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MyIKLIM: Bridging the Gap in Public Understanding and Promoting Climate Change Awareness Through a Centralized Platform

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ABSTRACT

Climate change significantly threatens Malaysia's environment, society, and economy. This article introduces MyIKLIM, a one-stop data curation portal designed to centralize and enhance access to climate data in Malaysia, addressing the lack of a coordinated climate database system. MyIKLIM aims to provide a comprehensive platform that gathers and curates Malaysia's climate-related research data, making it accessible and usable for researchers, policymakers, and the public. Despite the urgency of climate mitigation and adaptation efforts, Malaysia has limited systems to coordinate data from various stakeholders. MyIKLIM collects and curates published data from government agencies, research institutions, and global organizations, focusing on local relevance, such as climate trends, air quality, marine weather, and land use. Through its user-friendly interface, the platform empowers citizen science and fosters informed decision-making. Accessible through https://myiklimysd.ukm.my/, MyIKLIM simplifies access to reliable, up-to-date climate data, supports data-driven policies, raises public awareness, and ensures that climate change information is open, intuitive, and clear.

Keywords: Climate Change; Malaysia; Research Data; Open science; Data curation

1. INTRODUCTION

In recent years, the impacts of climate change have become more obvious, as countries worldwide struggle with higher global temperatures, unpredictable weather, and environmental damage (IPCC, 2022). Malaysia, located in the wet tropical climate zone and economically dependent on its natural resources and agriculture, is especially vulnerable to the impacts of climate change (ADB, 2021; Shahid et al., 2017). Despite increasing awareness of climate risks, Malaysia still faces a significant challenge in addressing climate change due to the absence of a comprehensive database that consolidates all necessary climate information (Green Climate Fund, 2024). Many studies and reports on climate change-related research were conducted in the country either by local or global researchers, but the sophisticated and abundant climate information and format makes it difficult, especially in scientific jargon are generically difficult for the public to comprehend (Sanderson et al., 2016; Papadopoulos and Balta, 2022). To address this issue, there is a need to connect scientific research with the public, ensuring accurate and easy-to-understand climate data is available to help everyone make informed decisions.

There are several databases available to share datasets openly. Malaysia Open Science Platform (MOSP) launched by MOSTI dan ASM in the year 2019 stores datasets from various universities and agencies to promote open science (MOSP, 2024). Nevertheless, the accessible dataset is in the raw format or report that is not easily comprehended by the public. Focusing on climate change-related data portals, the Climate Change Knowledge Portal by the World Bank has shared abundant climate change profiles globally as well as country-specific datasets including Malaysia (Climate Change Knowledge Portal, 2024). The data is useful, but it is limited to the input data sources that could be obtained on a global scale, which much iteration being done through the general global model. In Malaysia, Big Data Analytics (BDA) developed by the Ministry of National Resources and Environment Sustainability (NRES) stored several environmental datasets on internal analysis and usage, that are not shared or

open to the public (BDA, 2024). The National Water Research Institute of Malaysia (NAHRIM) has launched N-HyDaa for hydroclimate data access, but the data access is limited for the public (N-HyDaa, 2024).

To address this gap, Malaysia lacks a one-stop data portal to gather and provide free access to climate data, making it accessible to the public, researchers, and policymakers. To help solve this issue, MyIKLIM was launched as a one-stop curation portal for climate data to cater to the local context of Malaysia. "My" is the abbreviation of Malaysia, and "IKLIM" means "climate" in Malay. It highlights the geological content of the climate change data it covers for Malaysia. The data portal is launched on 10 January 2023 in the Climate Action Festival@UKM programme. MyIKLIM is managed by the Institute of Climate Change, Universiti Kebangsaan Malaysia under the grant provided by the UKM-Yayasan Sime Darby Chair (UKM-YSD) in Sustainability. The portal is envisioned to become an open database with climate change and environmental research data for Malaysia, through the collection, curation and sharing of research data to the public. MyIKLIM aims to close this gap between researchers, potential stakeholders and users by providing a central climate portal that helps researchers do accurate studies and allows policymakers to create better, informed strategies. From this, it would be able to increase the support data-driven decision-making system and increase awareness of the public.

This study highlights several key findings that address Malaysia's climate challenges. First, it emphasizes the need to make climate change awareness and education more accessible to engage the public and foster informed decision-making. By raising awareness, people can make informed decisions about their daily actions, such as conserving energy, reducing waste, and supporting sustainable practices. Second, it underscores the importance of open science and data sharing, enabling researchers, policymakers, and communities to use climate data effectively. Lastly, it identifies the necessity of collaboration among stakeholders, including government agencies, academia, and private sectors, to create impactful climate actions. These findings show how MyIKLIM can bridge gaps in data accessibility and collaboration, supporting data-driven decisions, increasing public awareness, and advancing sustainable climate solutions.

2. METHODOLOGY

MyIKLIM serves as an informative, interactive and user-centric platform for accessing climate change information relevant to Malaysia. The platform's development incorporated several key objectives:

i. **Data collection**: Climate-related research data were collected and screened to ensure relevance and quality, that fits the scope of MyIKLIM and Malaysia settings. Data sources include government agencies, academic publications, and global organizations.
ii. **Data curation**: Collected data undergo a rigorous curation process to ensure clarity and usability. The datasets are processed and presented in self-explanatory formats, including visualizations like spatial maps and plots. Simplified descriptions accompany the data to cater to a broad audience, enhancing intuitive understanding.
iii. **Open data**: The platform promotes open science by freely sharing curated datasets. This approach supports citizen science initiatives and encourages broader engagement in climate change discussions and research.
iv. **Foster coordination**: MyIKLIM fosters collaboration among diverse stakeholders, including the public, researchers, and policymakers. This coordination aims to build multidisciplinary linkages that strengthen climate action in Malaysia.
v. **Data-supported decision-making**: The platform equips scientists and government officials with comprehensive climate data to facilitate the development of effective strategies for addressing climate impacts.
vi. **Advocate for climate action**: MyIKLIM serves as an educational tool, raising awareness and advocating for immediate measures to mitigate climate change effects in Malaysia.

2.1 Key elements

MyIKLIM database is a platform to access and understand the climate change conditions in Malaysia. With that, it has embraced several key elements in the design stage, as stated below:

a. Localized scope
   MyIKLIM focuses on topics most relevant to Malaysia's climate change agenda, such as air quality, atmospheric weather, and land use. Data sources include reports and research papers from local and international contributors.

b. Comprehensive data sources
   To ensure quality and relevance, MyIKLIM uses published datasets from credible sources, such as from government agencies and academic publications. Openly published data are processed with contributor consent, while historical, present, and future data are integrated from satellite measurements, ground observations, and predictive models.

c. User-friendly presentation
   Processed data are presented in formats accessible to diverse audiences. Visualizations include spatial maps, plots, and dashboards created using various application tools. Detailed descriptions of data sources, methodologies, data contributors and citations, accompany each dataset.

d. Interactive features
   The platform's user interface is designed to be simple and interactive. It offers multiple search mechanisms, enabling users to navigate datasets based on topics, keywords, or featured statistics.

2.2 Data scoping and collection

MyIKLIM brings together data from different sources including satellite data, historical records, and predictive models. This portal simplifies the identification of trends and patterns, which is crucial for adapting to future changes and planning effective actions.

Our data collection process involved multiple methods to ensure a thorough and representative dataset. This includes contacting potential contributors by email, including experts from government agencies, scientific institutions, and international organizations. This outreach aims to obtain published datasets from credible sources to ensure its data quality and relevance. However, limited dataset from the agencies could be shared openly through MyIKLIM due to the restrictions from respective data sharing policy. Therefore, at the initial stage, MyIKLIM is sourced from available open data, especially from published reports. In parallel, our team conducted extensive in-house research, analysing datasets and extracting pertinent information to complement external contributions.

Among the dataset, the platform collects ranges of data from different sources including satellite data for temperature changes, rainfall patterns, and air quality. Historical climate data was gathered to establish long-term trends and changes, allowing us to create a baseline for comparing past and present conditions. Additionally, outputs from predictive models were used to forecast future climate scenarios, which informed our understanding of potential impacts to support appropriate responses plan.

MyIKLIM has identified eight topics focusing on climate in Malaysia, gathering information from a wide range of sources. This approach gives us a clear view and information of Malaysia’s climate-related issues. This includes:

a. Air Quality – monitoring, modelling and analysis of air pollution level
b. Atmospheric Weather - deals with general weather patterns and conditions for climate change assessment
c. Ecological Indicators – physical indicators of ecosystem health and biodiversity towards the climate change.
d. Fire Product - forest fire burning detection and risk assessment as it is one of the main contributors of air pollution in Malaysia
e. Land Use Land Cover - land utilization and vegetation and forest cover to monitor the evolvement of Malaysia’s landscape and role as the global carbon sink.

f. Marine Weather - coastal and marine weather conditions that greatly affect the atmospheric weather because Malaysia is mainly surrounded by the sea.
g. Social Economic – implication of climate change on social wellbeing, livelihood and economic status
h. Surface Water (coming soon) – water resources, flood, drought and sea level rise.

Currently, MyIKLIM incessantly work to include more relevant and suitable topics to enrich the dataset in the portal.

2.3 Curation, visualization and quality assurance

MyIKLIM used WordPress as our main platform to collate and organize the collected data. It is able to provide a more attractive and interesting approach to present and visualise the dataset. Most of the datasets that were identified are in a technical format which is difficult to comprehend. To simplify the dataset, a curation process of the dataset will be performed by MyIKLIM in-house researchers. The data are made more accessible by only accepting data formats limited to image files (like PNG and JPEG), reports (PDF), and tabulated data (Excel/CSV). Depending on the suitability, some data are transformed into Microsoft Power BI to create interactive visualizations, allowing users to explore and engage with the information easily.

The data contributors will need to provide detailed description of the dataset as well as its processing details and sources. The curated data page would then be sent to the data contributors for the agreement. In cases changes need to be made, the dataset will be revised based on the suggestions from the data contributors. Upon agreement, the data will be sent for validation and vetted by scientific committees from the Institute of Climate Change (IPI) to ensure the accuracy, reliability and quality of the published dataset. The dataset then will proceed for final production stage.

2.4 Data organization

The curated datapage was then entered into the MyIKLIM portal, which was designed to be user-friendly. This design ensures that researchers and policymakers can easily access and retrieve information. MyIKLIM uses a clear and consistent way to organize data and name files. Each dataset in MyIKLIM follows a format that combines information into a code that uses underscore to separate the attributes as follows:

- 2 characters for the subject (e.g. AT for Air Temperature).
- 1 character for data types (G for Ground Measurements, M for Model Output, S for Satellite Measurement and V for Survey Data).
- 1 character for data collection period (H for Historical, F for Future Projections).
- 3 digits for the data serial number (e.g. 001).
- 3 characters for the abbreviation of data provider (e.g. IKL for Center of Tropical Climate Change System, IPI).

For example, a dataset named "ATGH_001_IKL" means Air Temperature (AT), using Ground Measurements (G), collected from past historical dataset (H), as the first dataset (001) contributed by Center of Tropical Climate Change System, IPI (IKL).

3. RESULTS & DISCUSSION

3.1 Dataset

To date, 21 datasets have been archived in the MyIKLIM dataset as tabulated in Table 1.

Table 1. Archived dataset, topic and its data sources in MyIKLIM as of 7 Nov 2024 (Source: MyIKLIM 2024). Asterisk (*) indicates the data with top 5 view numbers.

No.	Data Name	Topic	Data Source(s)
1*	Surface Air Temperature Changes Between Two Decades	Atmospheric Weather	NASA
2	Modeled Future Precipitation Difference	Atmospheric Weather	CORDEX-SEA

3	Modeled Future Temperature Difference	Atmospheric Weather	CORDEX-SEA
4	Yearly Average Climate and Air Quality Data over the 20 years in Peninsular Malaysia	Air Quality	DOE Malaysia and Met Malaysia
5	Sensitivity of Air Quality to Future Changing Climate in Peninsular Malaysia	Air Quality	DOE Malaysia and Met Malaysia
6*	Global Background Carbon Dioxide (CO2) Concentration	Air Quality	NOAA
7	Greenhouse Gases Emission in Malaysia (Gg) in 1990 to 2016	Air Quality	NRES
8*	Greenhouse Gases Emission in Malaysia (Gg) in 1990 to 2019	Air Quality	NRES
9	12-hourly Reanalysed Total Aerosol Optical Depth (AOD) at 550 nm	Air Quality	Copernicus
10	Daily PM2.5 Concentration in 2019 at East Coast Peninsular Malaysia	Air Quality	DOE Malaysia
11	A Land Use Map of Peninsular Malaysia for the Year 2018 (25m grid)	Land Use Land Cover	UKCEH
12*	Land Use Land Cover Map in Peninsular Malaysia	Land Use Land Cover	USDS Landsat
13	Five-Years Time Series Averages and Differences of Sea Surface Temperature from 2003 to 2022 in Malaysia	Marine Weather	NASA MODIS
14	Monthly Sea Surface Temperature (SST)	Marine Weather	NASA Ocean Colour
15	Five-Years Time Series Averages and Differences (2003-2007 vs 2008-2022) of Chlorophyll-a Concentration from 2003 to 2022 in Malaysia	Ecological Indicator	NASA MODIS
16	Monthly Chlorophyll-a Concentration	Ecological Indicator	NASA Ocean Colour
17*	Monthly Fire Hotspot Data for Maritime Continent Region	Fire	NASA MODIS
18	Progressing towards Global Citizenship and a Sustainable Nation: Pillars of Climate Change Education and Actions	Social Economic	Review
19	Ecological Citizenship among Multi-Ethnic Youth through Education in Malaysia	Social Economic	Survey
20	Augmented Reality for Climate Change Education	Social Economic	Researcher
21	The value-psychological-educational factors for “learning to action” model for climate action	Social Economic	Review and Interview

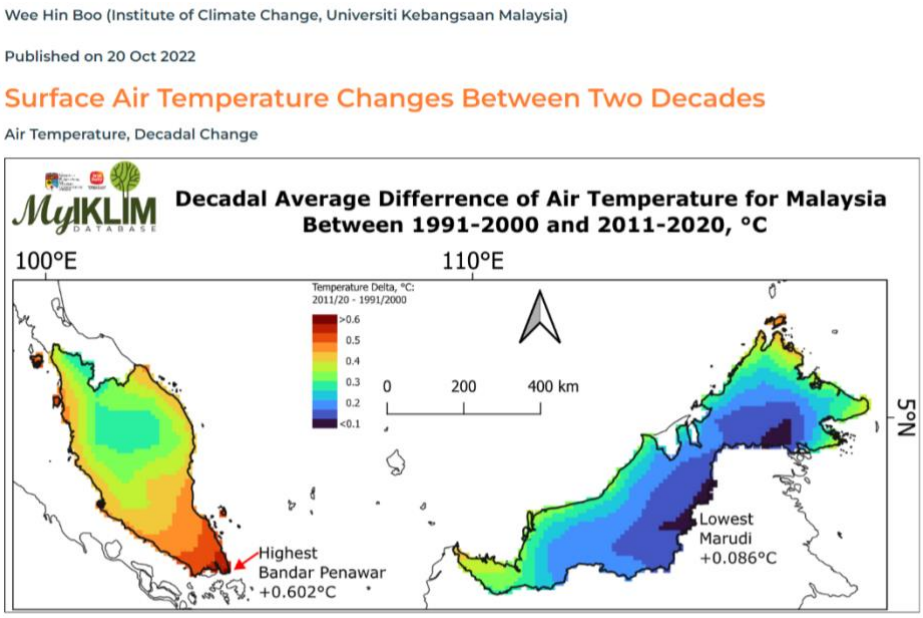
The paper provides an example of historical air temperature change (ATGH_001_IKL) and monthly hotspot maps (FISH_001_IKL) that have been hosted on MyIKLIM (Source: MyIKLIM 2024). This dataset is a historical ground dataset that has been collected from 1990 to 2020. Figure 1 shows the landing page of the dataset with data contributor, corresponding affiliation and data published shown at the top. Figure 1a provides demonstrated a decadal change of air temperature in Malaysia using the PDF. While the temperature of the two 10-years average temperature for 1991-2000 and 2011 -2020 are also made available in the webpage. In Figure 1b, the data contributor provided the monthly variation of fire hotspot counts extracted from NASA MODIS in image and csv format. With the latter, a PowerBI dashboard are designed for user to view the monthly and yearly variation of fire hotspot counts.

Prior to the data illustration, the data contributor, their affiliation and data publication date are included in the top of the page for an impression of the origin of the data sources. It then provides information about each dataset through several navigation tabs, offering a structured approach that user-friendly.

- The "**Key Takeaways"** section highlights the most important data from the dataset. Adapted from the NASA Climate Change portal (https://science.nasa.gov/climate-change/), this includes main findings, trends, or significant patterns observed in the data. From this dataset's main points, it will help users to easily understand its value and how it might be used in climate change studies.
- **"Data Description"** elaborates on the dataset's structure and content. This section provides a detailed overview of the variables included, their definitions, units of measurement, and any relevant statistical information. It also describes the data collection methods, temporal and spatial coverage, and resolution of the data, giving users a clear picture of what the dataset contains and how it is organized.
- The "**About Data"** section offers contain on the dataset's origin, purpose, and relevance. It includes information about the data supplier or collecting institutions, and its significance in the broader field of climate science. This background helps users understand the dataset's importance and potential applications in research or policymaking.
- **"Citation"** information is crucial for academic integrity and proper attribution. This section provides the correct format for citing the dataset in academic publications or reports. It usually includes details such as the dataset title, authors or institutions responsible for the data, publication year, and any unique identifiers or URLs where the data can be accessed.
- The "**Documentation"** tab contains technical information about the dataset. This may include detailed methodologies used in data collection and processing, and guidelines for interpretation. It often also provides information on data formats, and any file structures for data analysis. This section is essential for researchers to fully understand the details and ensure its appropriate use in scientific studies.

By providing this information, it will give researchers all the key information they need to use the data effectively in their studies, supporting careful analysis and well-informed conclusions.

(a)



(b)

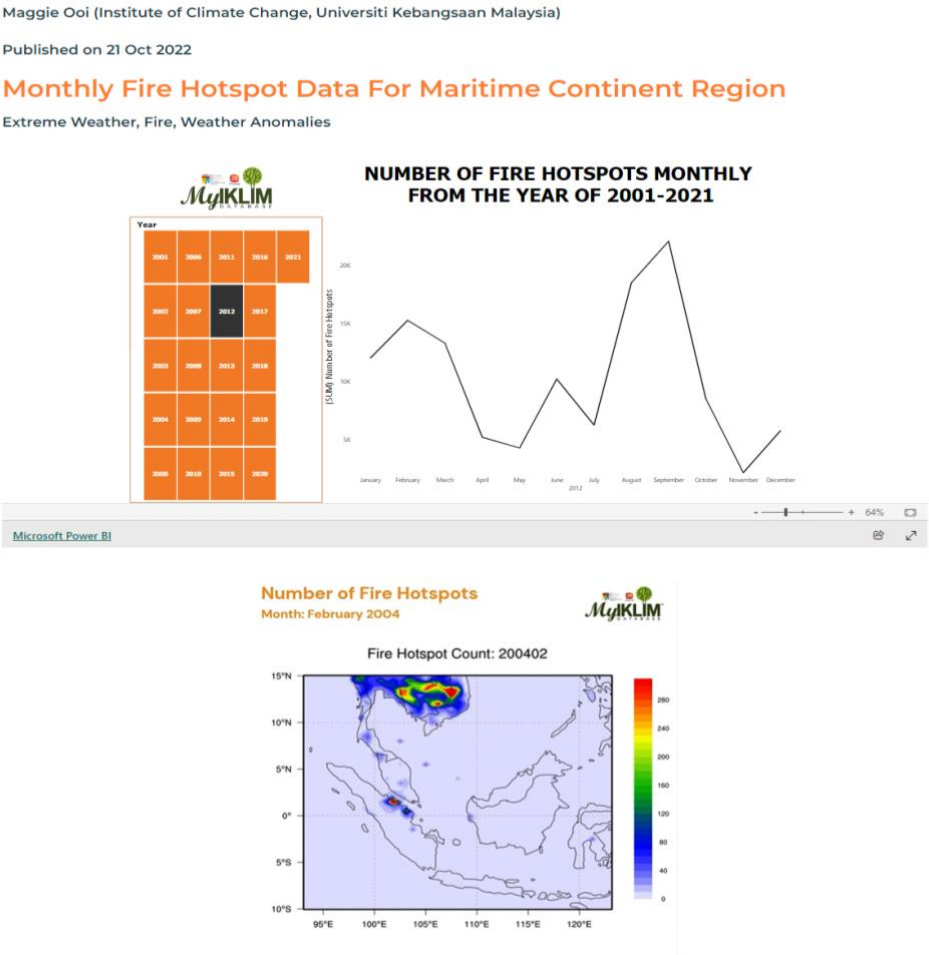


Figure 1. Landing page of the dataset (a) annual average temperature differences in Malaysia between 1991-2000 and 2011-2020, °C, (b) Monthly fire hotspot data for maritime continent region from 2001-2023, showing number of fire hotspots detected by satellite (Source: MyIKLIM, 2024).

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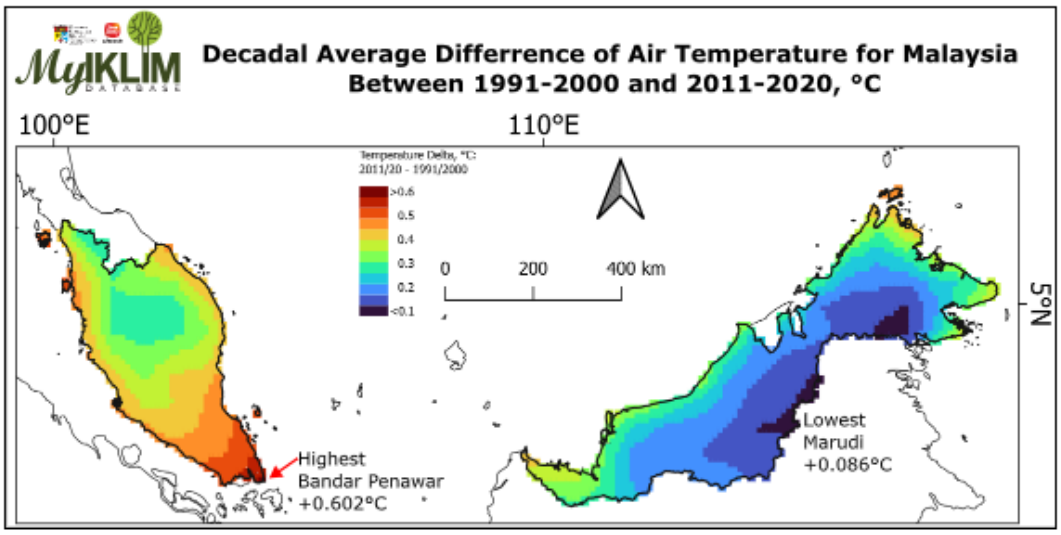
Surface Air Temperature Changes Between Two Decades

Air Temperature, Decadal Change



Key Takeaways

The surface air temperature of Malaysia has become warmer within 30 years.

Mean temperature +0.28 °C
Median temperature +0.24 °C

Data Description | **About Data** | **Citation** | **Documentation**

The increase of surface air temperature is a concerning climate change threat. This is a serious issue as it can influence a lot of our atmospheric chemical reactions, weather irregularities, and biological dynamics. It has been shown that since 1900, our global temperature has increased by 1 °C (NASA, 2022).

The subject data examined the air temperature within the jurisdiction of Malaysian land (Peninsular and Borneo) between 1991-2020. However, the observed data focused mainly on two decades, 1991-2000 and 2011-2020. The air temperature data was obtained from the NASA database with the Giovanni platform. The warmest place in Malaysia was in Klang, Selangor (1991-2000= 27.18 °C; 2011-2020= 27.66 °C). While the coldest place was at the peak of Mount Kinabalu, Sabah (13.22 °C; 13.47 °C).

Throughout three decades, the air temperature consistently and significantly increased by on average 0.28 °C. Pantai Timur, Bandar Penawar, Johor recorded the highest change within 3 decades (0.60 °C), while the heart of Sarawak (Marudi) recorded the least changes of temperature (0.09 °C). This result showed the threats of Climate Change is not equal across the country. More studies are required to understand the effect of climate change in the nation.

NASA. 2022. World of Change: Global Temperatures. Earth Observatory. [Accessed by: 20 September 2022]

Dataset

Figure 2. Navigation tabs for dataset on MyIKLIM: Data Description, About Data, Citation, and Documentation (Source: MyIKLIM 2024).

3.2 Other webpage design

The webpage features three (3) different data search mechanisms to ease the user experience in looking up dataset. They could be searched easily through explore tab, topics and featured statistics. The portal provides a "Quick Bit of Malaysia Climate" section, summarizing essential climate metrics.

MyIKLIM also provides an introduction section for the concept of climate change. This section is designed to be easily understandable, with infographics suitable for public including the younger generations. It covers the fundamental aspects of climate change, such as evidence, causes, and effects of climate change using infographics. These infographics make it simpler for readers to understand the main ideas of climate change, making learning easier and raising climate awareness, especially among young people. It could be accessed through this weblink: https://myiklimysd.ukm.my/what-is-climate-change/

3.3 Engagement session

MyIKLIM also actively promotes its initiatives and enhances its visibility through various channels, including news updates about roadshows and features in media coverage. These efforts listed in Table 2 not only keep the public up to date and encourage engagement with the portal, thus fostering a wider understanding of climate issues in Malaysia. By bridging the gap between scientific data and public accessibility, MyIKLIM offers clear, concise information on critical climate indicators. This helps the public to understand climate change better and encourages more people to get involved, which is important for tackling the challenges it brings.

Table 2. Roadshows and exhibitions that MyIKLIM participated in MyIKLIM also received enquiries on data access from students, research and agencies as reference point to obtaining climate change and environment-related information (Source: MyIKLIM, 2024).

Date	Event	ORGANIZER
10 Jan 2023	Climate Action Festival@UKM	UKM-YSD Chair of Sustainability
25 May 2023	Seminar on Sustainability Leadership 2023	UKM-YSD Chair of Sustainability
6 Jun 2023	Majlis Pelancaran dan Perasmian Program Kesedaran Universiti Malaya Open Science Inisiatif (UMOS)	Universiti Malaya (UM)
11 – 13 Jul 2023	29th International Sustainable Development Research Society (ISDRS)	Faculty of Law (FUU), UKM
17 – 19 Nov 2023	Ocean Hackathon 2023	France Embassy in Kuala Lumpur
20 – 21 Nov 2023	The 3rd International Conference on Unmanned Aerial System in Geomatics (UASG-2023)	Indian Institute of Technology Roorkee, India; Institute of Climate Change, UKM
23 Nov 2023	Sustainability Challenge 2023	Research Centre for Sustainable Process Technology (CESPRO)
14 Dec 2023	Sustainable Living Day Workshop @ PAAB	UKM-YSD Chair of Sustainability
6 Mar 2024	Bicara Perdana Naib Canselor 2024	Universiti Kebangsaan Malaysia (UKM)
24 Apr 2024	Program PERMATA@Pintar Antarabangsa	Pusat IDEA, UKM
30 Apr 2024	Celebration of the 10th Anniversary of IPI & UKM Earth Day 2024	Institute of Climate Change (IPI), UKM
20 Jun 2024	Exhibition in Conjunction with The Launch Ceremony of Low Carbon Campus 2030 & 10th Anniversary Celebration of UKM Strategic Center and Sustainability Celebration 2024	UKM Strategic Center
3 Sep 2024	6th International Conference on Science and Technology Applications in Climate Change (STACLIM 2024)	Institute of Climate Change (IPI), UKM

3.4 User acceptance

Figure 3 shows the google analytics of the visitors who browsed the MyIKLIM webpage since April 2023. It is shown that there are more than 3000 users who browsed the data pages as of Dec 2023 and they mainly come from Malaysia, the United States, Singapore, Indonesia and United Kingdom. The MyIKLIM project has also received recognition from the Centre of IDEA-UKM who support and manages research as an project with national impact (Projek Gegar Gamat). This has highlighted the potential of MyIKLIM to continually serve as the national referred database on climate change topics. Nevertheless, the feedback from users was also collected and used to refine the portal, enhancing its functionality and ease of use.

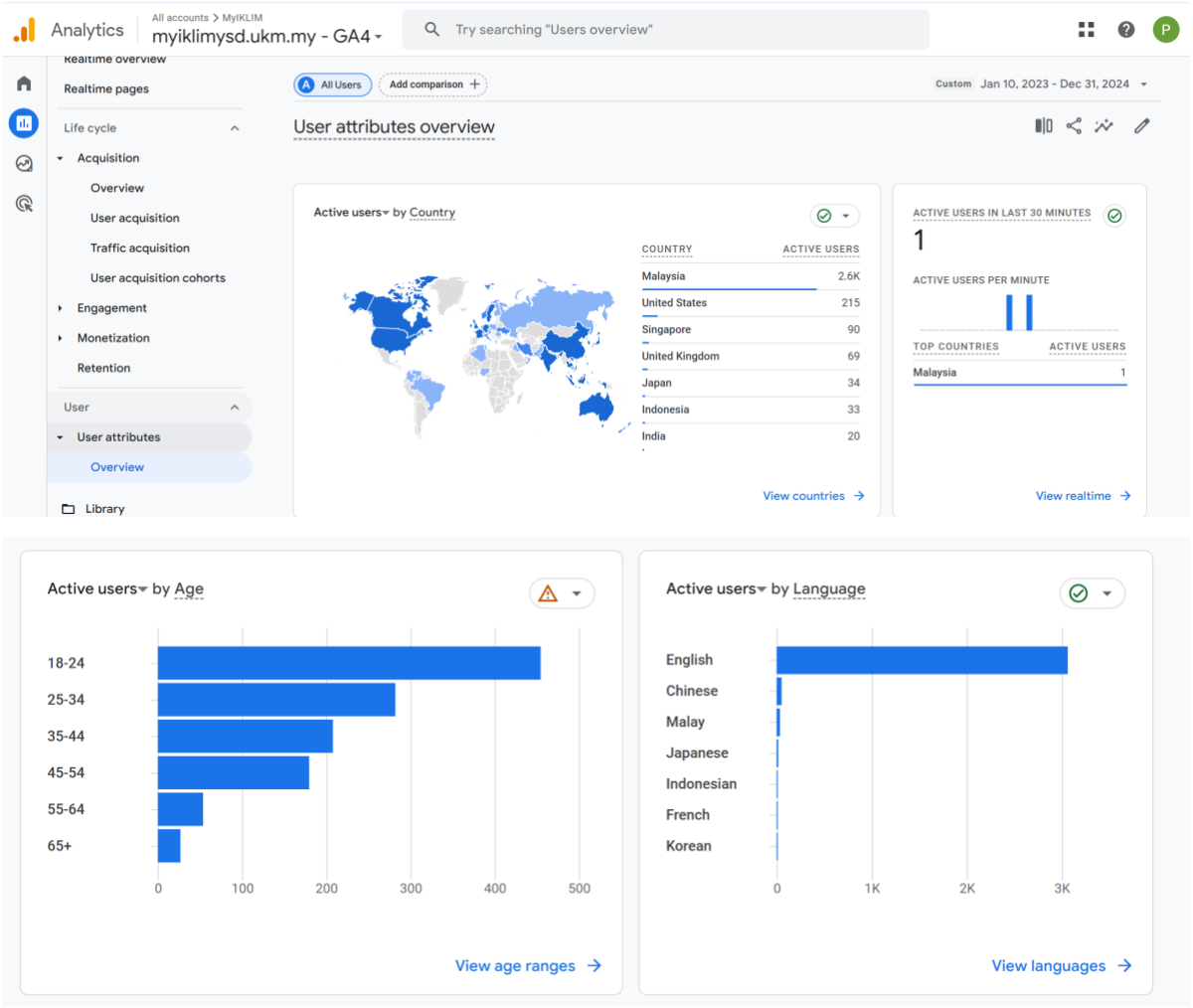


Figure 3. Google Analytics of MyIKLIM since launching in 2023.

4. CONCLUSION

MyIKLIM, which currently hosts 21 datasets from various credible sources including research institutes and local and international agencies, is developing into a comprehensive climate data platform for Malaysia. As the country previously lacked a centralized database for climate vulnerability and adaptation, MyIKLIM's evolution into a one-stop data curation portal marks a significant advancement in climate change research and information dissemination. By integrating real-time information and coordinating climate science with socio-economic data systems across multiple agencies and regional players, the platform enables decision-makers to access accurate information efficiently, supports research operations, and facilitates national collaboration among agencies and end-users. This centralized approach not only raises public awareness about natural disasters but also creates a reliable platform for sharing research, ultimately empowering future generations to address environmental challenges and enhance crisis management capabilities.

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