2024 CCRS seminar summary

1. **Date: 16th Jan 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Chen Schwartz (CCRS)
Topic: ***Biases of simulated tropical-extratropical teleconnections in subseasonal-to-seasonal (S2S) models***
Abstract: *To explore the simulated troposphere-stratosphere coupling in the models, we use outputs from models that participate in the WWRP/WCRP S2S Prediction Project and investigate how this simulated coupling might be related to the MJO-stratosphere teleconnection. A key ingredient for the linkage between tropical convection and stratospheric variability are extratropical large-scale stationary waves both in the troposphere and stratosphere. In our work, the biases of the simulated stationary waves in the S2S models are examined, including the relevance of the biases to troposphere-stratosphere upward coupling and the potential contributions from biases in the time-mean tropical convection.*
Bio: *Chen Schwartz is a research scientist in the Seasonal and Subseasonal branch at CCRS. He is completing his PhD in Atmospheric Science from the Hebrew University of Jerusalem (HUJI). His research focuses on the representation of tropical-extratropical teleconnections in S2S models, as well as idealized models that aim to link tropical convection to interannual stratospheric variability. Chen also holds a master's degree at HUJI and worked on the observed link between the MJO and sudden stratospheric warmings. At CCRS, Chen's work is focused on the representation of MJO-related rainfall over Southeast Asia, both in observations and hindcasts from S2S models.*

2. **Date: 30th Jan 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Rachel Koh (CCRS)
Topic: ***Weather, reservoirs and power systems: Connecting the dots***
Abstract: *With increasing emphasis on sustainable development, it is essential to explore solutions beyond conventional practices to support decision-making and ensure that resources can be better utilized. This is especially true for large-scale infrastructure, in particular, ones that: require heavy investments, are subjected to multiple sources of uncertainty, and can potentially affect human lives. In this seminar, we discuss two real-world case studies based in Southeast Asia. First, we assess the climate risks of a water supply utility in Thailand. Using a modified version of the Collaborative Risk Informed Decision Analysis (CRIDA) framework, we combined top-down and bottom-up methods to identify site-specific issues and formulate relevant adaptation pathways for the utility. Second, we shift our focus to explore the role of hydropower reservoirs within the power system, using the national power grid of Cambodia as our case study. By coupling a multi-reservoir system model and a power system model, we show that capturing the two-way feedback mechanisms between the models facilitates the integration of renewables in the power grid, thereby reducing operating costs and CO2 emissions. Overall, the two case studies highlight the interdependencies between the natural-man-made systems, all driven by weather and climate.*
Bio: *Dr Rachel Koh is a research scientist with the Department of Weather Research, Centre for Climate Research Singapore (CCRS). Her current work focuses on developing SINGV-EPS, the convective-scale ensemble numerical weather prediction system at CCRS. Leading up to this role, she completed her Bachelor's in Civil Engineering at the Nanyang Technological University, Master's in Water Engineering and Management at the Asian Institute of Technology, Thailand, and PhD at the Pillar of Engineering Systems and Design, Singapore University of Technology and Design. Her research spans multiple domains, including water resources management in large river basins, understanding of hydrological processes, and operations of hydropower-dominated power systems.*

3. **Date:** **6th Feb. 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Fei Luo (CCRS)
Topic: ***It takes two to tango: Rossby waves, soil moisture and their interactions on extremes***
Abstract: *Ms Fei Luo's PhD project is part of a Vidi project 'Persistent Summer Extremes' led by Dr. Dim Coumou (VU/KNMI) and Dr. Frank Selten (KNMI), which aims to understand the mechanisms behind persistent summer extremes in Europe and their relation to climate change. During this ViDi project, together with another project ExtremeX led by Dr. Sonia I. Seneviratne at ETH Zürich, she was involved in several studies that explore different aspects of summer extremes, such as: 1: The representations and biases in simulating summertime circumglobal Rossby waves and their surface imprints in climate models. 2: The thermodynamic and dynamic processes contributing to weather and climate extremes across different regions using a global climate model experiment ExtremeX . 3: The influences of early snowmelt and polar jet dynamics on extreme Siberian fire seasons. 4: The role of persistent Eurasian double jets in accelerating western European heatwave trends.*
Bio: *Ms Fei Luo obtained her BSc. from University of Victoria (Uvic.) at School of Earth and Ocean Sciences, and MSc. from University of Hamburg (UHH) at the School of Integrated Climate System Sciences. Additionally, she holds a MSc. in Finance from Nanyang Business School (NTU). She did her PhD research at Vrije Universiteit Amsterdam (VU) and Royal Netherlands Metrological Institute (KNMI). She is also a visiting scientist at PIK (DE) and ETH Zürich (CH). Her research interests lie in the field of extreme weather and climate, especially heatwaves, and their interactions with atmospheric circulation and land surface processes. She uses a combination of observational data, reanalysis products and climate model simulations to investigate the drivers, impacts and predictability of these extreme events under current and future climate conditions. She is an early career scientist representative of Atmospheric Sciences' division at European Geosciences Union (EGU) since 2018, and editor-in-chief since 2020.*

4. **Date:** **13th Feb. 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Pratiman Patel (CCRS)
Topic: ***Impact of Urban Surface Representation in NWP simulations***
Abstract: *Urban areas are increasingly vulnerable to climatic extremes such as heat stress, and floods. The climatic impacts of urbanization are a function of form and morphology, often represented in numerical weather prediction models through (i) fraction of impervious area, (ii) thermal and radiative feedback of infrastructure such as road, and buildings, as well as local vegetation, and (iii) anthropogenic activities. In this seminar, we discuss the impact of different urban representation on simulations of (i) rainfall, (ii) heatwave, and (iii) tropical cyclone using state-of-art techniques such as method for object detection and evaluation and factor separation.*
Bio: *Dr Pratiman Patel is a research scientist with the Department of Weather Research, Centre for Climate Research Singapore (CCRS). His current work focuses on the verification of numerical weather prediction forecasts. His earlier research work was in the field of urban climate mainly focusing on the influence of urban surface representation on simulations of extreme weather events such as heavy rainfall, heatwaves and tropical cyclones. He is also interested in the development of urban datasets that can be used to improve urban scale weather and climate simulations.*

5. **Date:** **20th Feb. 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Yi Wang (CCRS)
Topic: ***Potential impact of city development on extreme events***
Abstract: *Extreme events, both natural and anthropogenic, increasingly affect cities in terms of economic losses and impacts on health and well-being. With a growing majority of the global population residing in urban areas, the unprecedented expansion of Asian cities amplifies these challenges. Meanwhile, the economic and health consequences of climate-related events are worsening, a trend projected to continue. The vast majority of studies on urban perturbation of local*

weather and climate have been centered on the urban heat island (UHI) effect, referring to the higher temperature in cities in comparison to their natural surroundings. Urbanization not only influences the UHI effect and heat waves but also exerts significant effects on atmospheric moisture, wind patterns, boundary layer structure, cloud formation, air pollutant dispersion, precipitation, and storm patterns. In this study, we will first focus on the scientific insights on the impact of urbanization on various aspects of regional climate and extreme weather events. We will also highlight the major research challenges in our understanding of the impacts of urbanization and provide our perspective and recommendations for future research priorities and directions in this critical field.

Bio: *Dr Yi Wang is currently Research Scientist at core modelling branch at CCRS. Dr. Wang received her B.Eng. and M.Eng. degrees in Construction Environment and Equipment Engineering from Tianjin University in 2011 and 2013, respectively. She received her dual degree in Finance from School of Economics in Nankai University in 2011. She received her Ph.D. degree from the University of Hong Kong in 2017. She was an ASP Postdoctoral fellow at National Center for Atmospheric Research (NCAR). Afterward, she was a scientist at Aurora Automation Technology and also a visiting scholar at University of Colorado at Boulder. Her research interests focus on urban meteorology and climatology, urban resilience and sustainability against extreme events (including extreme heat, rainfall and wind events), inverse identification for air pollutant sources and energy-efficient on building systems and AC systems.*

6. **Date: 23rd Feb. 2024, Friday (2:00pm – 3:00pm)**

Presenter: Davide Faranda (CNRS)

Topic: ***ClimaMeter: Putting Extreme Weather in Climate Perspective***

Abstract: *Climate change is a global challenge with multiple far-reaching consequences, including the intensification and increased frequency of many extreme weather events. In response to this pressing issue, we present ClimaMeter, a platform designed to assess and contextualise extreme weather events relative to climate change. The platform offers near real-time insights into the dynamics of extreme events, serving as a resource for researchers, policymakers, and being a science dissemination tool for the general public. ClimaMeter currently analyses heatwaves, cold spells, heavy precipitation and windstorms. This talk elucidates the methodology, data sources, and analytical techniques on which ClimaMeter relies, providing a comprehensive overview of its scientific foundation. To illustrate Climameter, we provide few examples from recent weather extreme events. Moreover, we underscore the role of ClimaMeter in fostering a deeper understanding of the complex interactions between climate change and extreme weather, with the hope of ultimately contributing to informed decision-making and climate resilience. Follow us on X @ClimaMeter and on www.climameter.org.*

Bio: *Davide Faranda is a CNRS research director in climate science at the LSCE laboratory of Paris-Saclay University, leading the ESTIMR group. His main expertise lies in attributing extreme weather events to climate change. Since September 2017, he has also been an external researcher at the London Mathematical Laboratory in London, UK, and at the Laboratory of Dynamic Meteorology at the Ecole Normale Supérieure in Paris.*

7. **Date: 27th Feb. 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Francisco J. Doblas-Reyes (BSC)

Topic: ***Research on climate services at the Barcelona Supercomputing Center***

Abstract: *The BSC has performed research in climate services during several years. In this time it focused on aspects related to the usefulness of subseasonal to decadal prediction in the energy and agriculture sectors. It has recently started to explore examples for longer time scales. The regional focus of the service has been in Europe, Africa and South America. The accumulated experience as service provider in a research context has demonstrated that the rapidly growing sector of climate services will benefit from a comprehensive approach for quality assurance. This talk will illustrate these points with examples from the collaborative projects in which the BSC is involved.*

Bio: *Dr. Francisco J. Doblas-Reyes started to work on climate variability at the Universidad Complutense de Madrid (Spain) in 1992, where he did the PhD in physics. He worked as a postdoc in Météo-France (Toulouse), at the Instituto Nacional de Técnica Aerospacial (Torrejón, Spain) and for ten years at the European Centre for Medium-Range Weather Forecasts (Reading, UK). He was the group leader at the Institut Català de Ciències del Clima from 2010 to 2015. He now lead the Department of Earth Sciences of the Barcelona Supercomputing Center (BSC), which hosts more than 170 engineers, and natural and social scientists working on supercomputing and data analysis to provide the best information and services on climate and air quality. He is author of more than 200 peer-reviewed papers (h index 73, Google Scholar), lead author of the Fifth and Sixth Assessment Reports of the IPCC, member of several international scientific committees and advisory boards, and direct supervisor of around 30 postdocs, engineers and PhD students.*

8. **Date: 5th March 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Danielle Su (CCRS)
Topic: ***A Matter of Scale – Modelling physical, biogeochemical and ecosystem ocean processes***
Abstract: *The spatial and temporal scales that one decides to model at depends on its application for scale and process representation. Such consideration is crucial for ocean circulation models, since they are a foundational component for earth system, ecosystem and biogeochemical models. In this seminar, Dr Su will present on several coastal and regional ocean model configurations and how they can be applied for case studies addressing the following themes: (i) Coastal adaptation design; (ii) Biogeochemical and ecosystem processes; (iii) Impact of climate modes on sub mesoscale ocean processes.*
Bio: *Dr Danielle Su is part of the Core Modelling Development Branch at CCRS and will be working on the development of a high resolution coupled atmosphere-ocean-wave, cSINGV, for Singapore and Southeast Asia. Prior to joining CCRS, Dr Su worked as an oceanographer for the international consultancy, DHI, where her portfolio covered scenario design for coastal adaption, extreme MetOcean design and biogeochemical modelling for blue carbon ecosystems. She completed her PhD at The University of Western Australia where her research focused on the seasonal and interannual variability of flow topography interactions in the Northern Indian Ocean as part of UNESCO's Second International Indian Ocean Expedition. After her PhD, Dr Su worked at LOCEAN/CNRS in Paris, France as a postdoctoral scientist investigating physical mechanisms of oceanic carbon subduction.*

9. **Date: 12th March 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Htet Naing (CCRS)
Topic: ***Machine learning methods for data-driven microscopic traffic simulation modelling and calibration***
Abstract: *The progression of machine learning (ML) within the realm of microscopic traffic modelling and simulation presents a unique opportunity to explore the synergy between modern ML methods and traditional microscopic traffic simulation (MTS) models. Thus, this research work aims to enhance MTS models' accuracy and realism by integrating ML in two critical areas: MTS modelling and calibration. Firstly, it integrates physics-based and learning-based approaches to enhance the modelling and calibration of a central component of the MTS—namely, car-following model. To achieve this purpose, a novel calibration approach based on deep reinforcement learning is employed as well as new physics-guided graph learning-based method is introduced for car-following modelling. Next, a dynamic data-driven simulation framework is proposed for short-term traffic forecasting while adopting physics-guided machine learning paradigm. Finally, it addresses the challenge of fine-grained trajectory reconstruction using MTS combined with surrogate-assisted evolutionary optimization in real-world scenarios. In summary, this research work bridges the gap between ML and MTS models by exploiting their synergies, hence marking a significant step forward in the field of traffic simulation.*

Bio: *Mr Htet Naing is currently a Research Scientist working on the development of machine/deep learning approaches for weather nowcasting models. He has recently submitted his PhD thesis (Computer Science – Pending oral defense) at Nanyang Technological University. He has five years of extensive research experience in machine learning, simulation, and calibration. His prior research focuses on exploiting the synergy between physics and learning via physics-informed/-guided machine learning approaches with successful applications in data-driven microscopic traffic simulation modelling and calibration.*

10. **Date: 26th March 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Gianmarco Mengaldo (NUS)
Topic: ***Explainable AI for weather and climate with a focus on extremes***
Abstract: *Earth's climate is changing rapidly under the effect of global warming, leading to more frequent and severe extreme weather events [1,2]. These weather extremes, in turn, are exacting heavy socioeconomic and environmental tolls [3], prompting an urgent need for better understanding and predicting them. In this talk, we present some recent results obtained for the tropical Indo-Pacific region, using methods arising in dynamical system theory. In particular, we show that changes in weather patterns are leading to more weather extremes, namely heatwaves and extreme precipitation. These extremes can only be partially explained by El Niño-Southern Oscillation-driven variability. We then present the use of explainable AI tools to investigate the onset and precursors of these extremes. More specifically, we try to bridge existing human knowledge and "AI knowledge" to better understand their behaviour and predictability.*
Bio: *Dr Gianmarco Mengaldo is an Assistant Professor in the Department of Mechanical Engineering at National University of Singapore (Singapore), and an Honorary Research Fellow at Imperial College London (United Kingdom). He received his BSc and MSc in Aerospace Engineering from Politecnico di Milano (Italy), and his PhD in Aeronautical Engineering from Imperial College London (United Kingdom). After his PhD he undertook various roles both in industry and academia, including at the European Centre for Medium-Range Weather Forecasts (ECMWF), the California Institute of Technology (Caltech), and Keefe, Bruyette and Woods (KBW). Dr Mengaldo's adopts an interdisciplinary approach integrating mathematical and computational engineering to study complex systems that arise in applied science. His current research interests involve (i) explainable AI, both theoretical and applied, (ii) the intersection between AI and domain knowledge, (iii) high-fidelity multi-physics simulation tools, and (iv) data-mining technologies for coherent pattern identification. Dr Mengaldo's main application areas include engineering, geophysics, healthcare, and finance.*

11. **Date: 2nd April 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Yanyan Cheng (CCRS)
Topic: ***Earth system modelling for Nature-based climate solutions***
Abstract: *Bioenergy with carbon capture and storage (BECCS) is a key land-based carbon removal strategy in future Shared Socioeconomic Pathways that are designed to limit global warming to well below 2 °C by the end of the 21st century. It's crucial to assess the climate and carbon outcomes of such a large-scale projected expansion of bioenergy crops and its impact compared to alternative Nature-based climate solutions, such as reforestation and afforestation. However, most of the current assessments have focused on relatively small domains or have ignored crucial carbon-water-nitrogen interactions. In addition, existing assessments of BECCS either focus on the effectiveness of carbon removal or biophysically-driven climate change impacts. Given that carbon and climate outcomes can diverge, a consensus accounting of the two effects is yet to be done. By using an integrated multisector and multiscale human-natural system modeling framework, this study evaluates the biogeochemical and biogeophysical implications of two alternative land-based mitigation scenarios that aim to achieve the same end-of-the-century radiative forcing. Our findings highlight the need for strategic land use*

planning to identify suitable regions for bioenergy expansion and re/afforestation, thereby improving the likelihood of achieving the intended climate mitigation outcomes.
Bio: *Dr. Yanyan Cheng is currently a Research Scientist at the Core Modelling Development Branch at CCRS. Before joining CCRS, Dr. Cheng is a Senior Research Fellow at NUS. From 2018 to 2020, she was a Postdoc Research Scientist at the Pacific Northwest National Laboratory in the U.S. She received her Ph.D. degree from the University of Wyoming in 2018. She is an Earth System modeler and hydrologist working on the intricate vegetation-water-carbon-land dynamics. Her research interests focus on Nature-based climate solutions, tropical ecohydrology, and hydrological and Earth System model development. She also specializes in the utilization of optimization techniques for Earth system modeling applications.*

12. **Date: 7th May 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Kristel Anne Valerie M. Villasica (PAGASA) & Mohd Noor'Arifin Bin Hj Awang Yussof (BDMD)
Topic: ***ASMC Attachment: Machine learning for S2S predictions over Southeast Asia***
Abstract: *The ASEAN Specialised Meteorological Centre (ASMC) Attachment is part of the ASMC's Capability building Program (ACaP) for the ASEAN region. In the second run of the ASMC attachment, NMHSs officers in the region were invited to work on the use of machine learning to improve subseasonal-to-seasonal (S2S) predictions (i.e. on a timescale of weeks to months) over select regions of Southeast Asia. Using PyCPT2, a python-based interface for the Climate Predictability Toolkit, the officers ran various experiments using different machine learning techniques and parameters/configurations to assess the potential improvement to S2S model skill. In this presentation, they will be sharing their results, including some case studies for their region of interest.*
Bio: *- Ms Kristel Anne Valerie M. Villasica is a Weather Specialist at Climate Monitoring and Prediction Section (CLIMPS), PAGASA-DOST, the Philippines. Valerie works on the monitoring and analysing of the state of ocean and atmosphere and generating S2S and seasonal forecasts for the last two years in PAGASA, with experience in using PyCPT for seasonal forecasts over the Philippines.*
- Mr Mohd Noor'Arifin Bin Hj Awang Yussof is the officer-in-charge of digital product support and numerical weather predictions in Brunei Darussalam Meteorological Department (BDMD), being in service at BDMD since 2016. Arifin is involved in the production and exploration of seasonal and subseasonal product for Brunei Darussalam through PyCPT.
Both Valerie and Arifin attended previous workshops under the S2S SEA Capability Building Program under the ASMC, and are keen to apply machine learning methods to enhance predictive skill for S2S outlooks for their region.

13. **Date: 13th May 2024, Monday (11:00am – 12:00pm)**

Presenter: Gilbert Brunet (BoM)
Topic: ***On the role of breaking African easterly waves and critical layers in hurricane genesis***
Abstract: *This study by Asaadi and colleagues in (JAS, 2016, 2017) sheds new light on the long-standing challenge of understanding hurricane genesis. It focuses on the initial stage, which involves westward-traveling African easterly waves that have the potential to transform into organized cyclonic vortices. The outcome depends on various factors, including their intensity and nonlinear wave-breaking processes. In order to gain a deeper insight into the dynamics underlying hurricane genesis, we explore the flow characteristics and examine the physical and dynamical processes responsible for the formation of cyclonic vortices within easterly waves. To accomplish this, we employ atmospheric reanalysis data and numerical simulations. Our research involves a comprehensive analysis of developing easterly waves during the hurricane seasons spanning from 1998 to 2001, utilizing 6-hourly ERA-Interim reanalysis data. Composite analyses for all named storms reveal a consistent potential vorticity (PV) profile characterized by a steady, unchanging pattern, featuring a weak meridional PV*

gradient and a cyclonic (located to the south of the easterly jet axis) critical line. This pattern persists over several days leading up to the formation of the cat's eye. Additionally, when examining the composite of PV anomalies during development, a statistically significant companion wave-packet of non-developing easterly waves becomes evident. This observation allows for the establishment of a geometric criterion to distinguish between developing and non-developing easterly waves (EWs). It suggests that only approximately 25% of the total EWs are associated with a nonlinear critical layer adjacent to a region characterized by a weak meridional PV gradient. We employ a shallow water model to investigate disturbances in both initial value and forced scenarios. The outcomes underscore the important interaction between dynamical and thermodynamical mechanisms. These conclusions align with the analytical theory concerning free and forced disturbances within an easterly parabolic jet, as described by Brunet and Warn in 1990, Brunet and Haynes in 1995, and Choboter et al. in 2000. Furthermore, Tory et al. (2020) establish that our findings are consistent with the results obtained in CMIP5 models, extending their relevance to the broader context of tropical cyclones.

Bio: *Dr. Gilbert Brunet - the Chief Scientist at Bureau of Meteorology, Australia, since 2018. Chair, UK Met Office Scientific Advisory Committee (MOSAC) since 2018. Chair, World Meteorological Organization Scientific Advisory Panel since 2020. Director, Meteorological Research Division, Environment and Climate Change Canada, 2006-18. Director, Weather Science, Met Office (2012–15). Head (1999–2006) and research scientist (1993–98) at the Recherche Prévision Numérique Section, ECCC. PhD in meteorology, McGill University, 1989.*

14. **Date:** **21st May 2024, Tuesday (2:00pm – 3:00pm)**

Presenter: Benjamin Owen (BoM)

Topic: ***Improving NWP post-processing at the Bureau of Meteorology***

Abstract: *Statistical post-processing of numerical weather prediction (NWP) guidance is a crucial element of the forecast value chain, enabling the provision of reliable forecast-ready guidance tailored to the needs of users. For over a decade, the Bureau of Meteorology has relied on its own Gridded Operational Consensus Forecast (GOCF) system to provide calibrated, consensus-based guidance from a mix of ensemble and deterministic input models. While GOCF has been instrumental in enhancing the skill of the Bureau's forecasts and supporting increased automation of routine forecast production, this system has reached the limit of its utility in both technical execution and scientific capability. Hence the need to pivot to a new post-processing solution, particularly one that aligns with the shift towards ensemble models and probability-based forecasts. In 2019, the Bureau of Meteorology entered a partnership with the UK Met Office to adopt its Integrated Model Post-PROcessing and VERification (IMPROVER) system as the replacement post-processing platform. Since this time, staff at the Bureau have worked towards building a robust, extensible post-processing platform using the IMPROVER framework to replace our legacy system. In this talk I shall present an overview of the Bureau's implementation of IMPROVER and explore our usage and adaptations to enable effective post-processing over the vast Australian domain where a greater reliance on global models is required. I will present on some of the key science elements we have integrated into IMPROVER system in order to produce accurate forecasts for Australia, including a discussion on RainForests, a machine learning based calibration for rainfall developed at the Bureau. I will share some of our recent verification results benchmarking IMPROVER against the Bureau's legacy system and conclude with some discussion on future directions.*

Bio: *Benjamin Owen is senior post-processing scientist at the Bureau of Meteorology, where he has been primarily focussed on the IMPROVER integration. Ben research interests lie in ensemble post-processing methods that have an operations focus. Prior to taking up this research role, Ben worked as an operational meteorologist out of the Bureau's Adelaide office. Before joining the Bureau in 2016, Ben completed his PhD at the University of Adelaide in the area of particle and nuclear physics.*

15. **Date:** **31st May 2024, Friday (10:00am – 11:00am)**

Presenter: Vijay Tallapragada (NOAA)
Topic: ***Development and Status of NOAA's Unified Forecast System (UFS)***
Abstract: *Part I: High Resolution Rapid Refresh Forecast System (RRFS) for Regional Predictions*
The Rapid Refresh Forecast System (RRFS) is a high-resolution (3-km), hourly updated ensemble prediction system covering a large North American domain extending from Hawaii in the West to Puerto Rico in the East. The data assimilation system uses a hybrid 3DEnVar algorithm with 3-km ensemble covariances derived from 30 EnKF members. The ensemble of analyses from the EnKF also provides the initial condition perturbations for the forecast ensemble. Majority of the physics configurations for RRFS are derived from the operational WRF based RAP/HRRR framework. Development of RRFS has been a collaborative endeavor encompassing NWS/EMC, NOAA Labs, and the wider academic research community all within the Unified Forecast System (UFS) framework. This talk will focus on recent developments in implementing a multiscale data assimilation algorithm, reducing a high bias associated with the convective storms and precipitation, and improving the forecast ensemble. Future plans for RRFSv2 include transitioning to a new MPAS dynamical core.
Part II: Six-way Coupled Earth System Model for Sub-Seasonal to Seasonal Predictions
The next generation NWS/NCEP operational global modeling applications (GFS, GEFS and SFS for medium-range, sub-seasonal and seasonal predictions respectively) are being developed as UFS based fully coupled atmosphere/land/ocean/sea-ice/wave/aerosols modeling components. The final system will consist of the FV3 dynamical core and CCPP atmospheric physics package, Noah MP land model, MOM6 ocean model, CICE6 sea ice model, WAVEWATCH III wave model, and GOCART aerosol model, with a weakly coupled data assimilation system utilizing the advancements of the Joint Effort for Data Assimilation Integration (JEDI) spearheaded by the Joint Center for Satellite Data Assimilation (JCSDA). This talk describes results from various coupled-UFS high resolution and ensemble prototypes tested with increasing complexity prior to making informed decisions on final configurations for operational applications. Accurate seasonal predictions require improved physical descriptions of slowly changing processes on the land, in the oceans, for sea ice, and for atmospheric composition. Data assimilation improvements are also required to improve initial states for the land, ocean and sea ice in SFS component models that provide the long-term memory of the Earth System. Multidecadal historical reanalysis and reforecasts will also be performed for model calibration and to further improve seasonal forecast outlooks along with post-processing methods.
Bio: *Dr. Vijay Tallapragada is the senior scientist for NOAA's Environmental Modeling Center, leading and advancing the development and operational implementation of community-based prediction systems within the UFS framework. He is currently serving as co-lead of the UFS Research to Operations (UFS R2O) project and development manager of the Hurricane Forecast Improvement Project (HFIP). He received a Master of Science in meteorology, a Master of Technology in atmospheric sciences, and a doctorate degree in tropical meteorology from Andhra University, India. He has been elected as Fellow at the AMS in 2022.*

16. **Date: 4th June 2024, Tuesday (4:00pm – 5:00pm)**

Presenter: Hripsime Mkrtchyan (U Reading)
Topic: ***Using meteorological reanalysis to identify weather conditions for classifying atmospheric electricity data***
Abstract: *Atmospheric electricity Potential Gradient (PG) data has typically been classified by local weather conditions, such as by identifying data recorded during "fair weather" (FW) or in the absence of rainfall "no hydrometeors" (NH), to try and obtain globally representative values. In general, this approach is essential in obtaining global atmospheric circuit (GEC) signals. The weather information needed to do this is, however, only available from some of the sites providing atmospheric electricity measurements. For other sites, meteorological reanalysis – of which there are many products available, spanning different times and scales - may provide a data source for such classification of PG data. This study investigates the integration of ERA5 meteorological reanalysis data to identify FW and NH conditions and improves the quality of data used in long-term atmospheric electricity studies.*

Bio: *Hripsime Mkrtchyan is currently Marie Curie Research Fellow at the Department of Meteorology, University of Reading. Prior to this, she was holding an assistant professor position at American University of Armenia, where she taught "Introduction to Environmental sciences", "Environmental projects" and "Environmental monitoring" courses. She has also served as a Fullbright postdoctoral fellow at the Civil and Environmental Engineering department of Massachusetts Institute of Technology (MIT), where her research focused on radiation coming from thunderclouds and its electrical structure based on remote sensing.*

17. **Date: 11th June 2024, Tuesday (11:00am – 12:00pm)**

Presenter: I-Han Chen (CCRS)

Topic: *Regime-Dependent Predictability and Forecast Error Growth in Kilometer-Scale Models*

Abstract: *Numerical Weather Prediction (NWP) systems focusing on synoptic- to convective scales are now running routinely at weather forecasting centers worldwide. While there has been undeniable enhancement in NWP forecast skills in recent decades, inevitably, every forecast will ultimately encounter its predictability limit. Especially for convection-permitting forecasts, this predictability limit becomes more pronounced as their forecast errors amplify significantly faster than those of synoptic-scale forecasts. To explore the predictability at convection-permitting resolution, this presentation will discuss two studies investigating regime-dependent predictability and forecast error growth in 3-km regional models covering the Contiguous United States (CONUS).*

The first study demonstrates that convection-permitting forecasts display regime-dependent precipitation predictability. Specifically, equilibrium convection shows higher predictability compared to nonequilibrium convection, consistent with previous studies conducted under different environmental conditions and on considerably smaller domains. This study objectively categorizes convective regimes using the convective adjustment time scale and establishes convective regime climatology in the CONUS domain. Climatologically, convective regimes exhibit regional dependencies. In the northern CONUS, there is a stronger influence from synoptic flow, similar to Germany, while in the southern CONUS, locally forced convection is more prevalent. This objective classification realistically reflects our basic physical understanding when examining seasonal and diurnal dependencies. As the first climatological study in this area, the approaches and findings can serve as valuable guidance for future studies focusing on the CONUS domain.

The second study selects winter storm, equilibrium, and nonequilibrium convection cases to investigate regime-dependent forecast error growth in a convection-permitting model. The findings suggest that winter storm cases demonstrate the highest predictability, whereas nonequilibrium summer convection, particularly in terms of precipitation, shows the lowest predictability. In this study, the forecast error arises from the uncertainty in the model formulation, represented by the Stochastically Perturbed Parameter applied to Microphysics (SPPMP) scheme and the Physically based Stochastic Perturbation (PSP) applied to the Planetary Boundary Layer (PBL) scheme. The central idea is to discern whether forecast error growth is predominantly influenced by the flow dynamics or the details of the error representation schemes. The results suggest that for longer lead times, despite remaining small amplitude differences, the forecast error is primarily controlled by moist convection rather than the perturbation details. This explains why previous studies argue that the effects of stochastic schemes are not additive, as their impacts are not orthogonal. In contrast, the distinction between PSP and SPPMP can be more pronounced at short lead times, where the error growth predominantly occurs at the convective scale. Despite its overall smaller effect, microphysics perturbations can be important under certain conditions, as they may trigger instability earlier, particularly during times when the PSP scheme is not active due to a stable PBL. This conveys an important message for researchers focusing on developing stochastic physics suites for short-lead-time NWP systems.

Bio: *In the Core Modelling Development Branch at CCRS, Ms I-Han Chen's current research focus is on developing and evaluating a high-resolution regional data assimilation and modelling system for the Singapore and Southeast Asia seas. This research involves utilising MPAS-JEDI as a central component. Before joining CCRS, Ms Chen was involved in the development of high-resolution regional modelling* *systems at the Central Weather Administration in Taiwan. During her time there, Ms Chen's research centered around data assimilation and ensemble forecasting, with a particular emphasis on improving short-range weather prediction. Ms Chen recently completed her doctoral thesis defense at Ludwig-Maximilians-Universität München, where she investigated regime-dependent predictability and forecast error growth in kilometre-scale models. During her doctoral research, Ms Chen had the opportunity to enhance her expertise by collaborating with scientists at the University Corporation for Atmospheric Research in Boulder, Colorado, USA for two years.*

18. **Date: 14th June 2024, Friday (10:00am – 11:00am)**

Presenter: Nathanael Wong (Harvard U)
Topic: ***Investigating Vertical Profiles of Convective Heating in both Observations and Model Simulations***
Abstract: *Previous studies have demonstrated that we can use the depletion of heavy water isotopologues (HDO and H$_2^{18}$O) within precipitation as proxies to the vertical profiles of convective heating. We further tested this using isotopic analysis of rainfall over the eastern Pacific during the OTREC field campaign to determine if the vertical profile over the region is top- or bottom-heavy. While a composite of the station observations within the domain shows results consistent with previous studies, there are significant spatial variations across individual stations. This is corroborated by isotope-enabled WRF simulations that span the domain of the OTREC field campaign. The trends of heavy-isotope depletion are also not consistent even when we attempt to account for the impacts of horizontal advection in our budget analysis, implying that certain assumptions we made in order to use the depletion of heavy isotopologues as a proxy to convective heating profiles may not apply on a local level.*
Bio: *Nathanael Wong is a 5th Year PhD Candidate at Harvard University studying Tropical Climate Dynamics using a range of tools, from satellite observations and reanalysis datasets, to climate models that range from idealized small-domains, to global models. He aims to understand the differences in precipitation and moisture dynamics over tropical islands from both oceanic and continental regions. His current work under Professor Kuang Zhiming revolves around understanding vertical motion profiles and in using isotopic precipitation to understand the nature of convection over the East Pacific. He also has contributed to the creation of Julia packages for climate research.*

19. **Date: 18th June 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Jeremie Houssineau (NTU)
Topic: ***A dedicated representation of epistemic uncertainty for better decision making***
Abstract: *Sound decision making requires a reliable quantification of the uncertainty in the underlying problem. To this end, the different types of uncertainty should be identified and dealt with specifically. Although it is already common in the Machine Learning literature to distinguish between epistemic uncertainty, due to lack of knowledge, and aleatoric uncertainty, due to randomness, most uncertainty quantification methodologies use probability theory to represent both, hence limiting the practical consequences of such a distinction. In this talk, I will present an alternative framework for modelling epistemic uncertainty, called possibility theory, and I will illustrate how this approach allows for more nuanced decision making. Considered applications will include data assimilation, robust inference, active learning and reinforcement learning.*
Bio: *Jeremie Houssineau is an Assistant Professor in the Division of Mathematical Sciences at NTU since January 2024, and an honorary Associate Professor in the Department of Statistics at the University of Warwick. His research interests include possibility theory, Bayesian statistics, multi-target tracking, data assimilation, and reinforcement learning, with applications in Defence and Security, Space, Biology, and Healthcare.*

20. **Date: 2nd July 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Paul Field (UK Met Office)
Topic: *Cloud-aerosol interactions in the UM and some machine learning*
Abstract: *Clouds remain a large source of uncertainty for both NWP and climate. First, I will show results from the UM comparing observations of volcanic and ship aerosol plumes interacting with cloud and model simulations. These convenient plume sources combined with satellite monitoring provide a critical assessment of the ability of models to represent these interactions. Second, I will present a machine learned approach to representing sub-grid ice cloud fraction, showing training results and the impact on AMIP simulations.*
Bio: *Prof. Paul Field is a Science Fellow at the Met Office within Atmospheric Processes and Parametrizations (APP) and a Chair at the University of Leeds Institute for Climate and Atmospheric Science. He has worked on clouds using aircraft and laboratory observations and modelling since 1996 at the Met Office's Met Research Flight and at NCAR (2004-2007) before returning to develop the model cloud physics in the UM.*

21. **Date: 9th July 2024, Tuesday (2:00pm – 3:00pm)**

Presenter: Sharon Seah (ISEAS)
Topic: *Southeast Asia's Perceptions of Climate Challenges*
Abstract: *As climate change impacts intensify and affect more people in Southeast Asia, the urgency for a strong and unified climate agenda is gaining momentum. Regional governments are pledging more ambitious climate targets, while businesses and environmental groups are integrating climate considerations into their practices. The "business-as-usual" approach is no longer viable. But how do Southeast Asian citizens perceive these efforts and their countries' climate policies? The Climate Change in Southeast Asia Programme at the ISEAS-Yusof Ishak Institute launched the Southeast Asia Climate Outlook Survey in 2019 which has since become an annual survey aimed at understanding climate awareness and perceptions among Southeast Asian citizens. This seminar will unpack the fourth edition of the Survey which examines regional attitudes and concerns regarding climate change, government policies and actions, and the role of various stakeholders in climate action. Additionally, it gathered opinions on renewable energy transition, agriculture and food security, and international cooperation.*
Bio: *Ms Sharon Seah is Senior Fellow and concurrent Coordinator of the ASEAN Studies Centre and the Climate Change in Southeast Asia Programme at the ISEAS – Yusof Ishak Institute. Prior to academia, Ms Seah spent 15 years in the Ministry of Foreign Affairs of Singapore and the National Environment Agency. Her research interests are in ASEAN, multilateralism, rule of law, and climate change. Ms Seah graduated with a Master in Public and International Law from the University of Melbourne in 2018. She is co-editor of 50 Years of ASEAN and Singapore (World Scientific: 2017) and editor of Building a New Legal Order for the Oceans (NUS Press: 2019) by Tommy Koh. She is also the lead author of The State of Southeast Asia Survey Report and the Southeast Asia Climate Outlook Survey Report.*

22. **Date: 16th July 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Jason Lee (NUS)
Topic: *Humans in a warming world – more than just heat injuries and productivity losses*
Abstract: *While heat stress is the effect of the environment on the individual, heat strain is the resultant thermal load the body experiences predominantly from the weather, workload and clothing. Although heat stress is typically associated with outdoor work, it is also present in indoor workplace environments involving processes that emit radiant heat with inadequate ventilation. Workers, including military personnel, firefighters, law enforcers, construction workers, healthcare workers, gig workers and food stall hawkers are particularly affected by the heat. Heat stress not only increases the risk of heat injury but can also interfere with work productivity. In addition, heat stress can compromise decision making, thereby increasing the risk of accidents. Challenges associated with heat stress and*

solutions will be presented. Extreme heat will become more intense and frequent. It hurts the whole society and we must take urgent actions now to heatproof our people.
Bio: *Prof. Jason Lee is an Associate Professor at the Yong Loo Lin School of Medicine, National University of Singapore. He co-leads the Human Potential Translational Research Programme and directs the Heat Resilience and Performance Centre. Jason co-chairs the Heat Injury Clinical Practice Guidelines at the Ministry of Health and chairs the Scientific Committee on Thermal Factors at the International Commission on Occupational Health. He is on the management committee at the Global Heat Health Information Network and leads the WHO-WMO Southeast Asia Heat Health Node to scale up efforts in managing the complex health risks posed by rising ambient temperatures.*

23. **Date: 23rd July 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Pavel Tkalich (NUS/TCOMS)
Topic: ***Sea level trend and Low-Frequency Variability of South China Sea***
Abstract: *The low-frequency sea level variability in the South China Sea (SCS) is examined using high-resolution regional ocean model simulations spanning the last six decades. The analysis reveals interdecadal oscillations with a periodicity of 12-13 years as the dominant mode of sea level variability in the SCS. The fluctuations in the Luzon Strait transport (LST) are identified as the primary driver of interannual to interdecadal sea level variability, rather than atmospheric forcing within the SCS. Luzon Strait transport shows a weakening trend in the last six decades, resulting in higher heat accumulation and larger steric expansion in the deep SCS. The ocean mass redistribution acts as a mechanism to balance the contrasting steric-induced sea level changes over the deep SCS and shallow continental shelves.*
Bio: *Dr. Pavel Tkalich is Principal Research Fellow at National University of Singapore (NUS) and is holding joint appointment at Technology Centre for Offshore and Marine, Singapore (TCOMS). His research is directed to unite Climate Change and Variability, Ocean and Coastal Dynamics, Sea level trend and extremes, Environmental Impact Assessment.*

24. **Date: 30th July 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Sandeep Sahany (CCRS)
Topic: ***Singapore's Third National Climate Change Study***
Abstract: *As a follow-up of Singapore's Second National Climate Change Study (V2) released in 2015, Singapore's Third National Climate Change Study (V3) provides the required high-resolution climate change projections for Singapore (grid resolution of 8km and 2km) and the wider Southeast Asia region (grid resolution of 8km), by dynamically downscaling the coarse resolution global climate model data used in IPCC AR6. Key findings from V3 and the V3 Data Visualisation Portal containing the stakeholder and science reports, images, brochures, videos, infographic, and related materials were released earlier this year. This new data set forms the basis for impact studies and adaptation planning to help safeguard Singapore from the adverse effects of climate change.*
Bio: *Dr Sandeep Sahany is a Deputy Principal Research Scientist at the Centre for Climate Research Singapore (CCRS). He leads the Climate Projections and Extremes Branch at CCRS. His team of research scientists were responsible for delivering a major part of Singapore's Third National Climate Change Study (V3). He has published around 50 research articles in international journals, and delivered many talks at national and international conferences, meetings, and workshops.*

25. **Date: 6th August 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Jianjun Yu (CCRS)
Topic: ***Historical and Future Heat Extremes and Exposures in Southeast Asia***
Abstract: *Heat extremes pose a growing challenge to the world, particularly in Southeast Asia (SEA), where the projected increase of population, urbanization, and economic expansion amplifies the vulnerability to heat extremes. In this talk, based on ERA5-Land reanalysis datasets, the historical*

heatwave events and its characteristics in terms of intensity, duration and frequency will be firstly discussed. Furthermore, utilizing the recent high-resolution regional climate change projections from Singapore's Third National Climate Change Study (V3), we assessed the projected change in future extreme temperature characteristics (i.e. maximum temperature, distribution shift, exceedance rate and heatwaves etc.) in SEA under three emission scenarios. Our findings indicate a consistent increase in frequency of heat extremes across all scenarios in SEA, with a sustained longer duration. Last, the social economic and population exposure to extreme heat and the potential impacts will be discussed.

Bio: *Dr. Jianjun Yu is senior research scientist in Centre for Climate Research Singapore, Meteorological Service Singapore (CCRS, MSS). He participated in Singapore's Third National Climate Change Study for climate projections assessment especially in extreme temperatures and heat stress over Southeast Asia and Singapore. He has the academic background of physical geography, GIS and hydrology and water resources management. He participated in many natural hazard risk assessment projects in drought, flood, landslide, tsunami and chemical spills across China and Southeast Asian counties. He was also a specialist in spatial information technology with over 10 years' experience using spatial databases and GIS for geographical data analytics and hydro-informatics software development for examples Autodesk Map3D, DHI MIKE, Schneider water and energy distribution network modelling software and digital twin.*

26. **Date: 13th August 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Arun Ramanathan (CCRS)
Topic: ***Application of the Universal Multifractal Framework in Meteorology***
Abstract: *The concept of universality in complex systems states that only a few parameters out of many are relevant for defining the system since the same dynamical process is repeated scale after scale or the process interacts with many independent processes over a range of scales, resulting in this reduction. In the Universal Multifractal framework only three parameters, are necessary, and they each have different geometrical and physical meanings. This framework also seems to have some advantages in being a physically meaningful, statistically relevant, computationally cheap option for simulating the behaviour of complex systems such as the atmosphere since it readily considers spatiotemporal heterogeneity, and higher-order statistics. Some of Arun's earlier work in this context will be presented.*

Bio: *Dr. Arun Ramanathan has over three years of postdoctoral experience at the Hydrology, Meteorology, and Complexity Laboratory at École des Ponts, where he developed multifractal-based simulation methods and analysis techniques for modelling precipitation, temperature, and the hydrological behaviour of complex media. His doctoral research focused on mesoscale atmospheric predictability using spatially anisotropic universal multifractal models. He holds a joint M.Tech-Ph.D. in the field of earth system science and technology from the Centre for Ocean, River, Atmosphere, and Land Sciences at the Indian Institute of Technology Kharagpur. Currently, he is part of the Numerical Weather Prediction Branch in the Department of Weather Research at the Centre for Climate Research Singapore (CCRS), where he focusses on NWP post-processing.*

27. **Date: 14th August 2024, Wednesday (11:00am – 12:00pm)**

Presenter: Sandeep Mohapatra (UTAS)
Topic: ***Exploring New Mode of Variability in Global Sea level***
Abstract: *Climate modes are important tools for understanding internal climate variability. While existing regional climate modes explain a significant portion of sea level variability around the world, they do not account for its entirety. Our study identifies two new internal mode of variations (Asymmetric-ASYM and Symmetric-SYM) in sea levels that are not explained by existing common climate modes. The ASYM is characterised as variations in sea level with sea level higher (lower) in the southern (northern) hemisphere during the positive phase of this mode. Whereas the SYM based on sea level is characterised by a uniform global sea level increase (decrease). ASYM is associated with*

most of the hemispheric asymmetric volume change between the hemispheres and is defined by the coupled response of ocean-atmosphere interactions, wind driven circulations. Understanding these modes could significantly improve our approach to internal climate variability and potentially reduce uncertainties in projections of anthropogenic climate change.

Bio: *Dr. Sandeep Mohapatra is a physical oceanographer and working as a Postdoctoral researcher at the Institute for Marine and Antarctic Studies (IMAS), University of Tasmania, Australia under the Australian Centre for Excellence in Antarctic Sciences (ACEAS). He also serves as an Associate Investigator at ARC Centre for Excellence in Climate Extreme (CLEX). He completed his PhD in climate science from the Indian Institute of Tropical Meteorology, Pune, India in 2022. His research interests are in the climate dynamics of the Indian Ocean, Southern Ocean and global Ocean with a major focus on sea level, ocean circulation. He is currently investigating the ocean's role and the internal processes that drive the earth's climate system.*

28. **Date: 19th August 2024, Monday (11:00am – 12:00pm)**

Presenter: Mikael Kuusela (Carnegie Mellon University)

Topic: ***Locally Stationary Mapping and Uncertainty Quantification of Ocean Heat Content Based on Argo Profiles During 2004-2022***

Abstract: *Argo floats provide us with a unique opportunity to measure the global and regional Ocean Heat Content (OHC) and improve our understanding of Earth Energy Imbalance (EEI). Yet, producing Argo-based OHC estimates with reliable uncertainties is statistically challenging due to the complex structure and large size of the Argo dataset. Here we present the latest version of our mapping and uncertainty quantification framework for Argo-based OHC estimation based on state-of-the-art methods from spatio-temporal statistics. The framework is based on modeling vertically integrated Argo temperature profiles as a locally stationary Gaussian process defined over space and time. This enables us to produce computationally tractable OHC anomaly maps based on data-driven decorrelation scales estimated from the Argo observations. We quantify the uncertainty of these maps using locally stationary conditional simulation ensembles, a novel approach that leads to principled uncertainty quantification that accounts for the spatio-temporal correlations in the mapping uncertainties. A new cross-validation approach is presented to validate these uncertainties. The mapping framework is implemented in an open-source codebase that is designed to be modular, reproducible and extensible. We present a new Argo OHC data product with uncertainties for 2004-2022 based on this framework and report on various climatological estimates and their uncertainties obtained using this product. Finally, we describe how these estimates have contributed to several international climate reports and OHC and EEI intercomparison efforts.*

Bio: *Dr. Mikael Kuusela is an Assistant Professor of Statistics and Data Science at Carnegie Mellon University. His research focuses on developing statistical methods for analyzing large and complex datasets in the physical sciences. He specializes in questions related to ill-posed inverse problems, spatio-temporal data, uncertainty quantification and statistical learning in climate science, oceanography, remote sensing and particle physics. He works in close collaboration with physical scientists and has various ongoing collaborations with oceanographers working on Argo floats, with NASA scientists working on the OCO-2 mission and with particle physicists at CERN. He obtained his PhD in Statistics in July 2016 from EPFL in Lausanne, Switzerland. He then moved to the US where he was a postdoc at the University of Chicago and at SAMSI before joining Carnegie Mellon in summer 2018. His BSc and MSc degrees are in Engineering Physics and Mathematics from Aalto University.*

29. **Date: 20th August 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Roger Dargaville (Monash University)

Topic: ***Wind power output from reanalyses***

Abstract: *Atmospheric reanalyses are an increasingly popular source of wind speed for wind power simulation but are known to exhibit biases. Such biases can have a significant impact on the validity of* *techno-economic energy assessments that include simulated wind power. This study assesses the Australian BARRA-R2 atmospheric reanalysis and compares it with the global MERRA-2 and ERA5 reanalyses. The quality of wind power simulation is assessed at the level of operating wind farms, which reveals micro-scale factors that are not discernible in commonly used regional-scale assessments. Simulated wind power is compared with observed power from 54 wind farms across the Australian continent using site-specific wind turbine specifications. We find that all of the reanalyses broadly replicate wind speed patterns associated with the passage of weather systems and seasonal patterns. However, at shorter time intervals, correlation is variable, with substantial dissonance between simulated and observed wind power. Assessed by five factors —bias, bias spread, hourly correlation, root mean square error (RMSE) and the distribution of hourly ramp rates —BARRA-R2 gave the best results, followed by MERRA-2, then ERA5*

Bio: *Assoc. Prof. Roger Dargaville is the Director (Interim) of the Monash Energy Institute and also leads a team of PhDs and postdocs working in a diverse range of topics such as large-scale system transitions for Australia, Indonesia and India, integration of EVs, green hydrogen, steel and ammonia applications and novel energy storage technologies. With over 60 peer reviewed publication, an H index of 28, i10-index of 41 and over 3500 citations, not to mention over 500K reads of his 32 publications on The Conversation, Roger is an influential energy researcher. Roger obtained his BSc (Hons) and PhD in atmospheric physics from the University of Melbourne and began his career working in the field of global carbon cycle dynamics, investigating the processes of carbon exchange between fossil sources, the atmosphere, oceans and terrestrial biosphere. He completed postdocs at the University of Alaska (Fairbanks) and the National Center for Atmospheric Research in Boulder Colorado and a visiting Scientist role at the Centre Nationale de Recherche Scientifique in Paris, France. He has also worked at UNESCO, the International Energy Agency (IEA) and Melbourne University where he helped established the Melbourne Energy Institute.*

30. **Date: 22nd August 2024, Thursday (11:00am – 12:30pm)**

Presenter: Jing-Shan Hong (CWA, Taiwan) and Guo-Yuan Lien (CWA, Taiwan)
Topic 1: ***Introduction of the Climate Services in CWA***
Presenter: Jing-Shan Hong (CWA, Taiwan)
Abstract: *A key component of the climate service value chain- the NMHS- plays important roles in enhancing the understanding, monitoring, and forecasting of the weather, climate, and the hydrological cycle. This presentation will first explore collaborative networks within Taiwan's climate science community and outline the government's policies aim at facilitating the climate change adaptation and achieving the net-zero targets. Additionally, I will also demonstrate CWA's research and operation efforts in monitoring extreme climate events, with a particular focus on the extreme high temperature and draughts. The development of the robust post-process technique, including the bias correction and the downscale, for sub-season to seasonal forecast are also highlighted. Many of these postprocess method are especially based on the AI and machine leaning techniques.*
Bio: *Dr. Jing-Shan Hong is an expert in mesoscale meteorology and numerical weather prediction. He led the development of operational WRF-based regional systems in Central Weather Administration (CWA) of Taiwan and has played a crucial role in advancing the use of ensemble products for high-impact weather forecasting. Currently, he directs the Marine Meteorology and Climate Division at CWA, where he oversees the development of marine and climate forecasts. His leadership is pivotal in enhancing climate services and driving cross-domain cooperation, with a strong focus on energy, agriculture, and water resources. This effort significantly benefits society by improving our understanding and management of weather and climate impacts across various sectors.*
Topic 2: ***Convective-scale NWP in CWA: System overview, recent development, and the changing plans in the AI weather prediction era***
Presenter: Guo-Yuan Lien (CWA, Taiwan)
Abstract: *Due to the complex topography and various tropical and subtropical weather systems affecting the region, numerical weather prediction (NWP) with high-resolution models and data*

assimilation is critical for Taiwan's weather forecast. The Central Weather Administration (CWA) of Taiwan has developed and operated WRF-based rapid-update convective-scale NWP systems for short-range prediction in the Taiwan region. The systems have several components, including a hybrid 3DEnVar radar and surface data assimilation system, a local ensemble transform Kalman filter (LETKF) data assimilation system for the same data types, and a convective-scale ensemble prediction system under development. In this presentation, we will first give a brief overview of the above systems, followed by some recent development work associated with these systems. In addition, as the AI/machine-learning-based weather prediction is rapidly rising and reshaping the NWP concept, we will also talk about the impact of emerging AI techniques on CWA and its (changing) plans to expand AI applications, with a focus on the development of regional data-driven mesoscale prediction models in Taiwan.

Bio: *Dr. Guo-Yuan Lien is an associate researcher at the Technology Development Division, Central Weather Administration (CWA) of Taiwan. His expertise is in data assimilation, numerical weather prediction, and high-performance computing. He is currently leading the data assimilation research and development for CWA's global and regional numerical weather prediction systems. Prior to joining the CWA in 2018, he worked at the RIKEN Center for Computational Science in Japan, focusing on the high-resolution rapid-update radar data assimilation using the LETKF.*

31. **Date: 27th August 2024, Tuesday (4:00pm – 5:00pm)**

Presenter: Weiyu Zhang (U Leeds)

Topic: ***Impact of host climate model on contrail cirrus effective radiative forcing estimates***

Abstract: *Aviation is currently estimated to contribute ~3.5% of the net anthropogenic effective radiative forcing (ERF) of Earth's atmosphere. The largest component of this forcing comes from contrail cirrus (also with a large associated uncertainty of ~70%), estimated to be two times larger than the contribution from aviation CO2 emissions. Here we implement the contrail parameterisation previously developed for the USA NCAR Community Atmosphere Model (CAM) in the UK Met Office Unified Model (UM). By using for the first time the same contrail parameterisation in two different host climate models, this work investigates the impact of key features of the host climate model on quantifying contrail cirrus radiative impacts. We find that differences in the background humidity (in particular ice supersaturation) in the two climate models lead to substantial differences in simulated contrail fractions, with UM values being two to three times as large as those from CAM. We also find contrasting responses in overall global cloud fraction due to air traffic, with contrails causing increases and decreases in total cloud fraction in the UM and in CAM, respectively. The different complexity of the two models' cloud microphysics schemes (i.e. single and double-moment cloud schemes in the UM and CAM, respectively) results in significant differences in the simulated changes in cloud ice water content due to aviation. When accounting for the difference in cloud microphysics complexity, we estimate the contrail cirrus ERF of the year 2018 to be 40.8 mWm−2 in the UM and 60.1 mWm−2 in CAM. While these two estimates are not entirely independent, they indicate a substantial (i.e. factor of ~2) uncertainty in contrail cirrus ERF from differences in the microphysics and radiation schemes of the two host climate models. We also find a factor of 8 uncertainty in contrail cirrus ERF due to existing uncertainty in contrail cirrus optical depth.*

Bio: *Weiyu Zhang is a PhD student in the Institute for Climate and Atmospheric Science at the University of Leeds. Weiyu's research interests include contrail parameterisation and climate modelling, evaluation of uncertainties in contrail cirrus radiative forcing, and contrail cirrus radiative forcing under future aviation fuel scenarios. Weiyu's PhD project is supported by the NERC Panorama DTP with the UK Met Office CASE partnership.*

32. **Date: 28th August 2024, Wednesday (2:00pm – 3:00pm)**

Presenter: Isaac Tan (Monash Univ.)

Topic: ***The Dynamics of Cold Surges over the Maritime Continent***

Abstract: *Cold surges are large-scale monsoon weather systems that originate from a large anticyclone over Siberia during the boreal winter. Southward intrusions of cold air often result in sudden surges of northerly to north-easterly winds that extend over the South China Sea and Maritime Continent region, and temperature falls of a few degrees over several days. Over the Maritime Continent, cold surges are often accompanied by heavy prolonged rainfall and flooding but in other cases, suppressed convection. A combination of observations, reanalysis, and high-resolution models were used to investigate the synoptic and mesoscale dynamics of wet and dry surges, mainly focussing on the Singapore region. Synoptically, the wet surges are characterised by an anomalously strong Siberian high and resultant surge winds. Regionally, dry and moderate (wet) surges usually form in the suppressed (active) phases of the Madden Julian Oscillation and are sometimes linked to convectively active phases in the Australian summer monsoon. Locally, the diurnal precipitation patterns are consistent with the convection being controlled by the mid-tropospheric buoyancy of an idealised entraining plume.*
Bio: *Isaac Tan has recently completed his PhD at Monash University on The Dynamics of Cold Surges over the Maritime Continent, under Professor Michael Reeder. His research interests include extreme rainfall and tropical monsoon weather systems.*

33. **Date: 29th August 2024, Thursday (11:00am – 12:00pm)**

Presenter: Patrick Martineau (JAMSTEC)
Topic: ***Forecasting Infectious Disease Outbreaks: A Machine Learning Approach Utilizing Climate Data***
Abstract: *Infectious disease outbreaks have substantial socioeconomic impacts worldwide. Among various influencing factors, climatic variability is known to affect the severity of these outbreaks by creating optimal conditions for vector population growth and disease transmission. At JAMSTEC, we have been investigating the climatic precursors of infectious diseases, focusing on malaria in South Africa and dengue in Vietnam, both of which are mosquito-borne illnesses. We have concentrated our investigation on global sea surface temperature precursors that characterize modes of ocean-atmosphere coupled variability. These modes generate atmospheric teleconnections, which in turn influence local weather patterns in South Africa and Vietnam, thereby impacting mosquito breeding conditions. Leveraging these findings, we developed machine-learning prediction systems capable of providing early warnings up to a year in advance. These systems have the potential to mitigate disease outbreaks by supporting the planning and implementation of preventive interventions.*
Bio: *Patrick Martineau is a researcher at the Application Laboratory of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). His research interests encompass extratropical atmospheric dynamics, including storm tracks, blocking, teleconnections, and weather extremes. He also focuses on ocean-atmosphere interactions and the application of machine learning for infectious disease predictions.*

34. **Date: 3rd September 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Faye Cruz (Manila Observatory)
Topic: ***Climate research to support climate action in the Philippines***
Abstract: *The Philippines is at high risk to climate and geological hazards, which have caused significant damages and loss of lives in the country. With projected increases in intensity and frequency in climate extremes in a globally warmer world, it is essential to continue efforts to enhance climate and disaster resilience, especially in highly vulnerable communities and ecosystems. In the spirit of nearly 160 years of service through the atmospheric and earth sciences, the Manila Observatory responds to this urgent issue of climate change, with a mission to observe and understand these changes and to support science-based climate action. The observatory recognizes the importance of a whole-of-society approach by working together with researchers and the academe, national and local governments, NGOs, development and humanitarian agencies, civil society, and the private sector.*

Recent efforts of the observatory towards understanding climate change in the Philippines will be presented in this talk, highlighting the co-production of localized climate information to support adaptation planning in cities.

Bio: *Faye Abigail Cruz, PhD is a climate scientist and Head of the Regional Climate Systems Laboratory at the Manila Observatory in the Philippines. Currently, she is Co-Chair of CORDEX–SEA (Coordinated Regional Climate Downscaling Experiment–Southeast Asia), and leads the CARE for SEA megacities (Climatic hazard Assessment to enhance Resilience against climate Extremes for Southeast Asian megacities) project, funded by APN. Apart from her research on Philippine weather and climate, she is involved in projects providing localized climate information for adaptation planning in cities and impacts studies. 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 (PhilCCA): The Physical Science Basis, and the Philippine Climate Extremes Report 2020.*

35. **Date: 5th Sept 2024, Thursday (11:00am – 12:00pm)**

Presenter: Humphrey Lean (UKMO)

Topic: ***An Update on Urban-scale modelling research at the Met Office***

Abstract: *I will give a progress update on the project to develop Urban-scale models (gridlengths 25-300m) at the Met Office. I will briefly discuss recent progress and the latest plans for the next stages of the project including steps towards new urban surface parameterisations. Work is also ongoing on turbulence/convection representation as part of the joint NERC/Met Office ParaChute project using data from the WesCon field campaign. A key activity this year has been on the Paris Olympics RDP where we have been engaged in a model intercomparison project on past heatwave and thunderstorm cases and this is producing interesting results. More recently we are running a 300m ensemble every day for the Paris area during a period of 7 weeks encompassing the Olympic and Paralympic Games for comparison with models from other centres. I will show some interesting results from that and draw some preliminary conclusions. Finally, one of the biggest problems with Urban-scale models is their extremely high computational cost and I will describe our current thoughts about how AI might be used to mitigate this.*

Bio: *Humphrey has a BSc in Physics from the University of Bristol, UK and PhD in low temperature physics (superconductivity) from the Cavendish Laboratory, University of Cambridge, UK. In his early career he worked as a postdoc in Cambridge on high temperature superconductivity and on the plasma fusion programme at the United Kingdom Atomic Energy Authority Culham Laboratory. Since joining the Met Office Humphrey has worked on high resolution models, leading a project to develop km scale models during the 2000's. He now leads the Met Office project to develop 100m scale (often referred to as Urban-scale) models. His main scientific interests are in the areas of convection, urban meteorology and orographic rain. He is a PI on the WesCon/WOEST field campaign and the ParaChute project and is leading the Met Office high resolution modelling contribution to the WMO Paris 2024 Olympics Research Demonstration Project.*

36. **Date: 25th September 2024, Wednesday (2:00pm – 3:00pm)**

Presenter: Xin Wang (NUS)

Topic: ***CondensNet: A Physically-Enhanced ML Method for Cloud Physics in General Circulation Models***

Abstract: *We introduce CondensNet, a physically-enhanced machine learning method for resolving cloud physics in general circulation models, also known as hybrid modeling. Our approach addresses key challenges in hybrid modeling by using condensation connection, a physically-enhanced neural network design, to ensure the physical ML method's prediction accuracy and stable long-term simulation without loss of precision. CondensNet significantly enhances the robustness and interpretability of deep learning in hybrid modeling for climate prediction, potentially advancing our ability to simulate and predict complex atmospheric processes.*

Bio: *Dr. Xin Wang is a Postdoctoral Research Fellow at MatheXLab. His research focuses on AI for Climate, particularly enhancing General Circulation Models through deep learning. Wang developed the first ML-hybrid GCM capable of stable multi-decadal simulations. His current work explores generative and explainable AI in weather research, aiming to advance climate simulation and mid-range weather forecasting.*

37. **Date: 10th Oct 2024, Thursday (11:00am – 12:00pm)**

Presenter: Paul Davies (UK Met Office)
Topic: ***The reality of Climate Change: increasing extreme events and the disproportionate impacts from multiple, complex cascading risks across sectors and regions***
Abstract: *Evidence shows climate change poses serious risks to lives and livelihoods around the world, particularly from increases in extreme events, but what can we expect from future climate? The seminar will explore changes to extreme rainfall, flooding and heatwaves around the world, within the context of a seamless, scale interaction framework between large, synoptic to local scale meteorological systems. The disproportionate impacts on society from multiple climate induced hazards will be discussed, including the complex, compound and cascading risks across sectors and regions. Regional and international case studies and historical information will be used to examine why we can expect more complex risks associated with heatwaves, droughts and flooding events in the future, and how we can learn from the past to guide service solutions that matter most to users.*
Bio: *Prof. Paul Davies is the Chief Meteorologist, Head Climate Extremes, Head Profession and Principal Fellow at the Met Office and is a visiting Professor at Newcastle University and Honorary visiting Professor, Salford, Manchester University. He was the lead author to WMO's Multi-Hazard Impact Based Forecasting and Risk Based Warnings guidelines and currently chair of a WMO expert team on Cataloguing Hazardous Events (CHE) and member of the Standing Committee for Disaster Risk Reduction (DRR). A World Bank consultant operating in Sri Lanka and strategic advisor to UK industry, government and international committees he has a wealth of experience in driving innovative solutions to service delivery for the benefit of 'whole of society'.*

38. **Date: 15th Oct 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Jeff Lo (CCRS)
Topic: ***Advancing Our Understanding of Sumatra Squalls: Insights from High-Resolution NWP Modelling***
Abstract: *Sumatra Squalls are impactful weather systems affecting Malaysia and Singapore, studied using high-resolution physical modelling. Simulations of past events reveal key structural features, including rear-inflow jets and cold pool generation. This numerical weather prediction (NWP) modelling approach, combined with 22 years of observational data, enhances understanding of these understudied phenomena, emphasising the need for further research.*
Bio: *Jeff Lo, Head of High-Performance Computing (HPC) and formerly Head of Research to Operations (R2O), has extensive expertise in operational Numerical Weather Prediction (NWP) development. His experience encompasses the development of the SINGV NWP modelling system, as well as specialised knowledge in urban modelling and land use model development.*

39. **Date: 22nd Oct 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Prasanna Venkatraman (CCRS)
Topic: ***High-resolution convection-permitting regional climate model for V3 study***
Abstract: *The development and evaluation of the Singapore regional climate model (SINGV-RCM) is presented in this talk. The model's skill in predicting mean and extreme rainfall over the Maritime Continent at 8 km and 2 km grid resolution is assessed using observed rainfall. The model's sensitivity to vertical grid and convection parametrization is also evaluated. Results demonstrate the added value of downscaling to 8 and 2 km. The spatial and temporal characteristic of the diurnal rainfall is shown*

to be in good agreement with the observation. The model also demonstrates skill in capturing extreme rainfall. In general, the rainfall in the 8 km and 2 km simulations are quite similar, when regrided to a coarser resolution. Even then, the convection-permitting simulation at 2 km is found to add value over the 8 km simulation, particularly in capturing the higher rainfall thresholds. Mean biases over the ocean is found to be larger than that over the land, which suggests the need to further tune SINGV-RCM for long climate simulations.

Bio: *Dr Prasanna Venkatraman works on high-resolution dynamical downscaling as part of the Third National Climate Change Study for Singapore (V3). He was previously a researcher at the National Institute of Meteorological Sciences (NIMS), Pukyong National University (PKNU), APEC climate Centre, Korea and trained as a post-doctoral fellow at IPRC, University of Hawaii. Obtained his PhD from Nagoya University, Japan. He has studied the impacts of climate processes like ENSO, monsoon vagaries and extended monsoon breaks on agricultural productivity over the Indian Sub-continent. He is also interested in atmospheric and moist dynamical processes shaping the weather and climate over Singapore and the Maritime Continent.*

40. **Date: 29th Oct 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Markus Kraft (University of Cambridge)
Topic: ***Building Resilient Cities with The World Avatar***
Abstract: *In a world increasingly vulnerable to extreme weather events, The World Avatar (TWA) hopes to offer interoperable solutions to build urban resilience. TWA is a groundbreaking initiative that uses dynamic knowledge graphs to create a digital replica of our world – from molecules to cities and beyond. With TWA, we can model and test solutions for the most pressing challenges in managing complex systems, enabling both disaster planning and response to extreme weather events. In my talk, I will focus on TWA's ability to predict the impact of future flood scenarios by combining data from water, energy, and telecom industries. TWA addresses interoperability issues by bridging the gaps between individual data siloes, facilitating dynamic impact analyses that can determine how failures would propagate across networks. Beyond predicting impacts, TWA supports holistic disaster response through flood-avoiding route optimization, infrastructure accessibility assessment before and during floods, and critical path analysis. Additionally, TWA enhances long-term climate resilience through assessing economic and cultural impacts on cities due to sea-level rise. Join me as I showcase TWA's potential in fostering urban resilience and its broader role in shaping a more sustainable future.*

Bio: *Professor Markus Kraft researches data-driven modelling, machine learning, and semantic web technologies and has pioneered The World Avatar – an all-encompassing knowledge graph approach to developing a dynamic world model. He co-edited the book "Intelligent Decarbonisation" which comprehensively assesses the current and future impact of digital technologies and artificial intelligence on the decarbonisation of key economic sectors. He is a Fellow of Churchill College and a Professor in the Department of Chemical Engineering and Biotechnology at the University of Cambridge. He also is the Director of the Cambridge Centre for Advanced Research and Education in Singapore (CARES), the University of Cambridge's first overseas research centre, based at CREATE.*

41. **Date: 5th Nov 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Tao Han (HKUST)
Topic: ***FengWu-GHR and Aeolus: Explorations on Kilometer-scale Medium-range AI Weather Forecasting and Data-efficient Weather Research***
Abstract:
Kilometer-scale modeling of global atmosphere dynamics enables fine-grained weather forecasting and decreases the risk of disastrous weather and climate activity. Developing the higher resolution numerical model remains a long-standing challenge due to the substantial consumption of computational resources. Recent advances in data-driven global weather forecasting models utilize reanalysis data for model training and have demonstrated comparable or even higher forecasting skills

than numerical models. However, they are all limited by the resolution of reanalysis data and incapable of generating higher resolution forecasts. Therefore, we present FengWu-GHR, the first data-driven global weather forecasting model running at the 0.09° horizontal resolution. FengWu-GHR introduces a novel approach that opens the door for operating ML-based high-resolution forecasts by inheriting prior knowledge from a pretrained low-resolution model. The hindcast of weather prediction in 2022 indicates that FengWu-GHR is superior to the IFS-HRES. Despite strides in data-driven NWP, the immense demand for atmospheric data, notably in medium-range weather forecasting, challenges data accessibility and storage due to its massive size. To investigate high-ratio atmospheric data compression, we introduce a pioneering neural atmospheric data compression framework, Aeolus, to achieve a remarkable 472× compression ratio for meteorological data. It first compresses a large volumetric meteorological data into a compact hidden representation, and further encodes the latent into a more space-saving binary stream with a neural lossless entropy encoding. Aeolus framework extremely compresses the extensive 400 TB ERA5 reanalysis data down to a mere 0.85 TB, resulting in the CRA5 dataset. Extensive generalization analysis on an unseen test set demonstrates the CRA5 dataset's fidelity in maintaining high numerical accuracy, consistent climatology, and comparable power spectral density. Moreover, empirical discovery demonstrates our CRA5 has the capacities to replicate extreme weather events and supports skillful forecasting tasks. Hence, this dataset could potentially serve as a viable substitute for ERA5 in numerous research domains, promising to revolutionize cost-effective, data-driven meteorological studies in the era of artificial intelligence.

Bio: *Tao Han (韩滔) is Ph.D. student majored in computer science and engineering at the Hong Kong University of Science and Technology (HKUST), advised by Prof. Song Guo. He is also a research assistant in the Open Earth Lab at Shanghai AI Lab, mentored by Dr. Lei Bai. Prior to that, he received a B.E. degree in transportation equipment and control engineering and an M.S. degree in computer science and technology from Northwestern Polytechnical University in China. He has published more than 10 papers on the top-tier computer science conferences (incl. ICCV, CVPR, ICML, NeurIPS) and journals (incl. IEEE TNNLS, IEEE TITS). His research interests include computer vision, data-driven numerical weather prediction and AI for science.*

42. **Date:** **8th Nov 2024, Friday (2:00pm – 3:00pm)**

Presenter: Allegra Nicole LeGrande (NASA GISS)
Topic: ***Volcanic Dynamics and Climate Models: Insights from the GISS-E2.1 Simulations and PMIP3***
Abstract: *PMIP3 (Paleoclimate modeling inter comparison project, phase 3) introduced a novel coordinated simulation for modeling groups participating in experiments in preparation for the 5th IPCC (Intergovernmental Panel on Climate Change), the last millennium. This experiment was designed to start in year 850 and then carry on through the present day. In contrast to previous PMIP experiments, the principal drivers of change would be not greenhouse gases, orbital changes or continental configurations but changes to volcanism, anthropogenic land use, and solar forcing. Volcanos quickly emerged as the largest magnitude forcing of the three, but climate models initially - and uniformly - overestimated the impact. This seminar walks through the feedback process where initial mismatch led to improved climate model simulations of volcanoes impact on climate in general.*
Bio: *Dr. Allegra Nicole LeGrande is a Physical Research Scientist at NASA's Goddard Institute for Space Studies (GISS) and an Adjunct at Columbia University's Center for Climate Systems Research in New York City. She specializes in understanding and characterizing extreme climate conditions that extend beyond the historical observational period. Her research involves conducting simulations with the NASA GISS Model to study abrupt climate changes, including volcanic events, extreme freshwater forcing of the world's oceans, and atmospheric rivers. With a PhD in Earth Sciences from Columbia University, Dr. LeGrande employs advanced climate models and water isotopologues as tracers to explore the hydrologic cycle and uncover the provenance and history of air parcels. Her work focuses on validating climate models against proxy data from ice cores, cave deposits, and ocean sediments,*

aiming to bridge the gap between simulated and inferred climates and enhance predictive capabilities for future climate change.

43. **Date: 12th Nov 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Jingyu Wang (NIE)
Topic: *Diagnosis of heatwaves in Southeast Asia*
Abstract: *In April and May 2023, Southeast Asia (SEA) experienced an unprecedented heatwave, with temperatures exceeding 49°C and breaking records across the region. This study analyzes the heatwave's spatiotemporal evolution, physical mechanisms, forecast performance, and impacts, while also revealing the circulation patterns most conducive to regional heatwaves in SEA. Key drivers included high-pressure systems, moisture deficiency, and strong land-atmosphere coupling, with ECMWF models underestimating the intensity due to poor soil moisture forecasts. Additionally, based on the long-term reanalysis data, four large-scale circulation patterns conducive to the 831 SEA heatwave events were identified. Further analysis reveals that all patterns are significantly modulated by MJO activities, each showing distinct peak occurrences in different MJO phases, with further links to ENSO and IOD.*
Bio: *Dr. Wang Jingyu is an Assistant Professor in the Humanities & Social Studies Education Department, National Institute of Education (NIE), Nanyang Technological University (NTU). Before joining NIE/NTU, he worked as a research associate at the Department of Atmospheric Sciences & Global Change, Pacific Northwest National Laboratory (PNNL), observing and simulating mesoscale convective systems and the related natural hazards of tornado and hail. Jingyu received his Ph.D. degree in Atmospheric Sciences (with a minor degree in Hydrology) from the University of Arizona, with the focus of in-situ observation of cloud microphysics using research aircraft.*

44. **Date: 19th Nov 2024, Tuesday (3:00pm – 4:00pm)**

Presenter: Hui Su (HKUST)
Topic: *Convection, Cloud, Circulation and Climate Change*
Abstract: *Climate model simulations show that tropical circulation would experience significant structural changes under global warming, including weakening and poleward expansion of the subtropical descent, and strengthening and tightening of the equatorial ascent, although the magnitudes of these changes vary substantially between models. The tropical circulation changes are closely coupled with convection and cloud properties, which in turn affect long-term global temperature and precipitation responses to increasing greenhouse gases. In this talk, I will present the interactions between convection, cloud and circulation in the context of climate change in both models and observations, with a special focus on cloud feedback and hydrological cycle.*
Bio: *Prof. Hui Su is a Global STEM Professor and Chair Professor in the Department of Civil and Environmental Engineering, and the Executive Director of the Space Science and Technology Institute at the Hong Kong University of Science and Technology. She co-led the successful launch of the first HKUST satellite in 2023 and currently leads the HKUST carbon observatory on China's Space Station project. Before joining HKUST in 2022, she was a principal scientist and weather discipline program manager at NASA's Jet Propulsion Laboratory (JPL). Hui Su's research interests primarily focus on tropical meteorology, climate variability and climate change, and remote sensing. She has published over 140 peer-reviewed articles. In 2024, she received the Banner I. Miller Award from the American Meteorological Society, and she was awarded the NASA Exceptional Scientific Achievement Medal in both 2010 and 2022. Additionally, she is a recipient of the Edward Stone Award and the Lew Allen Award for excellence at JPL. Hui Su is a Fellow of the American Meteorological Society and serves as an Editor for Geophysical Research Letters.*

45. **Date: 21st Nov 2024, Thursday (4:00pm – 5:00pm)**

Presenter: Ashar Aslam (Univ. of Leeds)

Topic: ***Severe weather over southeast Asia: from air-sea interaction to Sumatra squalls***

Abstract: *The Maritime Continent in southeast Asia experiences extreme rainfall all year round. Patterns in rainfall and deep convection are modulated by processes which operate over a variety of spatial and temporal scales. While extensive research has been conducted into better understanding these processes, several gaps still remain in our knowledge. In this talk, I will be discussing two components of my PhD so far, which aim to address some of these gaps. Firstly, I explore air-sea interactions at the mesoscale and their role in influencing regional atmospheric properties. Using satellite altimetry data, I highlight geographical variability in mesoscale ocean eddy properties across the Maritime Continent. Coupling these results with reanalysis data, I assess whether there is a detectable atmospheric response to the surface anomalies associated with these eddies, which are known, elsewhere in the global ocean, to influence atmospheric boundary layer stability. Secondly, I introduce initial results which investigate the larger-scale drivers of eastward propagation of convection over Sumatra. Many studies have addressed the westward offshore propagation of convection from the Barisan mountains, but very few explore, in depth, propagation in the opposite direction. Extreme rainfall coming from these convective systems can affect eastern Sumatra, peninsular Malaysia and Singapore, the latter of which have historically coined the term 'Sumatra squalls'. Future work will aim to look into storm-scale dynamics influencing these squalls.*

Bio: *Ashar Aslam completed an integrated Masters' in Earth Sciences from the University of Oxford in 2021, before starting his PhD at the University of Leeds, funded by the SENSE Centre for Doctoral Training as part of a Met Office CASE studentship. His primary supervisors are Juliane Schwendike and Simon Peatman (who has recently joined MSS). Now in his final year, Ashar's PhD has aimed to explore various processes and scale interactions that influence rainfall patterns across the Maritime Continent in southeast Asia.*

46. **Date:** **3rd Dec 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Xiaohui Zhong (Fudan Univ.)

Topic: ***FuXi: From Medium-range to subseasonal-to-seasonal forecasts***

Abstract: *Skillful subseasonal forecasts are crucial for various sectors but present significant scientific challenges. Recent advancements in machine learning have led to machine learning models that outperform leading numerical forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) in medium-range forecasts, though they still lag behind conventional models at subseasonal timescales. FuXi model team developed FuXi Subseasonal-to-Seasonal (FuXi-S2S), a machine learning model capable of generating global daily mean forecasts for up to 42 days, encompassing five upper-air atmospheric variables across 13 pressure levels and 11 surface variables. Trained on 72 years of daily statistics from ECMWF ERA5 reanalysis data, FuXi-S2S exceeds ECMWF's state-of-the-art Subseasonal-to-Seasonal model in ensemble mean and forecasts for total precipitation and outgoing longwave radiation, significantly improving global precipitation predictions. This enhancement is largely due to FuXi-S2S's ability to capture forecast uncertainty and extend skillful Madden-Julian Oscillation (MJO) predictions from 30 to 36 days. Additionally, FuXi-S2S effectively identifies teleconnections associated with the MJO and serves as a valuable tool for discovering precursor signals, offering new insights for researchers and potentially reshaping Earth system science.*

Bio: *Dr. Xiaohui Zhong is a postdoctoral researcher at the Department of Artificial Intelligence Innovation and Incubation Institute of Fudan University, and a research scientist at the Shanghai Academy of Artificial Intelligence for Science. He obtained a PhD degree in Mechanical Engineering from the University of California San Diego. He was an algorithm expert at Alibaba Damo Academy before joining Fudan University. He is the chief atmospheric scientist at FuXi modeling team. His research interests are primarily in improving weather forecasting and data assimilation with machine learning models.*

47. **Date:** **17th Dec 2024, Tuesday (11:00am – 12:00pm)**

Presenter: Chun-Hsu Su (BoM)

Topic: ***Development of regional reanalysis and regional climate projections for Australia***

Abstract: *For Australia to adapt to climate change on regional and national levels, climate information is needed at a much higher resolution, than is currently available through global modelling. Newly formed Australian Climate Service (ACS) aims to improve individual hazard intelligence, across all scales (national, regional, local), to enhance all hazard prevention and preparedness. High resolution (<20 km) climate information, from reanalysis of historical/present conditions and downscaled projections, is required to support hazard modelling and ascertain climate extremes. Here I will discuss the development and results from the Bureau's regional reanalysis (BARRA latest version 2) and regional climate projections (BARPA).*

Bio: *Dr Chun-Hsu Su is a Senior Research Scientist and the Team Leader for Data Assimilation in Research Program of the Bureau of Meteorology. The Team is responsible for delivering new (atmospheric) Data Assimilation systems for operational numerical weather prediction, nowcasting and reanalysis applications. He is also the science lead for producing the second version of regional atmospheric reanalysis (BARRA2) and CMIP6-based climate projections (BARPA), which underpin the Australian Climate Service.*