanimaadhoo:

23 m

Average Age of the Protected Trees in Hanimaadhoo

96 years



Waste is one of the most pressing environmental issues in the Maldives. The waste collection mechanism practised in the island is commendable as the island is kept well clean. Waste is collected regularly from the dustbins systemically placed all around the island. As for the waste elimination, similar to most islands, open burning is practised in the waste management site of the island. Considering the health and well-being of the islanders, the waste should be burned during times where the winds are eastwards.



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