



MANILA OBSERVATORY

2022

ANNUAL REPORT





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Message from the Executive Director

Like many areas during the pandemic, the Manila Observatory was largely a deserted place. Physically, it was quiet and empty, save for some scientific instruments that were ticking away 24/7. Again, like most of what people were doing, most of the work was being done in online gatherings and in the "solitary confinement" of one's home.



Prior to 2022, we were all dispersed to work individually and come together occasionally, and online at that. We discovered we could still produce some of the science that had to be done. The Observatory was more than just a limiting and limited place now. *Puede naman. Puede na.* And we wondered how the new or next normal of doing science would take shape post-pandemic.

The year 2022 began the Observatory's gradual recovery from the pandemic. By midyear, we started coming back onsite. Like children awakened and walking about in a daze, we took some time to readjust and recalibrate our senses. Working spaces had to be renovated and, in some areas where termites had taken over, even repaired.

I took the state of disrepair as yet another instance of having to expend human effort to keep social "entropy" at bay. In other words, if we are not careful, inertia invariably takes over. If we do not put in "energy", we will readily scatter to the winds. We cannot take comfort in our little dispersed bubbles and virtual labs at home, and converging online on occasion, because we sense this is not the kind of science the Manila Observatory is about.

The social nature of science is something we hold dear. Who we do science with matters to us. Who we learn with and where, who we do science for, and why.

To our sense of loss and placelessness, which can be exhausting and disorienting (as we saw in the pandemic), we have yet to find an antidote. Digital ubiquity is not it. After all, we are still creatures of place and we know we cannot take geography and community for granted.

Thankfully, the year 2022 began our journey back to the place that is the Manila Observatory.

Jose Ramon T Villarín SJ PhD

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Executive Summary

This annual report is organized into three parts, namely: research activities, societal engagement, and publications and talks. Most of the scientific research in 2022 was undertaken by the Regional Climate Systems (RCS), Geomatics for Environment and Development (GED), Data and Sensor Development (DSD), and Air Quality Dynamics (AQD) Laboratories. The work of the fifth lab, Solid Earth Dynamics - Upper Atmosphere Dynamics (SED-UAD), is still in the process of being restarted.

Regional Climate Systems

RCS does research on high-resolution climate change science and weather extremes using numerical modeling and data analysis to provide the science for climate resilience planning and adaptation, and disaster risk mitigation.

Geomatics for Environment and Development

GED integrates Remote Sensing and Geographic Information Systems (RS-GIS) to map social and environmental themes and conduct spatial analyses to support decision making in sustainable development.

Data and Sensor Development

DSD works on sensor development, data management, systems integration, and data analytics research. DSD develops, operates, and maintains scientific instruments for environmental observations in coordination with the other MO labs.

Air Quality Dynamics

AQD aims to provide scientific guidance to air quality assessment and effective air quality management through monitoring and modeling activities.

Solid Earth Dynamics - Upper Atmosphere Dynamics

SED-UAD studies the behavior of electromagnetic radiation in the ionosphere and possible interactions with the lithosphere, magnetosphere, and heliosphere.

One highlight of 2022 was the reestablishment of Klima Center (Klima), which is MO's interface between science and society. The Observatory's two collaboratories—the Resilience Collab and Energy Collab—became the initial seeds for the formation of this Center. Its aim is to provide science-based policy and decision support, communication campaigns, technical assistance, and capacity-building to MO's stakeholders in government, civil society, and the private sector.

Klima draws from the scientific work of the five labs to ensure that science is harnessed by society and that social concerns shape the kind of science being done by the Observatory. It is designed to cover five areas:

Adaptation and Resilience

looks into preparing for and adjusting to both current and projected impacts of climate change especially in climate-vulnerable communities;

Renewable Energy and Transition

paves the way to transforming the energy sector from being fossil fuel-dominated into a zero-carbon one;

Land Use and Climate

identifies and establishes critical information for baseline thematic maps, environmental change detection, ecological and economic drivers of development and sustainability;

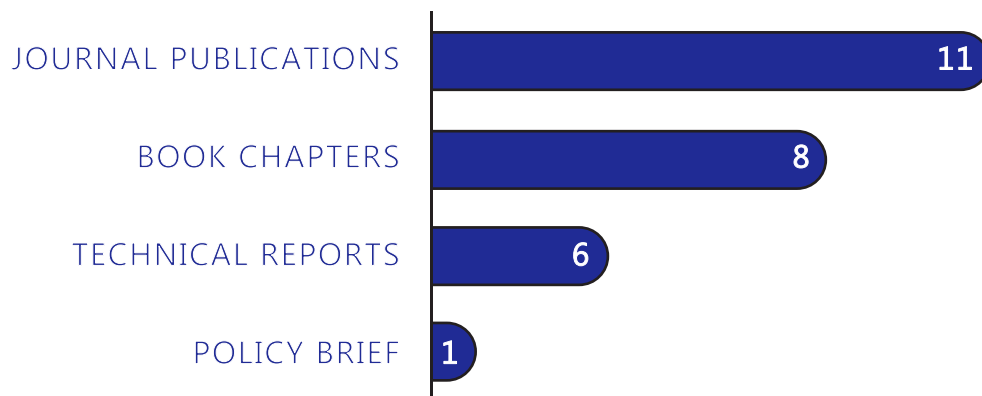
Loss and Damage (Climate Justice)

looks into climate consequences beyond what people can adapt to, the options and resources of a community, and climate justice-related concepts such as equality, human rights, collective rights, and the historical responsibilities for climate change action;

Ecosystems and Resources

addresses the interlocking challenges of climate change and biodiversity loss and how these are disrupting the ecosystems that sustain human well-being and the future of a thriving economy.

In terms of publication output, MO is pleased to report that a total of eleven journal articles (nine from the labs and two from Klima), eight book chapters (seven from the labs and one from Klima), six technical reports (five from the labs and one from Klima), and one policy brief (from Klima) were published in 2022. These are listed in Chapter 5.



We are also happy to note that Dr Maria Obiminda L Cambaliza of the AQD Lab was given the 2022 National Academy of Science and Technology - Environmental Science Award in recognition of her paper, titled “Spatiotemporal assessment of PM2.5 exposure of a high-risk occupation group in a Southeast Asian megacity”.

Also noteworthy in 2022 were the key projects that spanned the work of our different labs. These interlaboratory efforts include the:

- High-Definition Clean Energy, Climate, and Weather Forecasts (ECW) Project;
- Group on Earth Observations Microsoft Planetary Computer Programme (GEO MS Project); and the
- Access to Sustainable Energy Programme - Clean Energy Living Laboratories (ASEP-CELLs) (recently concluded)

The ECW Project that was started in 2021 continues to involve the RCS and DSD Labs. It produces hourly and fine-resolution forecasts on clean energy and weather on a daily basis over the Philippines. Data from MO’s network of Automated Weather Stations (AWS), coupled with satellite-based information, are used to validate and improve these forecasts. Furthermore, existing local climate projections over the Philippines are continually updated and incorporated into risk assessments to help vulnerable communities adapt to climate change using the latest information. The donation in 2022 of an additional 96-core compute server has helped substantially in improving the intensive computational work of our scientists.

The RCS, GED and DSD Labs have also been collaborating on the GEO MS Project. This one-year initiative was launched in September 2022 and is being funded by the Group on Earth Observations (GEO), an intergovernmental body based in Switzerland that seeks to improve the availability, access, and use of earth observations for sustainable development. For this project, MO is tasked to supplement GEO’s early warning systems on rapid disaster risk assessment by using automation and cloud technologies. This also enables MO to be part of the capacity-building efforts of the International Disaster Charter project and to become a Sentinel Asia data analysis node.

Lastly, the ASEP-CELLs Project—a multiyear joint effort among MO labs—was concluded in 2022. With support from the European Union, this was launched in 2019 with the aim of achieving 100% rural electrification powered by renewable energy, and increasing the share of renewable energy in the country. Most of the results of this project which involved our GED, RCS, and AQD labs will eventually be available online. The publication of the Renewable Energy Atlas, which features not only baseline renewable resources but various types of climate change-related risk to these resources, is currently underway.

Summary of activities and accomplishments

Regional Climate Systems

The RCS Lab carries on with its research on improving forecasts for clean energy and extreme weather, and climate projections at resolution scales important for end-users. While ASEP-CELLS has ended and Phase 2 of CORDEX Southeast Asia (SEA) is nearing completion, there are new and ongoing projects (i.e. ECW and the Strengthening Resilience through Early Warning System, Enhanced Anticipatory Actions and Multi-risk Landscape Approach in Bangsamoro Autonomous Region in Muslim Mindanao or SUPREME BARMM) that provide opportunities to strengthen climate science and build partnerships. Downscaling of CMIP6 global climate projections for SEA is underway as part of the CORDEX SEA initiative. Ongoing collaboration with local and international research partners helped the lab produce seven international journal publications and two book chapters. Research output and briefings with stakeholders continue to be shared online, but the gradual lifting of COVID-19 related restrictions has also allowed the resumption of in-person meetings and conferences.

Geomatics for Environment and Development

In 2022, the GED Lab was engaged in four projects, namely: (a) Optimizing the Microsoft Planetary Computer for Emergency Observation and Mapping (EO/M); (b) the incubation of the DEVCalque Framework Technology of Tools, Methods and Services; (c) the Access to Sustainable Energy Program – European Union Clean Energy Living Laboratories: Space-Based Decision Support System for Renewable Energy (ASEP-CELLS), specifically, the finalization of the Renewable Energy Decision Support System (RE DSS) which led to the generation of 1,103 maps and five peer-reviewed chapter papers; and (d) the conclusion of the ADB TA-9700: Sustaining Climate and Disaster Risk Resilient and Low Carbon Development in South Asia, in particular, the generation of 3,026 maps and four knowledge products for the Climate Risk Screening Decision Support System (CRS DSS).

Data and Sensor Development

The DSD Lab continues to work with other MO labs in areas such as weather data compilation and analysis, clean energy resource assessment, clean power production forecasting, and database and computing requirements. It has reconditioned 50 Lufft AWS and 54 Davis AWS that are located in various parts of the Philippines. To improve climate and weather model computation performance, node networking tests were done on the three compute servers that are used for daily weather forecasts to determine the necessary conditions for running our servers as a cluster. The database server for weather station data was replaced to increase system reliability. Real-time data from the AWSs is now accessible to the public with the update of the Panahon website (panahon.observatory.ph). Internal web portals were developed to enable timely system diagnostics for clean energy and weather forecasting.

Air Quality Dynamics

Measurement activities for two major projects—ASEP-CELLs and the Cloud, Aerosol and Monsoon Processes Philippines Experiment (CAMP²Ex)—were concluded in 2022. Data analysis and writing of scientific papers were undertaken as a result of these projects and previous ones such as CAMP²Ex Weather and Composition Monitoring (CHECSM), Advanced Institute on Disaster Risk Reduction with Systems Approach for Slow – Onset Climate Disasters (AI-SOCD), and Coastal Cities at Risk in the Philippines (CCARPH). The AQD Lab’s involvement in the Health Investigation and Air Sensing for Asian Pollution (Hi-ASAP) initiative and International Global Atmospheric Chemistry - Monsoon Asia and Oceania (IGAC-MANGO), as well as The Acid Deposition Monitoring Network in East Asia (EANET) Project, also provided significant results and a publication.

This year, the AQD Lab also continued its engagement with the national and local governments as well as nongovernmental institutions through its participation in the Quezon City Air Quality Management Project.

Klima Center

In 2022, Klima participated as observer delegates to the United Nations Framework Convention on Climate Change’s (UNFCCC) 27th Conference of the Parties (COP27). It is a member of a consortium led by the World Resources Institute (WRI): Alliance for Climate Transformation by 2025 (ACT2025), where a side event on Loss and Damage was co-hosted with other partners in the consortium. Klima also drafted the Paris Rulebook chapter for the Call for Enhanced Implementation and two other papers on climate justice that were published in 2022.

As the secretariat of OurEnergy2030 (OE2030), Klima’s role is to communicate renewable energy transition through science and policy gatherings. This work, currently in its third phase, focuses on capacity-building activities on energy transition among students and young professionals. The Climate Justice Capacity Initiative (CJCI) was also established by Klima in partnership with the other Ateneo law schools to enhance environment, energy, and climate law practice in the Philippines through capacity-building, climate and environmental justice assistance, as well as policy and advocacy work. Modules were developed for the law schools to implement.

Klima is also part of the Women Environmental Defenders consortium (WE-Defend). A climate playbook is currently in its pilot stage for training different stakeholders. Under The Samdhana Project, Loss and Damage work has been initiated, which includes developing the policy framework, stakeholder consultations, and communication activities. Corollary to this work, in partnership with the Stockholm Environment Institute, a regional workshop on Loss and Damage in Bohol was held in August 2022. As a result, a policy brief entitled “Loss and Damage: Perspectives from Southeast Asia” was shared with other civil society organizations within the Klima network.

3

Research Activities

3.1 Regional Climate Systems



Summary

The RCS Lab carries on with its research on improving forecasts for clean energy and extreme weather, and climate projections at scales relevant for end-users. While ASEP-CELLS has ended and Phase 2 of CORDEX Southeast Asia (SEA) is nearing completion, there are new and ongoing projects (e.g. ECW and SUPREME BARM) that provide opportunities to strengthen climate science and build partnerships. Downscaling of CMIP6 global climate projections for SEA is underway as part of the CORDEX SEA initiative. Ongoing collaboration with local and international research partners helped the lab produce seven international journal publications and two book chapters. Research output and briefings with stakeholders continue to be shared online, but the gradual lifting of COVID-19 related restrictions has also allowed the resumption of in-person meetings and conferences.

ASEP-CELLS

The ASEP-CELLS Project concluded in 2022. Future changes in regional climate variables relevant to solar, hydro and wind energy applications over the Philippines were examined and used in the risk analyses of the GED Lab. Project output (including methodology, maps, etc.) are documented in the Renewable Energy Atlas. Abstracts of manuscripts that are to be submitted for journal publication can be found in the ASEP CELLS Research Compendium.

CORDEX-SEA

The 5-km resolution runs over Mindanao for the baseline (1971-2005), near-future (2021-2050) and far future (2079-2099) periods were completed in 2022, as part of the Asia-Pacific Network for Global Change Research (APN)-funded “Southeast Asia Regional Climate Downscaling (SEACLID)/CORDEX Southeast Asia Phase 2: High-resolution Analysis of Climate Extremes over Key Areas in Southeast Asia” Project. Results were presented in international conferences and are to be submitted as a journal publication.

As part of the preparation for downscaling climate projections from the Coupled Model Intercomparison Project Phase 6 (CMIP6), a suite of sensitivity experiments has been conducted to determine optimal physics schemes to be used in the regional climate model. In addition to the model performance evaluation of temperature and rainfall, simulation of tropical cyclones in the region is being assessed. Downscaled climate simulations over the CORDEX-SEA region are underway.

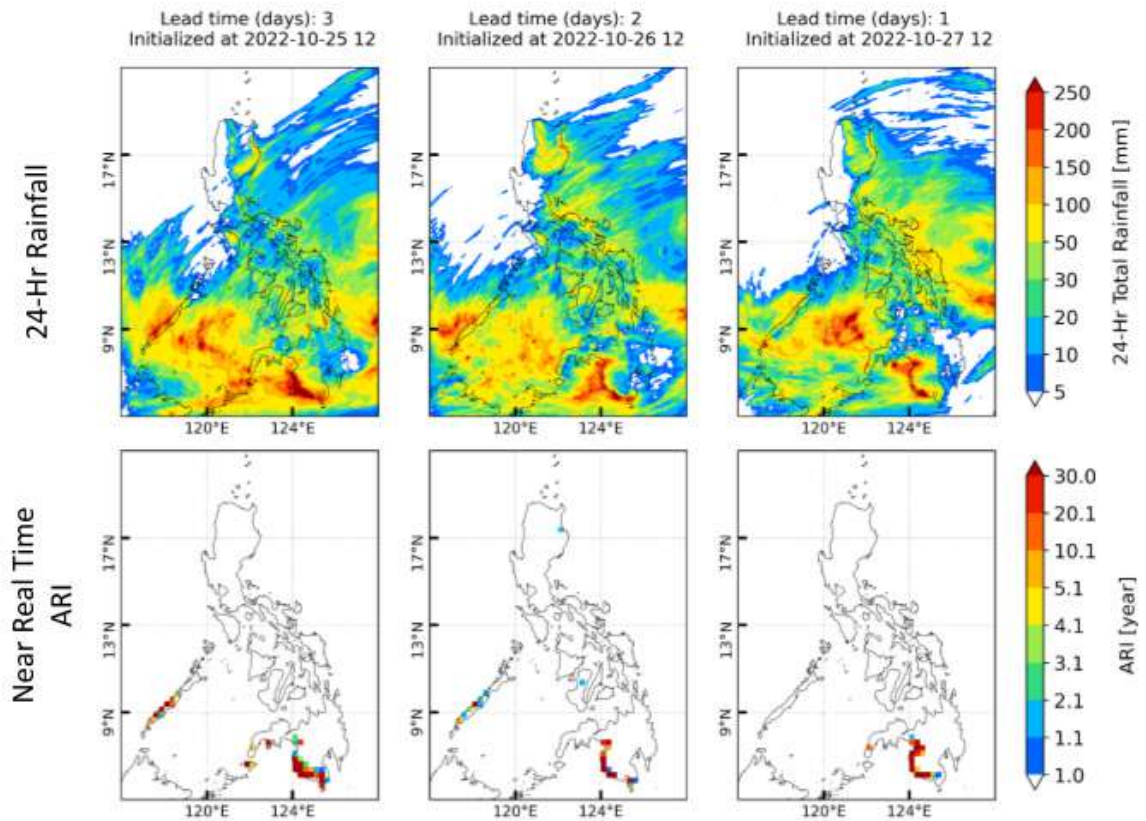
ECW

Under the ECW Project, the RCS Lab continues to develop its capacity in forecasting clean energy (namely for solar and wind) and extreme weather. The automated weather forecast system has been improved. It now includes operational 6-hourly assimilation of observation data from automated weather stations, soundings, buoys, etc., as well as updated land cover (see Panahon website at <https://panahon.observatory.ph>). Furthermore, climate-based indices of temperature and rainfall extremes are being developed to help communicate risk that is reported in the MO extreme weather bulletins (EWB).

SUPREME BARMM

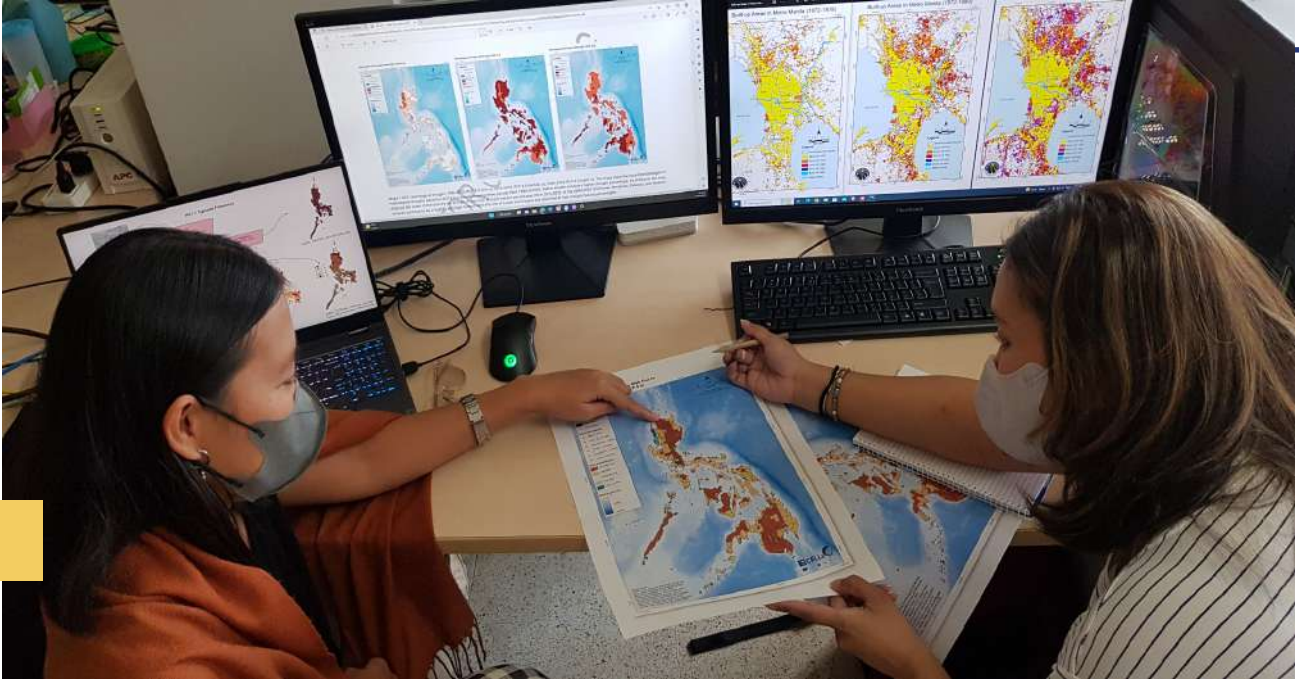
Strengthening Resilience through Early Warning System, Enhanced Anticipatory Actions and Multi-risk Landscape Approach in Bangsamoro Autonomous Region in Muslim Mindanao (SUPREME BARMM) is a two-year initiative that is funded by the European Civil Protection and Humanitarian Aid Operations. Launched in December 2022 and led by Oxfam Philippines, this project “aims to reduce the vulnerability and improve the disaster preparedness and resilience of at-risk communities in the Bangsamoro Autonomous Region in Muslim Mindanao.” MO has been tasked to support this project by leading the development of a multi-risk index (for flood, drought and typhoon) to support anticipatory and humanitarian action for the region.

24-hr WRF Ensemble Forecast of 2022-10-27 20 to 2022-10-28 20 PHT at different lead times



Maps of extreme rainfall forecast highlighting areas of concern based on the Average Recurrence Interval (ARI) for Severe Tropical Storm Nalgae (Paeng) on 27 October 2022 8 pm to 28 October 2022 8 pm PHT.

3.2 Geomatics for Environment and Development



Summary

In 2022, the GED Lab was engaged in four projects, namely: (a) Optimizing the Microsoft Planetary Computer for Emergency Observation and Mapping (GEO MS Project); (b) the incubation of the DEVCalque Framework Technology of Tools, Methods and Services; (c) ASEP-CELLs: Space-Based Decision Support System for Renewable Energy, specifically, the finalization of the Renewable Energy Decision Support System (RE DSS) which led to the generation of 1,103 maps and five peer-reviewed chapter papers; and (d) the conclusion of the ADB TA-9700: Sustaining Climate and Disaster Risk Resilient and Low Carbon Development in South Asia, in particular, the generation of 3,026 maps and four knowledge products for the Climate Risk Screening Decision Support System (CRS DSS).

GEO MS Project

Earth observation technologies and methods are widely applied in emergency observation and mapping. Beginning 1 September 2022, the GEO MS Project converges with the Observatory's mission to strengthen early warning systems through MO's extreme weather bulletins, while serving as a data analysis node for Sentinel Asia (a satellite data network) and building the capacity of project managers for the International Disasters Charter (IDC). Given the prospect of more frequent weather and climate extremes, the project aims to (i) enhance EWBs with GIS-based typhoon and hydrometeorological risk maps, (ii) rationalize and validate specific areas of interest for satellite emergency observation requests, (iii) implement the EO/M protocols on the GEO MS Planetary Computer, (iv) improve RS-GIS methodologies for EO/M, and (v) develop an enhanced EO/M application for end-users and stakeholders.

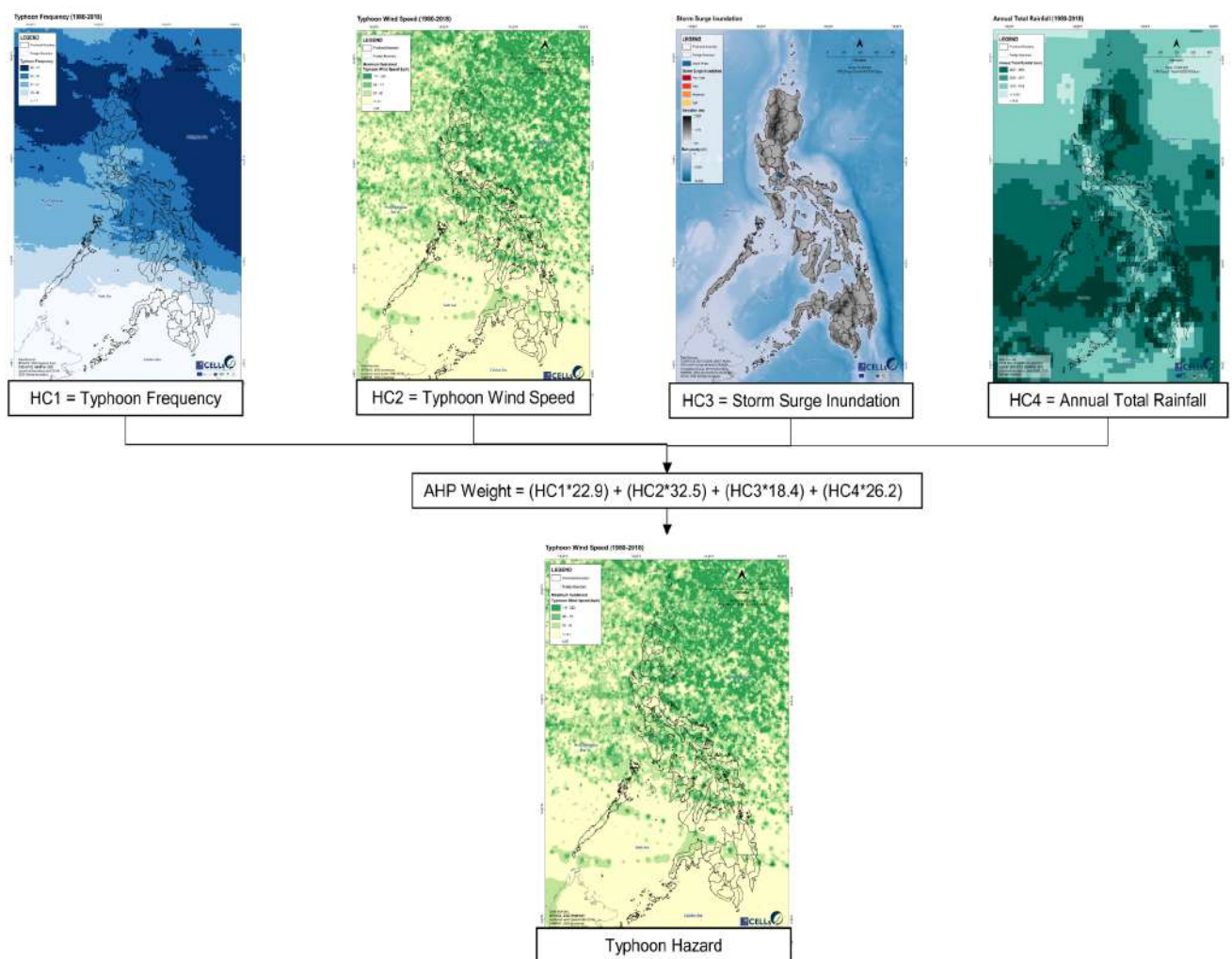
The GEO Initiative that the project is associated with is the GEO Data Access for Risk Management (GEO-DARMA). The research leverages MO's experience in climate and weather-related EO/M, in collaboration with international disaster information-sharing networks and platforms, such as the SA OPTEMIS and IDC Operations System or COS-2. The project also applies a test case based on past EO/M with SA and IDC, specifically Tropical Cyclones (TCs) Goni and Vamco that struck the Philippines in November 2020.

The GEO MS Project is a one-year grant accorded with three years of Azure cloud credits. It aims to use archived spatial datasets from the GEO MS Planetary Computer catalog and cloud-computing platform as well as those received beforehand under an EOR with the SA and other open sources. The project's five work packages include: (i) Enhancement of EO/M workflows, (ii) RS-GIS applications engineering for EO/M, (iii) Optimal automation of the EO/M workflows applying RS-GIS on the GEO MS Planetary Computer, (iv) EO/M simulations, further enhancements, evaluation, and final implementation, (v) capacity-building and outreach.

The outcomes of this project are value-added data, maps and methodologies for climate-vulnerable places in the Philippines, as well as an improved understanding of risks and impacts associated with TCs and their secondary hazards. The systematic and timely provision and analyses of imageries and their effective visualization and communication would lead to better: (i) EWBs, (ii) early warning and emergency protocols, (iii) forecasted and actual impact assessments, (iii) disaster response and recovery, (iv) coping and adaptive strategies, and (v) risk-informed, resilient, and sustainable development planning.

Logistical and staffing needs are provided by the RCS and DSD Labs, and the Xavier University Engineering Research Center (XU ERC). The chosen test cases are TC Goni (Naga City) and Ulysses (Metro Manila, Pampanga River Basin and Cagayan River Basin). EO/M workflows were streamlined from five stages to three, two of which may be automated. The first stage for automation concerns Philippine national to transregional risk-informed EWBs while the third stage for automation is about Areas of Interest (AOIs) for which satellite imageries have been obtained through various providers. The second stage involving any change in the AOI (since TCs are dynamic) is not automated because it concerns human interaction with Sentinel Asia. Ms Jezleer Montajes presented MO's EWB and EO/M Activities at the 12th Asia Oceania Meteorological User Conference on 12 November 2022. To level-off understanding across the different labs, three short courses on RS-GIS, EWBs and Azure resources were given.

A flow diagram of the GEO MS Project is shown below.



The DEVCalque Framework Technology of Space-Based Tools, Methods and Services: Resolving Competing Demands and Priorities toward Resilient and Sustainable Development

Land use/cover planning and development need to be coherent, intersectoral, solution-seeking, transdisciplinary, strategic yet convergent, transformative and timely. For this reason, DEVCalque—a Framework Technology of Space-Based Tools, Methods and Services—was conceived in 2017 and presented in the first Paris Peace Forum on 13 November 2018. It aims to help resolve competing demands on resources and disparate development priorities. Moreover, it intends to propose effective pathways to resilient and sustainable development.

From 6 June to 12 September 2022, DEVCalque was incubated after passing eligibility criteria. This initiative was presented as a Resilience Framework under the project titled “Using a Multi-Hazard and Catchment-Based Approach to Understand and Increase Resilience in Hyper-Expanding Cities in Vietnam and the Philippines.” Collaborative partners for DEVCalque’s gestation included the Alliance for Resilient Urban Southeast Asia (ARUSEA) and the Bridge for Billions. Institutional leadership for the wider project was assumed by the Ateneo de Manila University-Environmental Science Department (ADMU- ES) and the British Geological Survey (BGS), with support from The UK Royal Society and the Global Challenges Research Fund (GCRF).

According to the ARUSEA + Bridge for Billions tool for the incubation of DEVCalque, eight modules were completed with the following outcomes:

- 1 Value Proposition
- 2 Competition Map
- 3 Stakeholder Map
- 4 Social Enterprise Model and Nurturing Proponents
- 5 Costing and Social Enterprise Viability
- 6 Financial Projections
- 7 Impact Plan
- 8 Growth Plan

The intellectual property right for DEVCalque’s concept is currently under discussion with the Ateneo Property Rights Office. Startup and acceleration are being sought from interested co-developers with shared interests.

ASEP-CELLs: RE DSS

In close coordination with the Department of Energy, a principal stakeholder of the ASEP-CELLs project, GED conceptualized and implemented a geomatics-based renewable energy decision support system (RE DSS). Its main research thrusts were to map RE resource availability, site suitability and risk. Risks to affected RE resources, systems and facilities, and communities were mapped.

The resulting RE DSS is supposed to facilitate the transition to greater use of renewables in the country. The application of remote sensing (RS) and geographic information systems (GIS) in developing the RE DSS contributes to the project's primary goals. These targets consist of increasing the share of RE in the Philippine energy mix, promoting energy efficiency, and supporting sustainable development and inclusive growth.

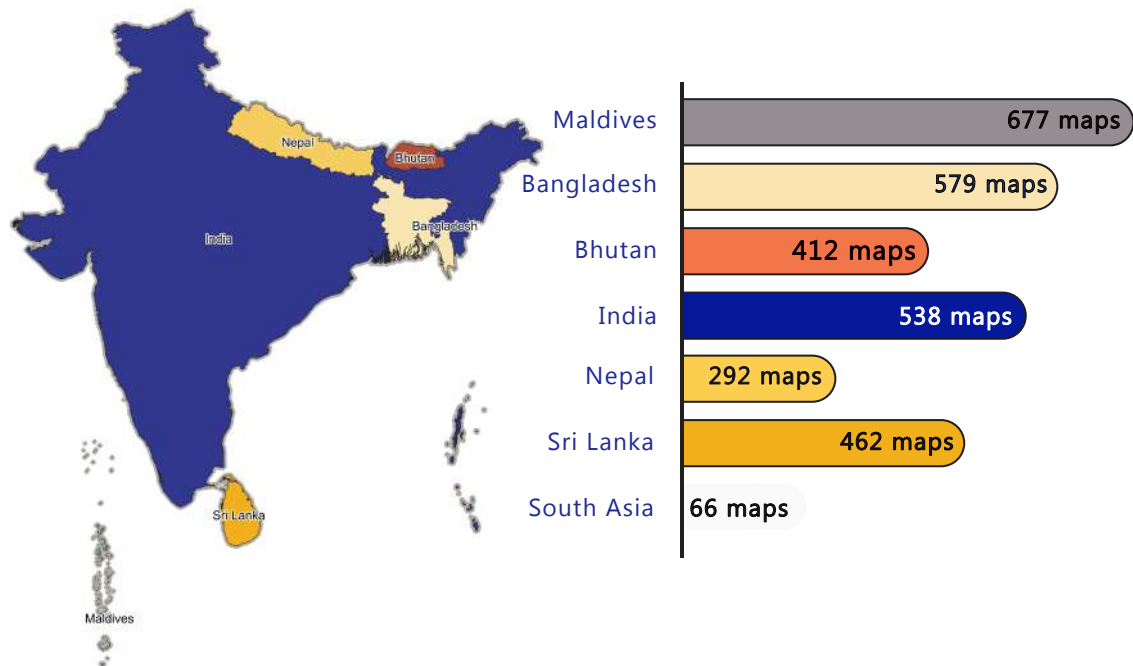
A total of 1,103 maps at the national and regional scales—including a local case study in Naujan, Oriental Mindoro—were finalized in 2022. These maps featured hazard, exposure (such as RE resource availability), vulnerability, risk, site suitability, and climate information. Mapping and spatial analyses were validated through participative and strategic options workshops. Five chapters were peer-reviewed and submitted for the project research compendium, *Promoting Energy Security in the Philippines*. An energy geoportal (of restricted use for now) was also created. An RE Atlas is soon to be published with contributions from MO labs and collabs, and editorial assistance from the Luis A. Yulo Foundation for Sustainable Development.

ADB TA-9700: Sustaining Climate and Disaster Risk Resilient and Low Carbon Development in South Asia (SARD)

The Final RS-GIS Consultant's Report was completed on 30 September 2022. Tasks entailed supporting the SARD Climate Change Team in terms of:

- Hazard, exposure, vulnerability, risk, and impact mapping
- Maps and geodatabases for the SARD Climate and Disaster Risk Resilience Decision Support System
- Mapping Guidelines as a Manual and Quick Reference Guide
- Contributions to reports, briefings, and knowledge products such as atlases and reports

The countries covered were Maldives, Bangladesh, Sri Lanka, India, Nepal, and Bhutan while the regional scope covered South Asia. The total number of maps produced for TA-9700 is 3,026 with the following breakdown:

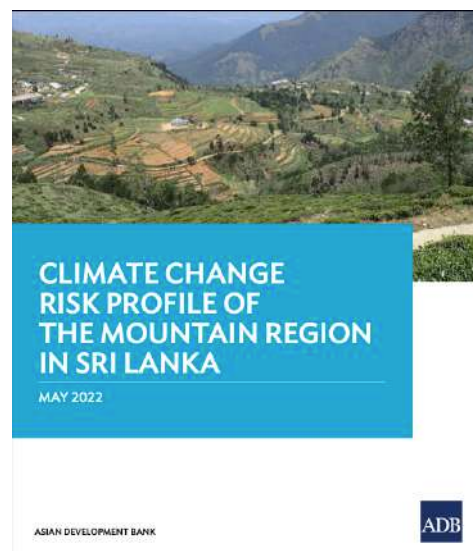


The knowledge products which included maps are:

- Risk atlases for Maldives (five volumes - 510 out of 677 maps completed) and Bangladesh (two volumes - 284 out of 579 maps finalized)
- Sri Lanka Mountain Region (eight and 32 maps for short and long reports, respectively)
- Bangladesh flooding and drought (four maps)

In the previous ADB project TA-8572, mapping hazard, exposure, vulnerability, risk, and impacts was done for Maldives, Sri Lanka, and Bangladesh. In this TA-9700, a total of 677 maps were completed for the Maldives Risk Atlas, out of which 510 were chosen for a five-volume publication. For the two-volume Bangladesh Risk Atlas, 284 out of 579 maps were published.

Future work may include updated and integrated disaster risk screening of ADB investment projects at finer spatial and temporal resolutions.



3.3 Data and Sensor Development

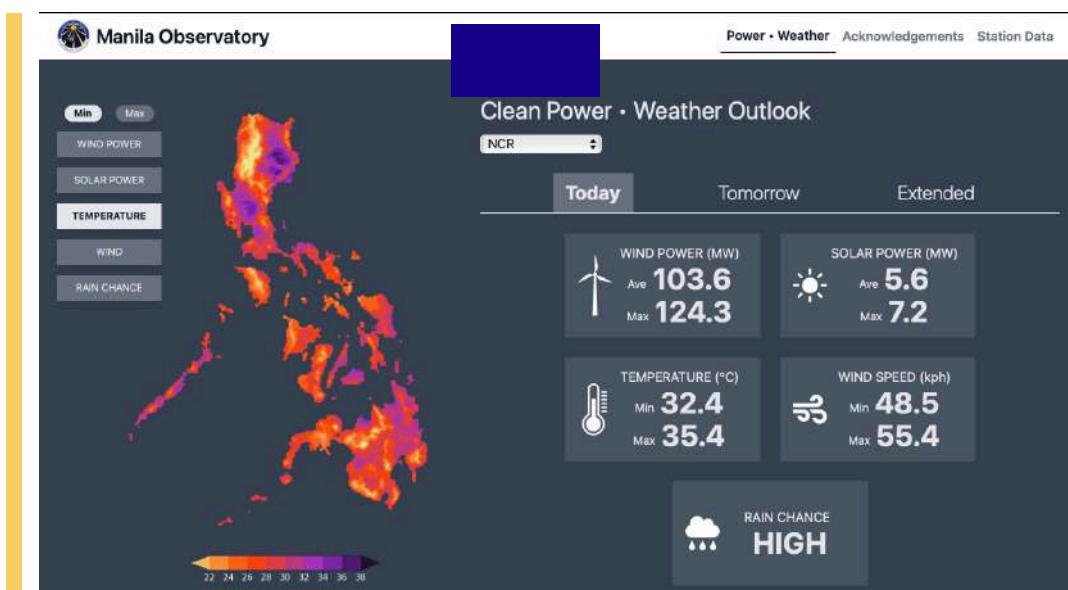
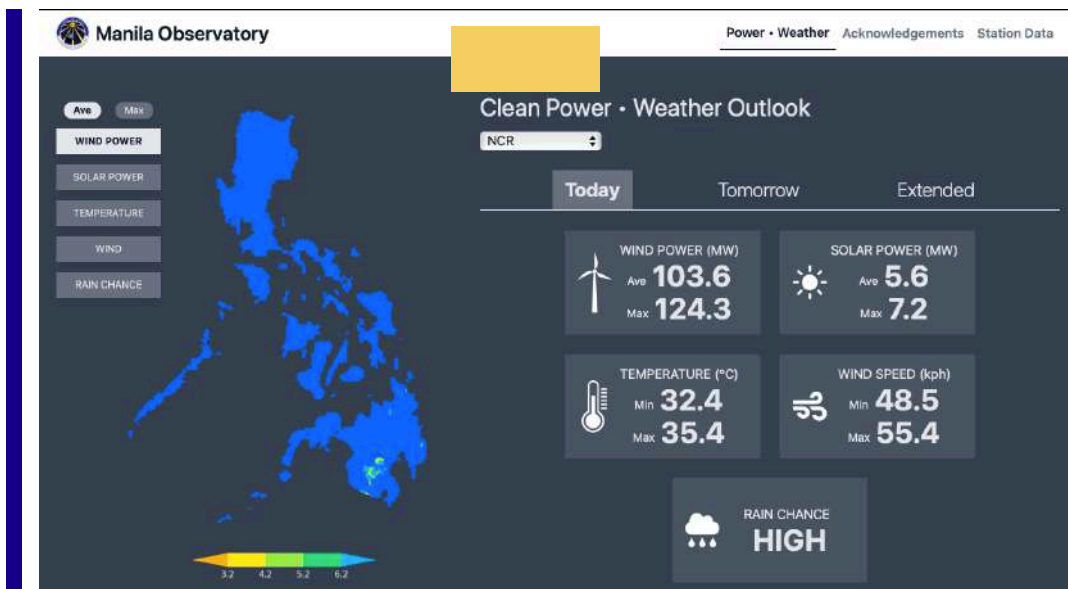


Summary

The DSD Lab continues to work with other MO labs in areas such as weather data compilation and analysis, clean energy resource assessments, renewable energy forecasting, database and computing requirements. It has reconditioned 50 Lufft AWSs and 54 Davis AWSs that are located in various parts in the Philippines. To improve climate and weather model computation performance, node networking tests were done on the three compute servers that are used for daily weather forecasts to determine the necessary conditions for running our servers as a cluster. The database server for weather station data was replaced to increase system reliability. Real-time data from AWSs is now accessible to the public with the update of the Observatory's Panahon website (panahon.observatory.ph). Internal web portals were developed to enable timely system diagnostics for clean energy and weather forecasting.

ECW

DSD continues to recondition MO's weather stations, including those donated by Weather Philippines Foundation (WPF). With the lifting of travel restrictions, reconditioning the AWS network has been much easier in 2022. The Lab undertook maintenance and repair of 50 Lufft AWSs and 54 Davis AWSs installed by MO and its partners. A web portal system has been developed for monitoring the AWS status of the different stations as well as a diagnostics web portal to improve MO's regular clean energy and weather forecasts.



Sample ECW web interface showing wind and temperature conditions from <https://panahon.observatory.ph/>



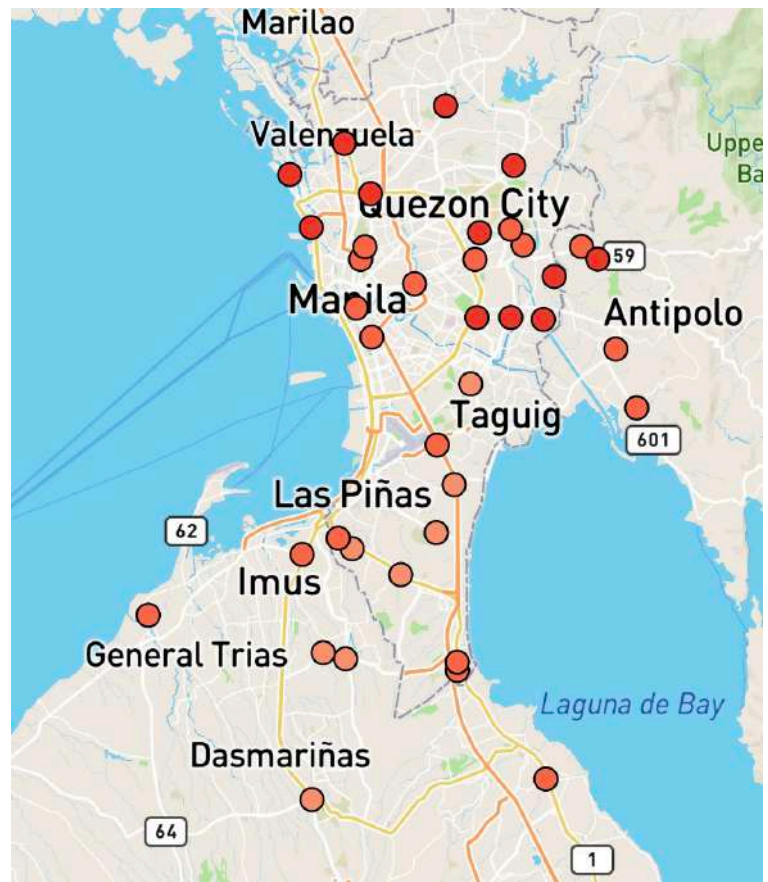
Automated Weather Stations

Lufft and Davis are the two brands of AWS that are currently being used by MO. There are 50 Lufft AWSs that are now operational, 48 of which are located at SM Malls, one in Northwind Bangui (Ilocos Norte), and one at the Canlubang Golf and Country Club.

As for the 54 Davis AWS network, 14 of these are located in Caltex retail stations and have been rehabilitated as part of the Metro Weather Project. There are 28 stations deployed in Pilipinas Shell Foundation Inc. (PSFI) sites, Shell Terminals, and Shell Mobility. Eight of the stations are in Iloilo Province, five in Cagayan de Oro, eight in Davao, one in Trece Martires, and another one in Imus, Cavite for Shell Mobility. There are also three in Masbate, Tagbilaran City, and Iligan City for Shell Terminal sites, and another two in Bombon, Camarines Sur and Pililla, Rizal for PSFI. The other 12 Davis AWSs are deployed in Mirador, MO Davao, Ateneo de Zamboanga, Xavier University, Notre Dame University of Marbel, Nangka in Marikina, Calumpit in Bulacan, St. Francis Xavier of Sigaboy Parish in Davao Oriental, Immaculate Conception Parish of Baganga in Davao Oriental, Iloilo City Hall, and Sta. Barbara Iloilo Municipal Disaster Risk Reduction and Management Office.

As part of the Lab's efforts to involve partners in the regular maintenance of the AWSs, a training session on the operations, basic cleaning, and simple troubleshooting was given on 28 March 2022. This was attended by technical personnel of SM Prime Holdings who are responsible for mall equipment operations. A separate training was also given to the personnel in charge of Shell Terminal sites. In addition to the training, short video guides for troubleshooting specific problems for the AWS are now available.

Xavier University (XU) has been instrumental in reconditioning the AWSs in Cagayan de Oro (CDO) City. They help maintain contact with Shell Mobility stations in CDO and provide maintenance updates. For Iloilo Province, the Iloilo City local government unit has been helpful in reaching out to local Shell Mobility Stations. They have shared special equipment to facilitate the rehabilitation of weather stations. The Lab coordinates with PSFI for contacts and site visits to all Shell Terminal and Shell Mobility stations there.



AWS sites in Greater Manila Area as of 31 December 2022

Computing and Information Systems

Through the support of Oxfam Pilipinas, the ECW Project received a 96-core compute server on 22 June 2022 which increased the computing capacity for running daily clean energy and weather forecasts. Automated model runs have been improved with the diagnostics monitoring web portal to aid modelers in assessing the accuracy of the simulations. The forecasts from these servers are regularly processed and uploaded to the ECW website (<https://panahon.observatory.ph/ecw>).

An additional cloud-based service called Microsoft Azure is now part of the system that MO uses through the MS-GEO Project. Thus, system administration of the cloud service is being provided by the Lab. The database server for weather station data has been transferred to a rack-type server to increase system reliability. The SMS gateway server used by the AWS network is also being transferred to the PhilCom system.

The Panahon website has been ported for progressive web applications to allow web browsers of mobile devices to view the ECW website in smaller screen sizes. A development page for model runs and a station database management page have also been created internally for system evaluation and maintenance.

3.3 Air Quality Dynamics



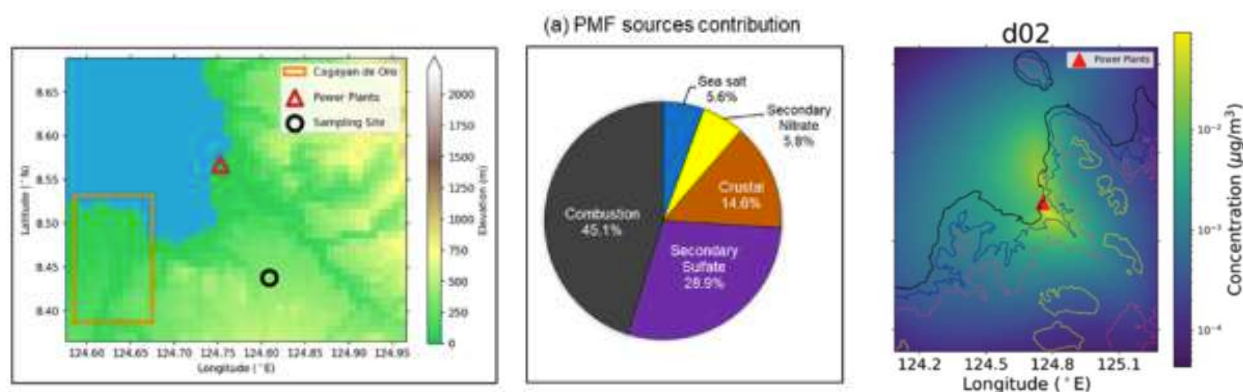
Summary

Measurement activities for two major projects—EU ASEP-CELLs and Cloud, Aerosol and Monsoon Processes Philippines Experiment (CAMP2Ex)—were concluded in 2022. Data analysis and writing of scientific papers continued as a result of these projects and previous ones such as CAMP²Ex Weather and Composition Monitoring (CHECSM), Advanced Institute on Disaster Risk Reduction with Systems Approach for Slow-Onset Climate Disasters (AI-SOCD), and Coastal Cities at Risk in the Philippines (CCARPH). The AQD Lab's involvement in the Health Investigation and Air Sensing for Asian Pollution (Hi-ASAP) initiative and International Global Atmospheric Chemistry-Monsoon Asia and Oceania (IGAC-MANGO) as well as The Acid Deposition Monitoring Network in East Asia (EANET) project also provided significant results and a publication.

This year, the AQD Lab also continued its engagement with the national and local governments as well as nongovernmental institutions through its participation in the Quezon City Air Quality Management Project.

ASEP-CELLS

The air quality portion of the ASEP-CELLS project concluded its activities this year with a presentation of research results to Xavier University partners and Barangay Alae (Bukidnon) Council in a closing ceremony held in April 2022. The AQD Lab's participation in this project is the measurement and characterization of PM_{2.5} downwind of coal-fired power plants in Cagayan de Oro (CDO) to determine the major sources of ambient PM_{2.5} levels and the contribution of these power plants to ambient air. Dispersion modeling was also performed to describe the transport and distribution of air pollutants in the area. From these two major activities, scientific papers for submission to peer-reviewed journals were drafted. The figures below show the sampling site at Barangay Alae in Bukidnon which is about 30 kilometers southeast of the coal-fired power plants along the coast of Macalajar Bay, and the estimated contribution of five potential sources of PM_{2.5} and modeled PM_{2.5} levels in the area.

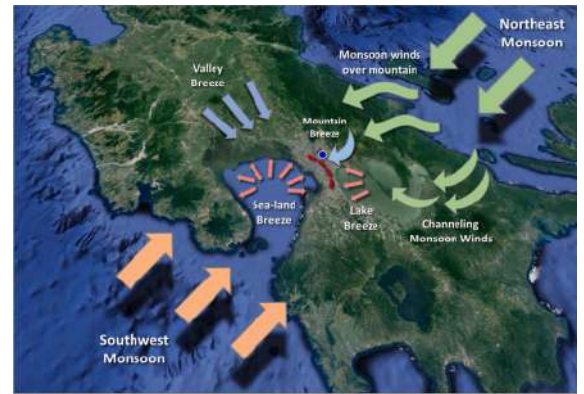


The average PM_{2.5} concentration was $22 \pm 6 \mu\text{g m}^{-3}$. Meteorological data measured at the site show that winds were generally weak ($< 3 \text{ m s}^{-1}$), especially at night. This suggests that sources affecting the PM_{2.5} concentration at the site were likely to be localized rather than influenced by transported aerosols (e.g., from coal-fired power plants in CDO). These results coincide with the simulations from the dispersion modeling which show that most pollutants coming from the coal-fired power plants are concentrated within the vicinity and in nearby coastal areas.

CAMP²Ex

Research results from the Cloud, Aerosol, Monsoon Processes Philippines Experiment (CAMP²Ex) CHECSM ground-based observation field campaign were presented in Pasadena, California at the CAMP²Ex Science Team Meeting in July. These covered potential effects of cirrus clouds on the planetary boundary layer (PBL) height and aerosol loading, and impacts of regional wind circulations on aerosol pollution and the PBL structure.

The latter has been accepted for publication in the journal *Atmospheric Environment*. Figure on the right shows the wind flows that influence the observed and modeled PM_{2.5} concentrations in Metro Manila (Cruz et al., 2023). Researchers from MO and the Ateneo de Manila University also presented the results of their studies at the CAMP²Ex Science Team Meeting in Pasadena, California. In 2022, data analyses investigating the concentration, composition, sources, and fate of air pollution in Metro Manila and Clark, Pampanga were also started.

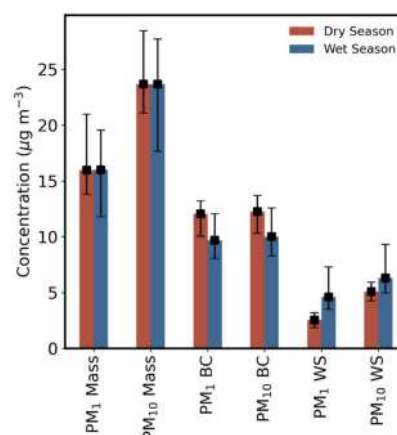


Quezon City Air Quality Management Project

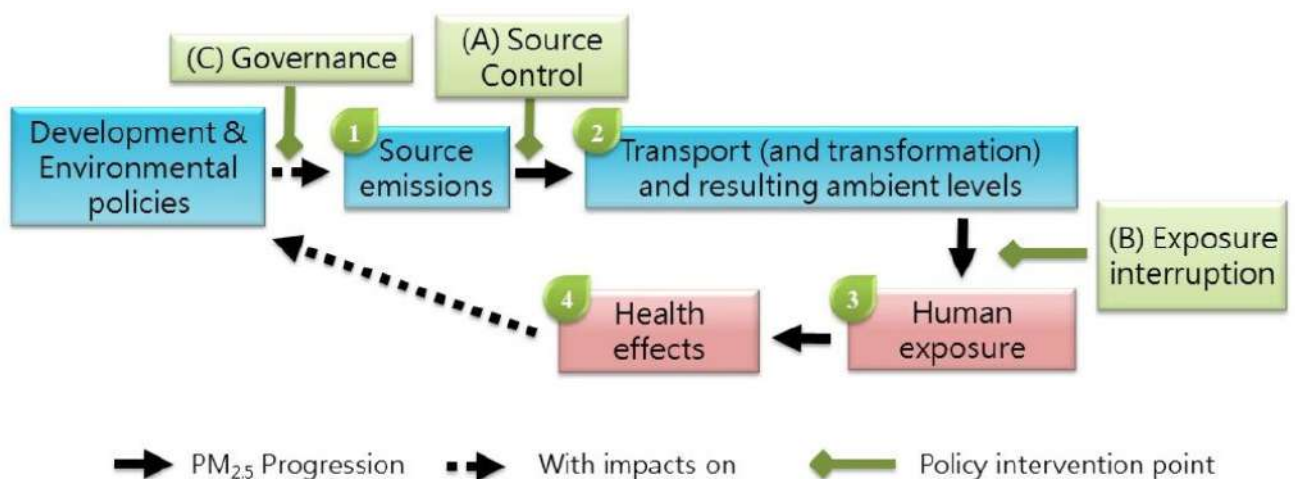
The Quezon City Air Quality Management Project, funded by the QC local government unit (QC LGU) and co-implemented by Clean Air Asia, engaged the AQD Lab in conducting an emissions inventory to strengthen the evidence-based Air Quality Management Plan of the city. The AQD Lab has been tasked to provide technical guidance on the methods, approaches, data preparation and analysis, mapping, and report preparation of the emissions inventory of criteria air pollutants, greenhouse gasses, and short-lived climate pollutants. As part of the city's efforts to improve its air quality, criteria pollutant sensors deployed in 2020-21 continue to be expanded. The QC LGU turns to MO for advice and guidance on the analysis of air quality and meteorological data.

Other research activities

In 2022, the analysis of data collected from completed projects continued. Measurements from the CAMP²Ex weatHER and CompoSition Monitoring (CHECSM) campaign, implemented from July 2018 to October 2019, resulted in a scientific paper (Hilario et al. 2022) that explains why aerosol concentrations in Metro Manila are comparable during the dry and the wet seasons. This seasonal consistency, which is contrary to the present literature as well as to other observations in the region, has been observed as early as the Asian Regional Research Programme on Environmental Technology (ARRPET) project that ran from 2000 to 2008. In addition to inefficient scavenging by short-term rain events, the Figure below shows that opposing seasonal cycles of black carbon and water-soluble particulate matter (PM) contribute to seasonally consistent PM concentration in Metro Manila.



The AQD Lab's work with regional partners, which paved the way for the Advanced Institute on Disaster Risk Reduction with Systems Approach for Slow-Onset Climate Disasters (AI-SOCD) project and the Health Investigation and Air Sensing for Asian Pollution (Hi-ASAP) initiative, also resulted in a paper (Lung et al., 2022) on the research priorities concerning the utilization of low-cost PM_{2.5} sensors in Southeast Asia. The research priority areas that can be addressed by studies using low-cost PM_{2.5} sensors, and the relationship with control policies and measures are shown below. One application of low-cost sensors related to air quality and its health effects was what transpired in the AI-SOCD and Coastal Cities at Risk in the Philippines (CCARPH) projects which analyzed the social and personal health risks of jeepney drivers to PM_{2.5} pollution in Metro Manila. The paper on the results of the characterization of the exposure of jeepney drivers to PM_{2.5} pollution was submitted to *Aerosol and Air Quality Research* on 16 March 2022.



On 22 April 2022, Dr Maria Obiminda Cambaliza received the National Academy of Science and Technology's Environmental Science Award for her work on this study. Lastly, a book chapter (Cambaliza et al.) on the regional and urban air quality in the maritime continent was submitted on 2 October 2022 and has been accepted for publication.

MO is also one of the sampling sites of the Acid Deposition Monitoring Network in East Asia (EANET). In 2022, analysis of the influence of emission sources on rainwater chemistry in Metro Manila, Los Baños, Laguna, and Santo Tomas, Benguet was conducted. Initial results showed that rainwater in the three sites had high neutralization factors, indicating the predominance of alkaline ions over acidic ions.

4

Societal Engagement

4.1 Klima Center



Making Sense of and Responding to Loss and Damage in Southeast Asia is a project awarded by the Stockholm Environment Institute under the second phase of its Strategic Collaborative Fund. This was implemented with project partners Chiang Mai University - School of Public Policy, and The Samdhana Institute.

Through five months of project implementation, Klima led a regional hybrid workshop in Bohol that was attended by around 50 individuals representing nine Southeast Asian countries. This workshop entailed visits to island communities affected by Typhoon Odette and culminated in a set of recommendations on the need for the creation of a Loss and Damage financing facility.

Klima also organized a webinar that discussed the outcomes of the workshop. In the lead-up to COP 27 in Sharm El-Sheikh, Egypt, the project partners released a policy brief on Loss and Damage from the perspective of Southeast Asia.



WHAT IS LOSS AND DAMAGE?

Loss and Damage is the general term that climate negotiators, workers, and advocates use in the context of the United Nations Framework Convention on Climate Change process to refer to consequences of climate change that go beyond what people can adapt to, or when options exist but a community doesn't have the resources to access them.

Source: Bandhari, Preety, N. Warszawski, D. Cogan, and R. Gerholt. "What is Loss and Damage" from *Climate Change? 6 Key Questions Answered*. 6 April 2022. World Resources Institute. <https://www.wri.org/insights/loss-damage-climate-change>

Allied for Climate Transformation

Allied for Climate Transformation 2025 (ACT2025) is a consortium that aims to elevate the voices and priorities of climate-vulnerable countries in UN climate negotiations. As an integral member of this consortium, the Manila Observatory held side events on Loss and Damage at COP 27.

Amid a backdrop of various world crises, people all throughout the world, especially in fragile developing nations, are dealing with the stifling effects of climate change paired with skyrocketing energy and food prices. As MO's policy arm, Klima participated in core partners and technical lead meetings as well as in the launch of ACT2025's Call for Enhanced Implementation.

COP27 in Sharm El-Sheikh, Egypt. MO's Associate Director for Climate Policy and International Relations Dr Antonio Gabriel La Viña (second from left) spoke as a panelist during the launch of the Philippines Country Climate and Development Report by the World Bank.



WE-Defend: Women Environmental Defenders Consortium

As part of the WE-Defend Project, the Manila Observatory through Klima assists women environmental defenders (WEDs) by improving their access to justice. Klima does this through a two-pronged approach: (a) creating a community of practice between scientists and WEDs, and (b) upskilling the case build-up competencies of WEDs.

In the latter part of 2022, Klima drafted a localized environmental and climate action playbook that WEDs can use for their litigation strategies. It covers five issues that WEDs usually face: biodiversity loss and deforestation, cases, development aggression, environmental impact assessments and compliance certificates, and the special writs of kalikasan and mandamus.

The playbook is set to be rolled out to communities and organizations by March 2023.

As one of the recipient institutions of the gender component of the project, MO also participated in the project's gender audit.

OurEnergy2030

Klima acts as chief decision maker and secretariat of OurEnergy2030 (OE2030), which is an energy transition platform led by and for young professionals. It serves as a vehicle for improving the knowledge and capabilities of the next generation of the climate and energy sector. In order to introduce the intricacies of energy transition and develop future university projects, OE2030 organized conferences in Luzon, Visayas, and Mindanao.

By the end of 2022, the PH coal moratorium was still in place but pre-approved coal and gas-fired power plants were still powering through. Paired with ecologically destructive issues like mining and fossil gas, work has yet to be made in the grassroots to ensure support for a truly just transition.

OE2030 will continue to be a tool for capacity building as it develops and gains valuable insights from its work with constituents. The platform will ground its work through targeted initiatives supported by technical help from the Klima Center.



WHAT IS JUST TRANSITION?

Energy transitions are about people: the ones who make the decisions and the ones affected by those decisions.

A Just Transition Approach ensures that the affected people are considered by those making decisions.

Source: <https://www.iisd.org/topics/just-transition>

Climate Justice Capacity Initiative

MO in collaboration with ClientEarth, Foundation for International Law for the Environment (FILE), and a consortium of Ateneo law schools, undertakes to implement the Climate Justice Capacity Initiative (CJCI) to enhance the environmental, energy, and climate law practice in the Philippines through clinical legal education.

The partner clinics capacitate law students by participating in legal activities related to environmental protection and advocacy. It also invites lawyers to take on environment-related issues and concerns.

MO and its partner legal clinics had their second periodic assessment and accomplished the following in September 2022:



Ateneo de Manila University law school students had their onsite immersion at an Aeta community in Bagac, Bataan.

Ateneo De Naga University continued its community engagement activities, as well as conducted legal research on the benefits of the waste-to-energy facility and solar energy as a renewable energy source in Naga City.

Ateneo de Davao University organized a youth leadership and environmental workshop with the Ata Youth in Paquibato. They were also actively involved in the petition for the realignment of the Samal-Davao Bridge.

Ateneo de Zamboanga University conducted a legal caravan with an outreach activity that benefited four adjacent barangays.

Xavier University continues its ridge-river-reef approach.

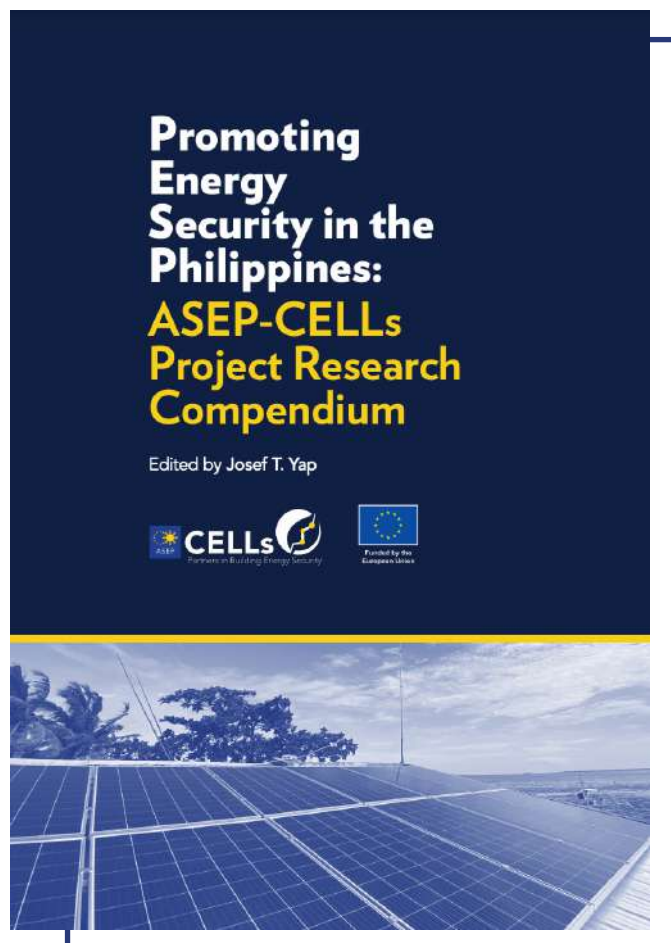
Understanding Local Needs, Endeavoring to Influence International Negotiations—also known as The Samdhana Project—is a project with partner Parabukas and Atty Vicente Yu. Its main goal is to look at current gaps internationally and regionally on Loss and Damage and see how project partners can be of assistance.

With its scientific, technical, and policymaking knowledge, the partners wish to contribute to the Loss and Damage discourse and hopefully influence decision making on the newly established Loss and Damage Fund.

ASEP-CELLs

The ASEP-CELLs Project aimed to mainstream national energy plans into local policies. As a member of the consortium, Klima's role was to serve as the information, education, and communication arm of the project. In 2022, the project partners released a comprehensive research compendium that dealt with renewable energy through the lenses of science, policy, economics, and law.

As part of the overall output for this project (and a collaboration among the laboratories), access to the energy geoportal of the Renewable Energy Atlas remains restricted pending turnover to the Department of Energy.



4.2 Other Engagements

In 2022, the RCS Lab shared the latest updates in climate change research as reported in the IPCC Sixth Assessment Report (AR6) and the Philippine Climate Extremes Report 2020 with different stakeholders, including government, civil society organizations, and the general public (via webinar), to help inform and strengthen the evidence base for climate and disaster resilience planning and action. Insights on co-producing climate information were also shared through webinar series such as “Ang Ating Kwentong Klima” of the Asia Society Philippines and Oscar M. Lopez Center, and “Climate Research ‘As if People Mattered’” of the My Climate Risk (MCR) - Ateneo de Manila University Hub, Ateneo Institute of Sustainability.

The DSD Lab conducted virtual training sessions on the maintenance and troubleshooting of automated weather stations (AWS) for Pilipinas Shell Foundation partners in September 2022. This was for Shell terminal or depot areas where MO’s stations are deployed.

5

Research Publications and Presentations

5.1 Regional Climate Systems

Journal publications

1. Bilang, R.G.J.P., Blanco, A.C., Santos, J.A.S., Olaguera, L.M.P., 2022. Simulation of Urban Heat Island during a High Heat Event Using WRF Urban Canopy Models: A Case Study for Metro Manila. *Atmosphere*, 13(10), 1658. <https://doi.org/10.3390/atmos13101658>
2. Lagare, M.C., Coronel, R., Cruz, F., Narisma, G.T., Villafuerte, M.II, Tibay, J., 2022. Impacts of planetary boundary layer parameterization in RegCM4.7 on the intensity and structure of simulated tropical cyclones over the Philippines. *Climate Dynamics*. <https://doi.org/10.1007/s00382-022-06246-9>
3. Manalo, J.A., Matsumoto, J., Kudzu, M.I., Olaguera, L.M.P., 2022. Diurnal Variability of Urban Heat Island Intensity: A Case Study of Metro Manila, Philippines. *Geogr. Rep. Tokyo Metrop. Univ* 57, 13-22.
4. Ngai, S.T., Juneng, L., Tangang, F., Chung, J.X., Supari, Salimun, E., Cruz, F., et al., 2022. Projected mean and extreme precipitation based on bias corrected simulation outputs of CORDEX Southeast Asia. *Weather and Climate Extremes*. <https://doi.org/10.1016/j.wace.2022.100484>
5. Olaguera, L.M.P., Manalo, J.A., Matsumoto, J., 2022. Influence of boreal summer intraseasonal oscillation on rainfall extremes in the Philippines. *International Journal of Climatology*, 42(9), 4656-4668. <https://doi.org/10.1002/joc.7495>
6. Olaguera, L.M.P., Matsumoto, J., Manalo, J.A., 2022. The contribution of non-tropical cyclone vortices to the rainfall of the Philippines. *International Journal of Climatology*. <https://doi.org/10.1002/joc.7950>
7. Ruane, A.C., ..., F. A. Cruz et al. 2022. The climatic impact-driver framework for assessment of risk-relevant climate information. *Earth's Future*. <https://doi.org/10.1029/2022EF002803>

Book chapters

1. Olaguera, L.M.P., Cruz, F.A.T., Dado, J.M.B., Villarin, J.R.T., 2022. Complexities of Extreme Rainfall in the Philippines. In: Unnikrishnan, A., Tangang, F., Durrheim, R.J. (eds) *Extreme Natural Events*. Springer, Singapore. https://doi.org/10.1007/978-981-19-2511-5_5
2. Tangang, F., Chung, J.X., Cruz, F., Santisirisomboon, J., Ngo-Duc, T., Juneng, L., Salimun, E., Narisma, G., Dado, J., et al., 2022. CORDEX Southeast Asia: Providing Regional Climate Change Information for Enabling Adaptation. In: Unnikrishnan, A., Tangang, F., Durrheim, R.J. (eds) *Extreme Natural Events*. Springer, Singapore. https://doi.org/10.1007/978-981-19-2511-5_1

Conference presentations

1. Climate Change Education: Collective Initiatives and Efforts for Our Earth, online, 23-24 February 2022, F. Cruz (Keynote Speaker)
2. 2022 Asia Pacific Science and Technology Conference for Disaster Risk Reduction, Manila, Philippines, 7-8 April 2022, F. Cruz (Presenter)
3. 19th Annual Meeting of the Asia Oceania Geosciences Society (AOGS2022 Virtual), 1-5 Aug 2022, “Performance evaluation of high-resolution simulations over Mindanao”, J.M. Dado (Presenter)
4. 2nd Vietnam Conference on Earth and Environmental Sciences (VCEES), Quy Nhon, Vietnam, 7-11 August 2022
 - Oral Presentation: “High-resolution climate information for Mindanao: Projections from CORDEX Southeast Asia Phase 2”, J.M. Dado
 - Oral Presentation: “Projecting future hydropower potential in the Philippines”, F.A. Cruz
 - Oral Presentation: “Characterizing wind energy sources for wind turbine designs over Mindanao Island, Philippines, L. Kosca
5. SPP2022 (Special session to honor Dr. Gemma Narisma), Legazpi City, Albay, 19-21 October 2022, J. Dado (Invited Speaker)
6. DOST PCIEERD Innovate Pinas, online, 21 October 2022, F. Cruz (Presenter)
7. CORDEX Southeast Asia Workshop: Regional Climate Downscaling and Applications, Bangkok, Thailand, 8-9 November 2022
 - Oral Presentation: “High-resolution climate information for Mindanao: results from CORDEX SEA Phase 2”, J.M. Dado
 - Oral Presentation: “Climate information to support shift to renewable energy in the Philippines”, D. Loqueloque and E. Pillas
 - Oral Presentation: “Bias adjusted climate data for climate risk assessment”, E. Gozo
 - Oral Presentation: “Process-based analysis of the impacts of sea surface temperature on climate in CORDEX-SEA simulations”, A. Magnaye
8. UNFCCC 27th Conference of Parties, Sharm El-Sheikh, Egypt, 6-18 November 2022, R. Perez and F. Cruz (Technical Advisers to the Philippine Delegation)
9. 11th National Panel of Technical Experts (NPTE) Forum, Quezon City, Philippines, 23 November 2022, F. Cruz (Resource Speaker)

5.2 Geomatics for Environment and Development

Technical reports

1. Remote Sensing and Geographical Information System (RS-GIS) Specialist: Final Consultant's Report. 13 March 2019 to 30 September 2022. Version 1.7. Asian Development Bank South Asia Department (SARD), TA 9700-REG: Sustaining Climate and Disaster Risk Resilient and Low Carbon Development in South Asia.
2. Review and Enhancement of Maps. May 2022. Climate Change Risk Profile of the Mountain Region in Sri Lanka.

Book chapters

In Isles, J.R., Yap, J.T., eds. 16 May 2022. Promoting Energy Security in the Philippines: ASEP-CELLs Project Research Compendium. The European Union.

1. Austria, R.V., Familiar, A.D.F., Muzones, D.M., Reyes, S.R.C., and Vicente, M.C.T.M. 2022. Chapter 34: Mapping Risks to Renewable Energy: A Value-Added Feature of a Space-Based Decision Support System. p. 571.
2. Biguerras, M.G., Dimain, M.R.S., Montajes, J.T., Reyes, S.R.C., and Vicente M.C.T.M. 2022. Chapter 35: State of Hydropower in the Philippines: Key Issues and Challenges in Harnessing the Power of Water. p. 604.
3. Agad, A.G., Jacela, J.D., Reyes, S.R.C., and Vicente, M.C.T.M. 2022. Chapter 36: Resource and Associated Risks of Wind Energy in the Philippines: A Review of Existing Literature. p. 644.
4. Familiar, A.D.F., Reyes, S.R.C., Sebastian, A.V.C., and Vicente, M.C.T.M. 2022. Chapter 37: Mapping Biomass Resource, Biomass Power Plants Site Suitability, and Associated Risks. p. 689
5. Montajes, J.T., Palicpic, J.M.M., Reyes, S.R.C., Vicente M.C.T.M., Loqueloque, D., Cruz, Faye A.T., and Abundo, M.L.S. 2022. Chapter 38: Mapping the Resource, the Associated Risks and Suitable Sites for Land- and Water-Based Solar Power Plantations in the Philippines. p. 715.

5.3 Air Quality Dynamics

Journal publications

1. Lung, S.-C.C.; Thi Hien, T.; Cambaliza, M.O.L.; Hlaing, O.M.T.; Oanh, N.T.K. ; Latif, M.T.; Lestari, P.; Salam, A.; Lee, S.-Y.; Wang, W.-C.V.; et al. (2022). Research Priorities of Applying Low-Cost PM2.5 Sensors in Southeast Asian Countries. *Int. J. Environ. Res. Public Health*, 19, 1522. <https://doi.org/10.3390/ijerph19031522>
2. Hilario, M. R. A., Bañaga, P. A., Betito, G., Braun, R. A., Cambaliza, M. O., Cruz, M. T., Lorenzo, G. R., MacDonald, A. B., Pabroa, P. C., Simpas, J. B., Stahl, C., Yee, J. R., & Sorooshian, A. (2022). Stubborn aerosol: why particulate mass concentrations do not drop during the wet season in Metro Manila, Philippines. *Environ. Sci.: Atmos.*, 2, 1428-1437. <https://doi.org/10.1039/d2ea00073c>

Technical report

New Year's Eve 2022 Particle Pollution Measurements in Metro Manila. <https://www.observatory.ph/2022/03/29/new-years-eve-2022-particle-pollution-measurements-in-metro-manila/>

Conference presentations

1. Webinar on Acid Deposition, 18 June 2022, "Air Quality and Acid Deposition", Oral presentation by Dr. Maria Obiminda L. Cambaliza and Zenn Marie Cainglet
2. CAMP2Ex Science Team Meeting, 12-14 July 2022
 - Oral Presentation: "Impacts of regional wind circulations on aerosol pollution and planetary boundary layer structure in Metro Manila, Philippines", Cruz, M.T., et al.
 - Oral Presentation: "Potential Effects of Cirrus Cloud on PBL Height and Aerosol Loading in Metro Manila using Ground-Based High Spectral Resolution Lidar", Visaga, S. M., et al.
 - Oral Presentation: "Manila Observatory (MO) CHECSM Site", Cambaliza, M.O.L., et al.
3. Department of Environment and Natural Resources (DENR) Multistakeholder Forum, 5-7 October 2022, Oral presentation by Dr. Maria Obiminda L. Cambaliza
4. APN Training, 19 October 2022, "PBLH and wind effects on diurnal PM2.5 surface concentrations in Metro Manila during CAMP2Ex Weather and CompoSition Monitoring 2019", Oral presentation by Shane Marie Visaga

5. Pandora Asia Network (PAN) and Airborne and Satellite Investigation of Asian Air Quality (ASIA-AQ) Meetings, November 2022, “Air Quality Studies at the Manila Observatory”, Oral presentation by Dr. James Bernard B. Simpas
6. Asia Summit on Global Environmental Measurement & Monitoring (GEMM Asia), 5-6 December 2022, “Air Quality Studies in Metro Manila, Philippines”, Oral presentation by Dr. Melliza T. Cruz
7. American Geophysical Union (AGU) Fall Meeting, 12-16 December 2022

Poster Presentation: “Impacts of regional wind circulations on aerosol pollution and planetary boundary layer structure in Metro Manila, Philippines”, Cruz, M.T., et al.

Poster Presentation: “Potential Effects of Cirrus Cloud on PBL Height and Aerosol Loading in Metro Manila using Ground-Based High Spectral Resolution Lidar”, Visaga, S. M., et al.

Trainings attended

1. APN Training Workshop For Air Pollutants Measurement Using Satellite, 21-25 March 2022, Attended by Shane Marie Visaga
2. APN Training Workshop On Data Interpretation Combining Satellite And Ground-Level Observations In The Asian Monsoon Region, 17-20 October 2022, Attended by Shane Marie Visaga and Dr. Maria Obiminda L. Cambaliza
3. Health Investigation and Air Sensing for Asian Pollution (Hi-ASAP) Training Workshop, 5-7 December 2022, Attended by Dr. Maria Obiminda L. Cambaliza

Award received

The National Academy of Science and Technology (NAST) Environmental Science Award was given to Dr Maria Obiminda L Cambaliza for her paper titled, “Spatiotemporal Assessment of PM_{2.5} Exposure of a High-risk Occupation Group in a Southeast Asian Megacity”. This study made use of results from the Advanced Institute on Disaster Risk Reduction with Systems Approach for Slow-Onset Climate Disasters (AI-SOCD) and Coastal Cities at Risk in the Philippines (CCARPH) projects.

5.4 Klima

Journal publications

1. Which Social Justice?: Situating the Philippine Legal Concept of Social Justice Within Just Transition Research Collaborative's Analytical Framework *Journal of Global South Studies* Volume 39, No 2, pp 402-430, Nov 2022. <https://journals.upress.ufl.edu/JGSS/article/view/2021>
2. Making space for just transition in climate change legal instruments: Philippine Nationally Determined Contributions from Paris to Glasgow, and beyond. *Asia Pacific Journal of Environmental Law* Volume 25, No 1, pp 77-99, Oct 2022

Technical report

Jamero, M. L., Vicente, M.C., Cruz, F., Perez, R., Dela Paz, M.A., Dimain, M.R., and Gozo, E. Bataan Province Risk Profile. CDRA Coaching and Mentoring Project, March 2022.

Book chapter

Anthropocene, Capitalocene, and climate change. A.G.M. La Vina and J.J.M. Reyes. *The Routledge Handbook of Global Development*. Routledge, 2022. eBook ISBN: 9781003017653

Public statement

M. Adow, P. Bandhari, M. Bynoe, S. Huq, F. Hussein, A. Jenkins, M. Khan, T. La Viña, M.L. Gonzalez, J. Nichols, C. Okereke, Y.G.M. Paras, J.J. Reyes, M.L.R. Vallejo, C. Thangata, and N. Warszawski, ACT2025 Alliance Statement 2022: A Call for Enhanced Implementation at COP27 and Beyond, October 2022. Available at <https://files.wri.org/d8/s3fs-public/2022-10/act-2025-alliance-statement-2022.pdf>

Policy brief

A. La Viña, J. Reyes, M.L. Jamero, L. Batino, W. Chaiyapa, B. Inthapat, N.J.J. Sacramento, and J. Jamisolamin, *Loss and Damage: Perspectives from Southeast Asia*, November 2022. Available at https://www.observatory.ph/wp-content/uploads/2022/12/Policy-brief_Loss-and-Damage_ManilaObservatory.pdf

MARIANO A

31 December 1920 -

IN MEMORIAM
2022

ESTOQUE PhD

10 January 2022

Former supervisor,
Regional Climate Modeling Group



“I have come full circle.”

Doc Estoque, at the turn of the 21st century, upon his return to the Manila Observatory where he first worked as a young weather observer

Acknowledgments

We are truly grateful to our partners and benefactors for their generous support of our work as an environmental observatory that shares in the urgent mission to care for our common home

AC Energy Corporation
Alphaland Corporation
ARISE Philippines
The Asia Foundation
Asian Development Bank
Ateneo de Davao University
Ateneo de Manila University
Ateneo de Naga University
Ateneo de Zamboanga University
Ayala Corporation
Bank of the Philippine Islands
Bureau of Soils and Water Management
Chiang Mai University
ClientEarth
CORDEX Southeast Asia
Department of Environment and Natural Resources
Department of Science and Technology
European Union
Group on Earth Observations
La Filipina Uy Gongco Corporation
Meralco
Metro Pacific Investments Corporation
Mines and Geosciences Bureau
National Mapping and Resources Information Authority
National Resilience Council
Oxfam
Philippine Atmospheric, Geophysical and Astronomical Services Administration
Philippine Institute of Volcanology and Seismology
Pilipinas Shell Foundation Inc
PLDT Inc
The Samdhana Institute
San Miguel Corporation
Sentinel Asia
SM Supermalls
TARA Climate Foundation
Tokyo Metropolitan University
University of Colorado Boulder
US Embassy - Manila, Philippines
World Resources Institute

List of acronyms

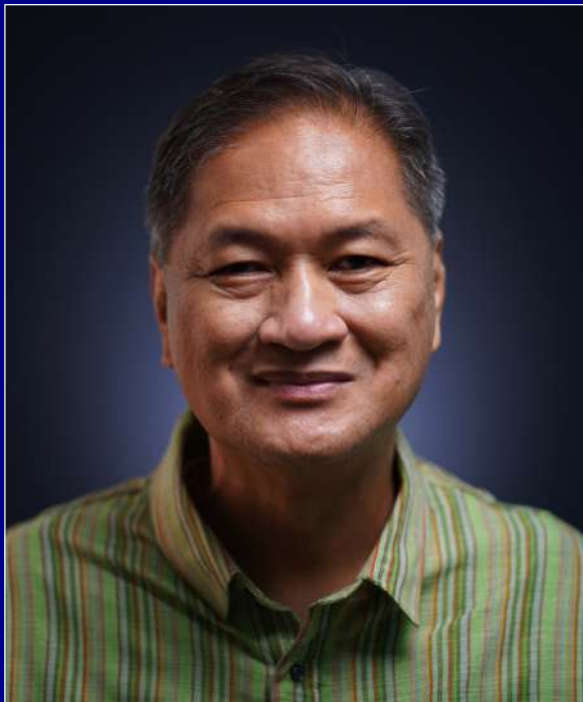
ACT2025	Allied for Climate Transformation by 2025
AI-SOCD	Advanced Institute on Disaster Risk Reduction with Systems Approach for Slow – Onset Climate Disasters
AWS	Automated Weather Station
AdDU	Ateneo de Davao University
AdMU	Ateneo de Manila University
AdZU	Ateneo de Zamboanga University
ASEP-CELLs	Access to Sustainable Energy Program - Clean Energy Living Laboratories
CAMP2Ex	Cloud, Aerosol and Monsoon Processes Philippines Experiment
CCARPH	Coastal Cities At Risk in the Philippines
CHECSM	CAMP2Ex weatHEr and CompoSition Monitoring
COP27	Conference of Parties - 27th United Nations Climate Change
CORDEX-SEA	Coordinated Regional Downscaling Experiment - Southeast Asia
CRS DSS	Climate Risk Screening Decision Support System
EANET	Acid Deposition Monitoring Network in East Asia
EO/M	Emergency Observation and Mapping
EWB	Extreme Weather Bulletin
FILE	Foundation for International Law for the Environment
GEO MS	Group on Earth Observations - Microsoft
HEV	Hazard, Exposure, Vulnerability
Hi-ASAP	Health Investigation and Air Sensing for Asian Pollution
IGAC-MANGO	International Global Atmospheric Chemistry - Monsoon Asia and Oceania Networking Group
NAST	National Academy of Science and Technology
OE2030	Our Energy 2030
PM	Particulate Matter
RE	Renewable Energy
RS-GIS	Remote Sensing - Geospatial Information System
SARD (ADB)	South Asia Department (Asian Development Bank)
SUPREME BARMM	Strengthening Resilience through Early Warning System, Enhanced Anticipatory Actions and Multirisk Landscape Approach in Bangsamoro Autonomous Region in Muslim Mindanao
UNFCCC	United Nations Framework Convention on Climate Change
WED	Women Environment Defenders
WRI	World Resources Institute
XU-AdC	Xavier University - Ateneo de Cagayan

Research Heads



JOSE RAMON T VILLARIN SJ PhD
Executive Director

Jose Ramon Villarín SJ is Executive Director of the Manila Observatory. He holds a PhD in Atmospheric Sciences from Georgia Tech, an MS in Physics from Marquette University, and BS in Physics from Ateneo de Manila. His past commitments include serving as president of the Ateneo de Manila University and Xavier University. He was a member of the National Panel of Technical Experts of the Climate Change Commission of the Philippines and of the Intergovernmental Panel on Climate Change. He was a lead reviewer of greenhouse gas inventories for the UN Framework Convention on Climate Change and a member of the UN Consultative Group of Experts for developing countries. He is coordinating lead author of "The 2016 Philippine Climate Change Assessment: The Physical Science Basis" that was written with several Filipino scientists to assess the state of climate science in the country.



ANTONIO GABRIEL M LA VIÑA JSD
Associate Director for Climate Policy and International Relations
Head, Klima Center

Dr Antonio Gabriel La Viña is Associate Director for Climate Policy and International Relations of the Manila Observatory, and Chair of the Jurisprudence and Legal Philosophy Department of the Philippine Judicial Academy of the Philippine Supreme Court. He is an adjunct faculty member of the Departments of Environmental Science, Political Science, and Philosophy of the Ateneo de Manila University. He also teaches in several law schools in Manila and Mindanao. He obtained his LLM and JSD degrees from Yale University and his first degrees in philosophy and law from Ateneo de Manila University and the University of the Philippines respectively. He served as dean of the Ateneo School of Government and undersecretary of the Philippines' Department of Environment and Natural Resources, and was a Senior Fellow and Program Director of the World Resources Institute.



MAY CELINE THELMA M VICENTE PhD
Head, Geomatics for Environment and Development
Laboratory

Dr May Celine Thelma Vicente has worked with international organizations, multilateral development institutions, national and local government agencies, humanitarian entities, academic and research institutes, and public-private partnerships for over 30 years. Dr Vicente is also a part-time faculty member of Ateneo de Manila University's Environmental Science Department. She has a PhD in Human, Economic and Regional Geography from the Université de Paris X-Nanterre. She received a Diplôme d'Études Supérieures Spécialisées in Remote Sensing: Methods and Applications. She obtained an MSc in Human Settlements Development and a Certificate in Remote Sensing (with honors) from the Asian Institute of Technology in Thailand. Dr Vicente graduated with a BSc in Architecture (cum laude) from the University of the Philippines.



SHERDON NIÑO Y UY PhD
Head, Data and Sensor Development Laboratory

Dr Sherdon Niño Uy is a research scientist and head of the Data and Sensor Development Lab of the Manila Observatory. As a scholar under the DOST-Newton Agham Programme, he obtained his PhD from Birmingham City University where he worked on offshore wind resource assessment methods for the Philippines using numerical weather prediction and computational fluid dynamics models. He was part of the Knowledge-based Engineering Laboratory of BCU where he assisted undergraduate students with their robotics and system automation projects. He obtained his MSc in Physics and BSc in Physics with Computer Engineering from the Ateneo de Manila University. Currently, he is the project coordinator of the High-Definition Clean Energy, Climate, and Weather Forecasts (ECW) Project. His research interests are in the fields of instrumentation and renewable energy.



JAMES BERNARD B SIMPAS PhD
Head, Air Quality Dynamics Laboratory

Dr James Bernard Simpas is head of the Air Quality Dynamics Lab of the Manila Observatory. He also teaches Physics and Atmospheric Sciences at the Ateneo de Manila University. He is the founder and present coordinator of the Master of Science in Atmospheric Science program of the University. He has a PhD in Meteorology from the Pennsylvania State University and has been with the faculty of the Ateneo since graduating with a BSc in Physics in 1985. His present research is on the monitoring and analysis of atmospheric hazards (i.e. air pollution, extreme weather events, etc) to mitigate disaster risk and improve resilience and public health. Toward this end, he has led a number of international scientific campaigns (e.g. NASA CAMP2Ex, US NRL 7SEAS, etc.) as the Philippine principal investigator or project manager.



FAYE ABIGAIL T CRUZ PhD
Head, Regional Climate Systems Laboratory

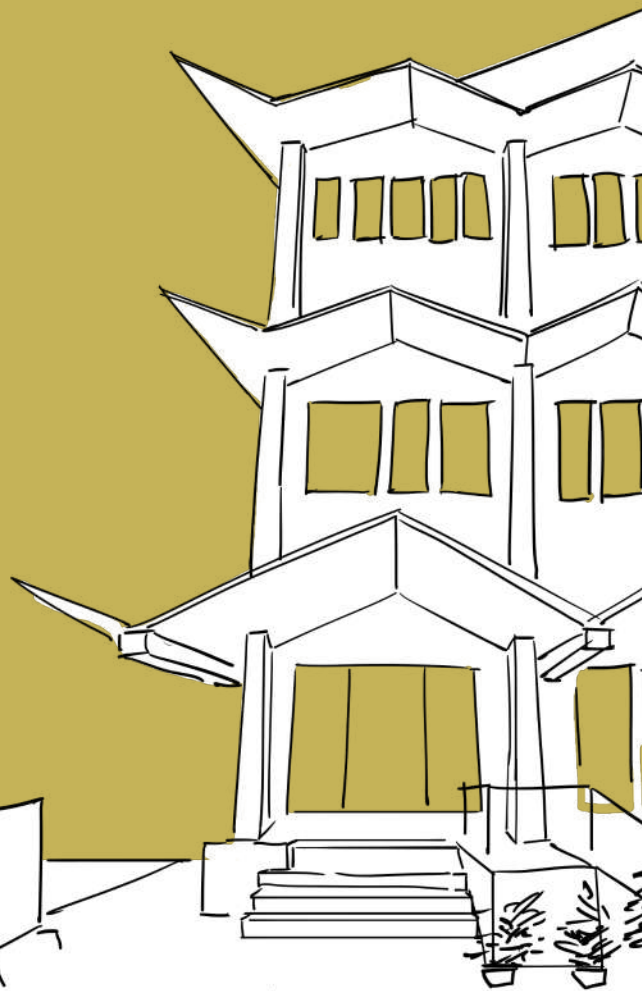
Dr Faye Abigail Cruz is head of the Regional Climate Systems Lab of the Manila Observatory. She obtained her PhD in Climate Science from the University of New South Wales, and her MSc and BSc in Physics from the Ateneo de Manila University. She was also an International Research Fellow of the Japan Society for the Promotion of Science. She is actively involved in atmospheric and climate research in the Philippines and in Southeast Asia, and is a core member of the Southeast Asia Regional Climate Downscaling/Coordinated Regional Climate Downscaling Experiment Southeast Asia Project, which aims to provide finer resolution climate change information for the region. She was a Lead Author in the IPCC AR6 Climate Change 2021: The Physical Science Basis, and a contributing author to the 2016 Philippine Climate Change Assessment: The Physical Science Basis, and the Philippine Climate Extremes Report 2020.

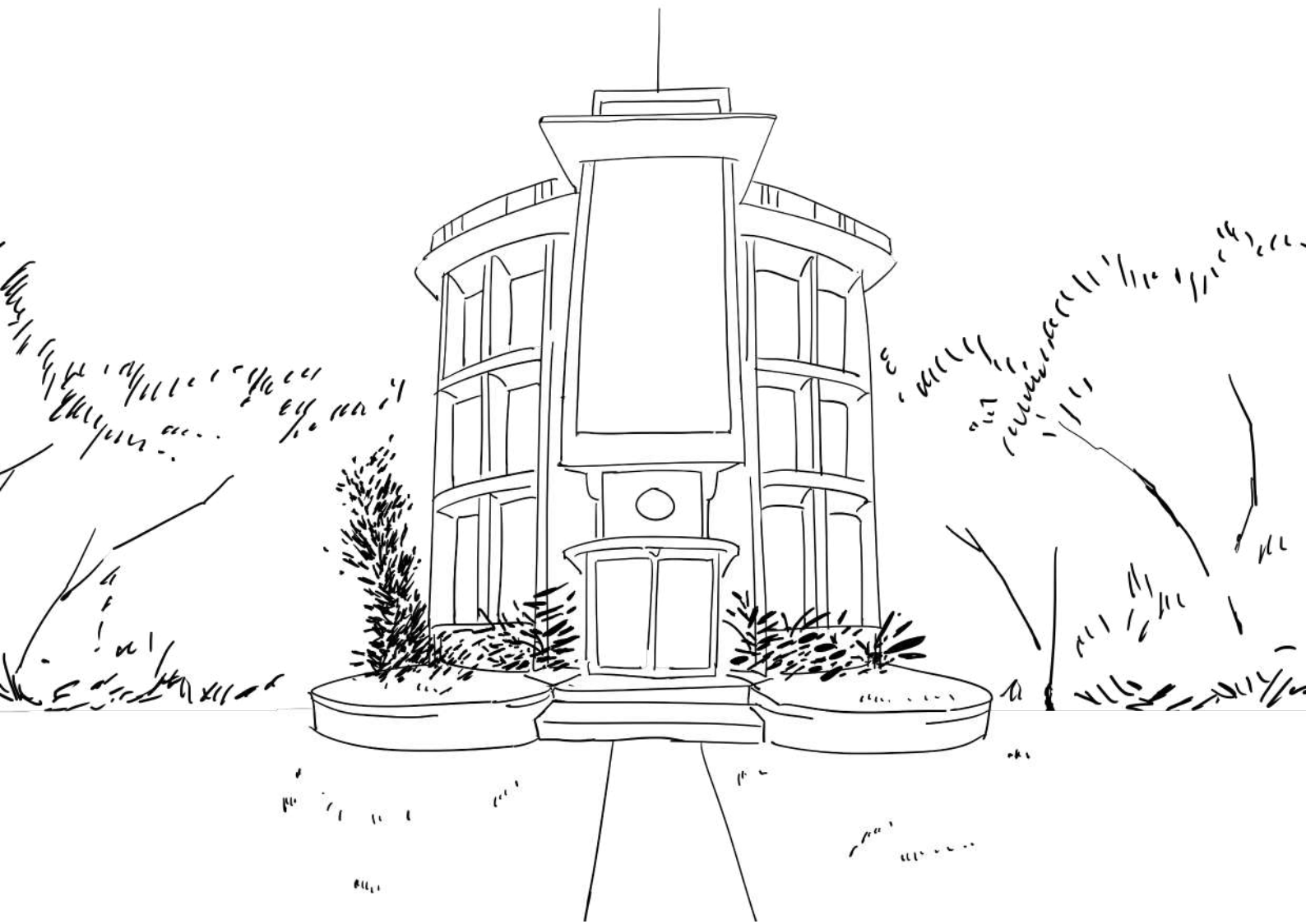
Who we are

The Manila Observatory is a research institution that does science to empower communities to take up the urgent challenges of sustainable development and disaster risk resilience. Established in 1865 under the auspices of the Jesuit mission in the Philippines, the Observatory was the official meteorological and seismological agency of the Philippines until operations were handed over to the Philippine government in the aftermath of World War II. Since then, as a nonprofit institution, it has been bringing science to bear on various environmental concerns.

These days, the Observatory has been deploying the atmospheric and earth sciences, remote sensing technologies, the instrumentation and data sciences to help communities respond to the climate emergency.

Knowing science to be essential but not enough, the Observatory has collaboratories working in climate policy and practice that connect the scientific work of its laboratories to the needs of society.





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