CCRS Newsletter

Issue 2, October 2022

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From Singapore to Norway: Expanding Scientific Networks and Research

Drivers of Regional Sea-level Rise: A Maritime Perspective

Kongsberg Satellite Station (KSAT) at Longyearbyen, Svalbard; taken during CCRS scientist's field trip to Norway

METEOROLOGICAL SERVICE SINGAPORE
Centre for Climate Research Singapore

A quarterly newsletter of the Centre for Climate Research Singapore

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Published quarterly, the CCRS Newsletter highlights CCRS' latest news, activities and progress. The Newsletter also shares latest climate/weather science developments that are relevant to CCRS' mission. For feedback and enquiry, please email: NEA_CCRS_Engage@nea.gov.sg.

Word from the Director

Welcome to the second issue of the CCRS Newsletter.

This issue has a special focus on climate change and sea-level rise, described as the 'existential threat' for Singapore in the Prime Minister's National Day Rally in 2019.

CCRS was part of the organising committee for the third World Climate Research Programme Sea Level Conference 2022 held in Singapore's spectacular Marina Bay Sands in July 2022. The Opening Session of the Conference saw the announcement by Ms Grace Fu, Minister for Sustainability and the Environment, of a new S$23.5 million Climate Impact Science Research (CISR) Programme, to be administered by CCRS' Climate Science Research Programme Office (CSRPO).

Two CCRS scientists have contributed to this issue – research scientist Trina Ng recounts her recent work trip to Norway to enhance international collaborations and planned work, and Nidheesh Gangadharan shares his perspective on the drivers of regional sea-level rise in Southeast Asia (SEA).

CCRS' weather and climate science activities are strongly dependent on the availability of significant supercomputing resource. In preparation for major advances in operational numerical weather prediction (NWP) and climate modelling, CCRS' workhorse 'SINGV' modelling system has recently been ported to our new in-house 'Utama' supercomputer.

On 30 August 2022, the commissioning of Utama was officiated by Singapore's Senior Minister of State for Sustainability and the Environment Dr Koh Poh Koon on a visit to CCRS, together with Permanent Secretary (Sustainability and the Environment) Mr Stanley Loh. CCRS also provided Dr Koh and Mr Loh an update on CCRS' status and plans, explaining how our research on tropical climate and weather benefits stakeholders in Singapore and the wider SEA region.

Finally, in this edition of the newsletter, we share the latest information on our science highlights, seminars and events. We hope you find the newsletter informative. Please let us know if there is something in particular you would like to hear about. I encourage you to share the newsletter with colleagues and friends – contact us to sign up, and do follow us on LinkedIn.

Happy reading!

Professor Dale Barker
Director,
Centre for Climate Research Singapore

World Climate Research Programme Sea Level Conference 2022

CCRS and other divisions of the Meteorological Service Singapore (MSS) were part of the committee that supported the organisation of the World Climate Research Programme (WCRP) Sea Level Conference 2022. Held on 12–16 Jul 2022, the Conference was attended by about 370 participants, comprising more than 60% international participants from 42 countries.

With the theme 'Advancing Science, Connecting Society', the Conference provided a platform for the sharing of the present status and future of climate-related sea-level research, with a strong focus on the application of sea-level science for stakeholders' adaptation needs.

Launch of the Climate Impact Science Research Programme

In her opening address, Ms Grace Fu, Minister for Sustainability and the Environment, described the challenges and opportunities in climate change mitigation, and the role of science in adapting to climate change.

Minister Fu announced that CCRS would strengthen local research capabilities in climate impact science through the S$23.5 million Climate Impact Science Research (CISR) Programme.

Led by CCRS' Climate Science Research Programme Office (CSRPO), the CISR Programme aims to improve understanding of the long-term impacts of climate change on Singapore. The Programme will focus on five key priority areas – sea level rise; water resource and flood management; biodiversity and food security; human health and energy; and cross-cutting research to bridge science-policy translation.

Ms Grace Fu, Minister for Sustainability and the Environment, announced the launch of the Climate Impact Science Research (CISR) Programme at the World Climate Research Programme (WCRP) Sea Level Conference 2022.

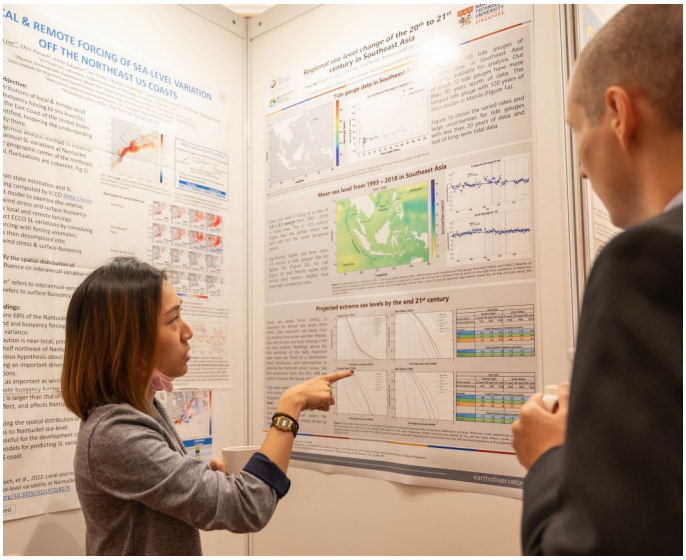
The CISR Programme will utilise the latest climate projections to address key research gaps. One area of potential research is the assessment of compound risk from the combination of extreme rainfall and storm surges in the light of rising sea levels, which will be useful for agencies involved in coastal adaptation planning.

"By downscaling global climate projections and producing localised, high-resolution models of wind, rainfall, and temperature, we can better assess the impacts of climate change on local crop and aquaculture yields. We could also evaluate the indirect impact of higher temperatures through the increased prevalence of pests and diseases. This would in turn allow us to strengthen our food resilience, be it through the development of climate-resilient crop varieties, or choosing sea spaces with more suitable habitat conditions for aquaculture," Minister Fu said.

Overview of Singapore's National Sea Level Programme

CCRS Director Prof Dale Barker presented an overview of Singapore's National Sea Level Programme (NSLP), also managed by CSRPO. He shared that preliminary findings from the NSLP have shed light on the uncertainty of probable sea levels in Singapore, which will allow a more accurate understanding of climate impact science for downstream policy and infrastructure implementation.

CCRS Director Prof Dale Barker gave an overview of Singapore's National Sea Level Programme (NSLP) at the WCRP Sea Level Conference 2022.



CCRS Research Scientist Trina Ng delivered a poster presentation on regional sea-level change in Southeast Asia at the WCRP Sea Level Conference 2022.

CCRS' sea-level research

CCRS Research Scientist Trina Ng presented her work on the regional sea-level change from the 20th to 21st century in Southeast Asia.

Using data from tide gauges and satellite altimetry, Trina investigated the rates of sea-level rise in different parts of Southeast Asia. She also shared her work on projected sea levels in some parts of this region by the end of the 21st century.

From Singapore to Norway:
Expanding Scientific Networks and Research

The effects of climate change can be seen in many parts of the world—countries near the poles experience changes that directly encroach onto the livelihoods of the population, whilst others may only feel the effects of climate change later because of delayed responses of the Earth's system. Located near the equator, many climate change issues that affect Singapore are long-term. In May 2022, as part of Singapore's effort to expand sea-level research networks, I had an eye-opening opportunity to travel to several parts of Norway, witnessed first-hand encounters of some immediate ramifications climate change has on the local communities, and engaged in meaningful conversations with climate scientists working on ice sheet and sea-level research. Jointly supported by the Earth Observatory of Singapore and CCRS, this trip will remain unforgettable and inspiring to me for a long time.

My personal favourite of this trip was the one-night stay in Longyearbyen, Svalbard. Known as the High Arctic, Svalbard is located 74–81 degrees north in the Arctic Circle—and this would be the furthest north of the planet I have ever been (and will ever be)! As a junior research scientist at CCRS and PhD candidate at the Nanyang Technological University Singapore working on sea-level research, I felt very privileged to have such an opportunity during the early stages of my career.

Ms Trina Ng is a sea-level research scientist in the Climate Impacts Branch at CCRS whose role includes delivering and communicating sea-level related science, such as projections, to stakeholders. Joined in 2020, Trina has been working on sea-level observations in Singapore using instrumental records. Since then, her work has also extended to other parts of Southeast Asia, looking at historical and future sea-level variability in the region. Trina is currently doing a part-time PhD at the Earth Observatory of Singapore at Nanyang Technological University Singapore, to improve her knowledge in this area of science.

Bird's-eye view of Svalbard from the plane. Svalbard is known as the 'Arctic Desert' because of its extreme climate. As Svalbard is north of the Arctic Circle, it experiences midnight sun in the summer (24 hours of sunlight) and polar night in the winter (24 hours of darkness).

The first itinerary was a visit to the Kongsberg Satellite Station (KSAT), which is the world's largest ground station support for polar orbiting satellites. The station was located on slightly elevated grounds away from the settlement. Structures that looked like massive golf balls littered the vast plateaus against a backdrop of cloudless blue skies and glaciers. I found out later that these structures were carefully designed to shield the ground receivers from the harsh, extreme environment in Svalbard. As a scientist whose work mainly involves crunching numbers at my desk, being out on the field experiencing the novelty of such a satellite station was really refreshing, and it gave me a more holistic outlook to my research.

Kongsberg Satellite Station (KSAT) at Longyearbyen, Svalbard, Norway

Back on the mainland in Tromsø, I attended the Arctic Frontiers Event 2022 for a couple of days. The conference brought politicians, scientists and even the indigenous community together to exchange knowledge about the Arctic. This was where I learnt that many communities in the North, like the Svalbard population, are in fact adapting to climate change daily right now. And the effects of climate change may not always be an immediate threat to livelihood. The loss of sea ice, for instance, extends the fishing season in the Greenlandic societies. In turn, this makes year-round shipping now possible and more opportunities for tourists. This sure sounds like immediate economic gain, but what about the environmental implications in the long run? Could overfishing occur, and could the influx of tourists put a strain in local resources for example?

The walk to the University of Svalbard (UNiS) which is located near the coast (facing the Greenland Sea)

Norwegian Research Centre (NORCE) at Bergen

My discoveries and learnings did not stop at Tromsø. I spent my last week in Norway at the Norwegian Research Centre (NORCE), situated in Bergen. The city was pleasant, and yet again blue skies daily with no sign of rain—an unusual phenomenon during that time of the year according to the locals. I spent the week with Dr Kristin Richter from NORCE, whose role includes communicating science and delivering sea-level projections to the Norwegian stakeholders, akin to my role here at CCRS. We had fruitful discussions on the methodologies both research centres employ to projecting sea-level rise, including validation of methods to estimate Singapore's sea-level projections and learning about the different impacts of future sea-level change both countries potentially face.

Later in the trip, I had a discussion with Dr Heiko Goelzer, a Senior Researcher at NORCE, on the possibilities of collaboration for my PhD study that aims to look at the impacts of ice sheet mass loss on Singapore's sea level.

Embarking on this journey has enabled me to foster relationships with several international sea-level experts and gain both scientific and non-scientific insights of the polar ice sheet communities, which are invaluable to the nascent sea-level work here in Singapore. I am thrilled to be a part of the community, and the trip to Norway had been a delightful induction.

Drivers of Regional Sea-level Rise: A Maritime Perspective

Global-mean sea level has been rising at a rate of about 3–4 mm/year during recent decades. Many coastal regions and islands in the world are already facing the adverse effects of sea-level rise because the relative sea-level change (the sea-level change that we observe at the coasts) is further affected by several geophysical processes involving land, the ocean and atmosphere. Indonesia's capital city Jakarta, for example, is sinking towards the sea at an alarming rate[1] (up to 10 cm/year), and the country is moving its capital to mitigate the situation. The Solomon Islands, a low-lying island nation in the western tropical Pacific, has lost at least five of its reef islands to the rising seas and intense wave action, and many of the small islands in the archipelago await a similar fate[2]. The water level of the Ganges-Brahmaputra-Meghna delta in the northeastern Bay of Bengal is expected to rise by more than 1 m by 2100 due to sea-level rise and land subsidence, posing a great threat to nearly 200 million inhabitants in the region[3].

Components contributing to global-mean sea-level rise

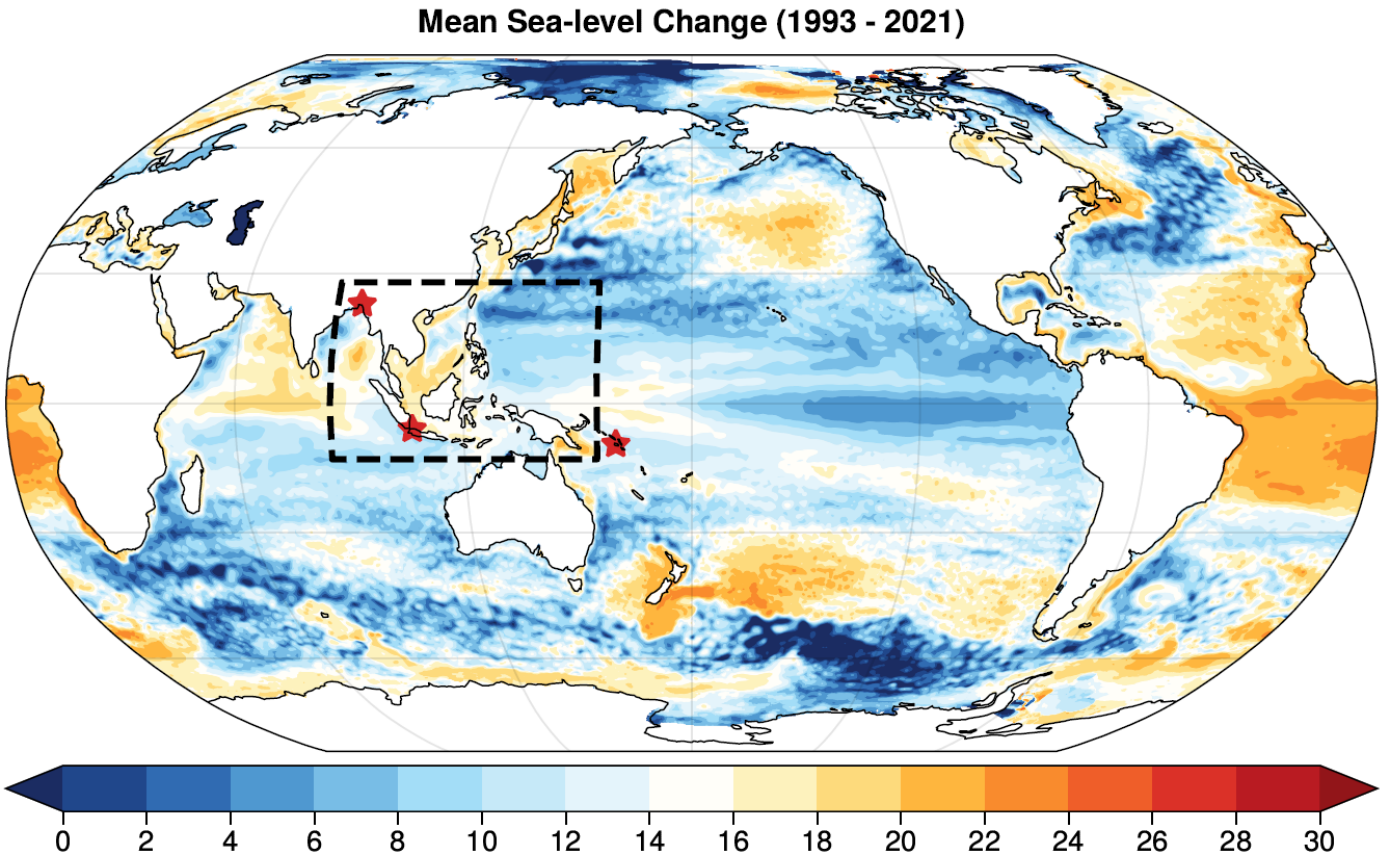
The scientific understanding of mean sea-level rise has advanced significantly in recent decades. Researchers are able to explain the recent global sea-level rise by summing up the contributions from ocean thermal expansion and redistribution of water between the ocean and land (which includes melting of ice from glaciers and ice sheets, and changes in land-water storages). The oceans play a key role in regulating the Earth's climate as they absorb about 90% of the excess heat in the climate system due to global warming. An inevitable consequence of this heat absorption is the ocean thermal expansion and mean sea-level rise. Satellite-based observations and other in-situ measurements suggest that the ice loss from glaciers and ice sheets at Antarctica and Greenland has increased over the recent decades, and can potentially become large sources of sea-level change in the current century.

Dr Nidheesh Gangadharan is a sea-level research scientist in the Climate Impacts Branch at CCRS. His research mainly focuses on sea-level changes at various spatial and temporal scales. In CCRS, Nidheesh's work will contribute to understanding sea-level changes around Singapore and the wider Southeast Asia region.

Spatially non-uniform sea-level rise

Sea-level rise is not spatially uniform. For instance, the satellite-measured sea-level rise in the seas around Singapore (about 18 cm; as seen in the figure on page 8) during 1993–2021 is near twice the global -mean sea-level rise over the same period (about 10 cm). This spatially non-uniform rise is primarily caused by ocean circulation which redistributes water mass and heat within the ocean basins under the influence of winds and density differences. The sea-level change in response to land-ice melting is also not uniform across the oceans. The changes in the local gravitational field and Earth's rotational effects (in response to water mass redistribution between the land and ocean) impose characteristic regional sea-level patterns called "sea-level fingerprints". For instance, the ice loss from the Greenland ice sheet over the last few decades caused a sea-level fall around Greenland by a few centimetres while sea levels rose over most of the tropical oceans in response to that melting (the local and remote impact of ice sheet melting).

Addressing coastal sea-level rise and its impacts is challenging as it requires information on various coastal processes: vertical land movements (VLM), storm and wave activities, (changes in) coastal morphology, etc. On average, the ocean basins (continents) are slightly subsiding (uplifting) due to the loading (unloading) of sea water (land ice) since



Mean sea-level rise (cm) during the period 1993–2021 estimated from satellite sea-level data[4]. The Southeast Asia maritime region is shown by the dashed rectangle. Stars (from left to right) indicate the locations of Ganges-Brahmaputra-Meghna delta, Jakarta and the Solomon Islands.

the last glacial maximum which occurred about 20 000 years ago. This process is known as glacial isostatic adjustment (GIA), which is one of the main drivers of relative sea-level change in many coastal regions. Locally, the VLM caused by other factors such as tectonic movement and anthropogenic subsidence can also cause significant relative sea-level changes over shorter time scales. Hence, estimates of the VLM at coastal regions are critical to understanding relative sea-level rise within the maritime Southeast Asia (SEA) region (highlighted by the dashed rectangle in the figure above).

Importance of observational systems and data

As far as the ocean in the SEA region is concerned, the lack of long-term, spatially dense observations is one of the main caveats for a better understanding of sea-level rise in the region. Ideally, each tide-gauge installation must possess a complementary Global Navigation Satellite System (GNSS) receiver to monitor land movements. Hydrography and current measurements are also fundamental to understanding the coastal ocean dynamics and sea-level changes. However, the availability of such complementary observational systems and data is very sparse in many parts of the region, including Singapore. Sustaining the existing observing networks (e.g. tide gauges, Lidar) and initiating coordinated ocean observational programmes are important in addressing sea-level rise in the SEA region.

Where CCRS can help

The complexity of the local sea-level rise problem and the lack of observations also call for developing a high-resolution hydrodynamic modelling system for the SEA region. This topic is a strategic priority for CCRS in the next 3–5 years through the development of a regional, km-scale 'cSINGV' coupled ocean-wave -atmosphere-land modelling system to better understand and simulate the weather and climate over the SEA Maritime Continent region.

References:

[1] Bott et al (2021) *Ocean Coast Manag.* **211** 105775
[2] Albert et al (2016) *Environ. Res. Lett.* **11** 054011
[3] Becker et al (2020) *Proc. Natl. Acad. Sci.* **117(4)**:1867-1876
[4] E.U. Copernicus Marine Service Information – https://resources.marine.copernicus.eu/products

Science Highlights

On applying large-scale correction to limited-area numerical weather prediction models

Dr Peter Heng, Senior Research Scientist
Research to Operation Branch, Department of Weather Research

Developing and running operationally an advanced high-resolution regional numerical weather prediction (NWP) system to support weather forecasts in Singapore and the nearby region is a core activity within CCRS' Department of Weather Research. Large-scale atmospheric features with long wavelengths, such as high- and low-pressure systems across the Indo-Pacific region, can influence weather patterns in Singapore. It is therefore important to include information about these features when trying to simulate what goes on in the atmosphere over a smaller geographical region, as in the regional 'SINGV' NWP system developed at CCRS which guides forecasters in Singapore.

Regional NWP model runs are typically started via regional data assimilation (DA), a process that provides the model with information of the atmosphere at the start of a run. Regional DA, however, cannot adequately capture large-scale information because data outside the model domain are not assimilated into the model. Various techniques have been proposed to fix this large-scale information deficit in regional models.

CCRS scientists have developed a blending approach to supplement the small-scale information in SINGV's analysis[1] with large-scale information derived from its driving global NWP model forecast, as described in their recent paper.

The authors conducted three sets of blending experiments:

1) EXPT_uv, which blended horizontal winds;
2) EXPT_uvT, which blended potential temperature[2] in addition to the winds; and
3) EXPT_uvTQ, which blended specific humidity on top of EXPT_uvT.

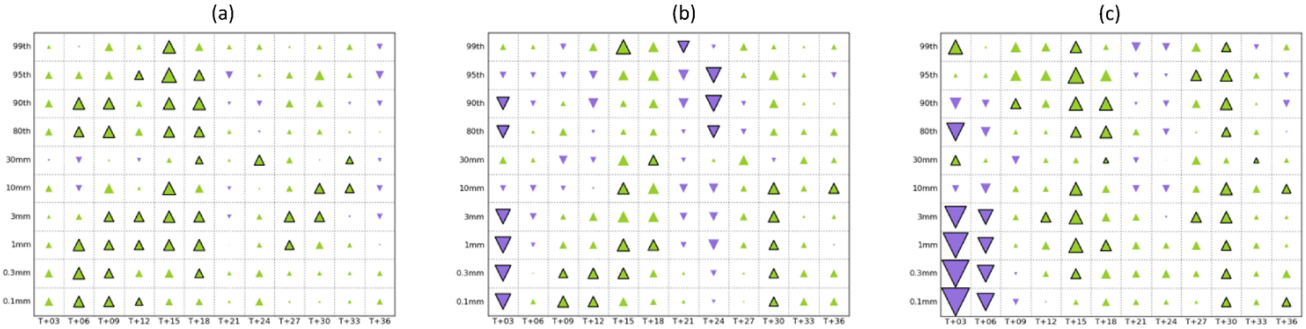
The results were benchmarked against a control run (CTRL), in which blending was not applied.

The evaluation from this study showed that EXPT_uvTQ produced the greatest reduction in the root mean squared errors of SINGV temperature and wind forecasts with respect to analyses from the European Centre for Medium-Range Weather Forecasts, implying more accurate initial conditions. On the other hand, upon verification with rainfall measurements, the greatest improvement in rainfall forecasts is found to come from EXPT_uv (i.e. blending winds only) instead of EXPT_uvTQ, as shown in figures (a) and (c), respectively.

The results show that the proposed method results in more accurate initial conditions for starting a model run with respect to global model analyses. On the other hand, more accurate initial conditions may not translate into better rainfall forecasts. In this study, selective blending of winds produced the best rainfall forecasts. These findings will help us prioritise future SINGV development and results may also be more broadly applicable to regional NWP systems in the tropical region.

Click here to read the full paper.

Differences in verification scores (max = 0.073) for (a) EXPT_uv − CTRL, (b) EXPT_uvT − CTRL, and (c) EXPT_uvTQ − CTRL. Green upward-pointing triangles indicate higher skill for experiments, and purple downward-pointing triangles indicate otherwise. Solid triangles mean the differences are statistically significant.



[1] The best estimate of atmospheric conditions based on observations and the model's short-range forecast
[2] The temperature that an unsaturated parcel of dry air would have if brought adiabatically and reversibly from its initial state to a standard pressure, typically 1000 hPa

Seminar Series

CCRS hosts a weekly seminar series to share research and development in areas of relevance to CCRS' activities, amongst our staff as well as with our collaborators. These seminars also serve to connect local and international researchers from the wider Earth system research community and provide avenues for discussions and collaborations on seminar topics. For more details of past and upcoming seminars, please visit http://ccrs.weather.gov.sg/ccrs-seminar-series/.

Previous seminars cover a broad range of topics, including sea-level research, climate change impact studies, air quality prediction, and urban impact on weather and climate. Below are some highlights of the seminars held in Q3 2022.

Title of seminar:
Overview of my research activities at the BoM including Hadley Circulation and droughts

Abstract:
Dr Hanh Nguyen from the Bureau of Meteorology (BoM), Australia gave an overview of her research on the variability and trends of the Hadley Circulation. Expansion of the Hadley Circulation was first mentioned in the literature in the 1990s and has since gained paramount interest and publications. More recent research has been focusing on the regional aspects of changes in the Hadley Circulation, with the Indo-Pacific sector being the main contributor. Understanding the regional impacts of Hadley Circulation expansion is crucial to relate global and local climate changes. Dr Nguyen also shared her current research on flash drought, a type of agricultural drought that is distinctive by its rapid intensification. This research is part of the Northern Australian Climate Program (NACP) that delivers research, development and extension outcomes to improve the capacity of the red meat industry and to manage drought and climate risk across northern Australia.

Title of seminar:
Climate impacts and risks: case studies in water and ecological sectors

Abstract:
Dr Jianjun Yu from CCRS discussed the impacts of climate change on the extreme rainfall in Singapore and the potential impacts on drainage design through an urban hydrological study. He then presented his previous works to model the drought risks on forests and tree species vulnerability in Britain, and to integrate the species distribution modelling to investigate the Lyme risks in Europe under climate and land cover change drivers. Dr Yu also presented the preliminary results of using Landsat remote sensing to analyse the dynamics of Singapore's tropical urban vegetation in response to historical droughts and shared his opinions to infer the fate of urban greenery under global warming.

Events

Visit by Singapore's Senior Minister of State for Sustainability and the Environment

On 30 August 2022, CCRS hosted Singapore's Senior Minister of State for Sustainability and the Environment Dr Koh Poh Koon and Permanent Secretary of the Ministry, Mr Stanley Loh.

CCRS scientists shared with Dr Koh and Mr Loh about CCRS' research achievements, and how its research on tropical climate and weather benefits stakeholders in Singapore and the region, for example, supporting policy-making and climate adaptation. Dr Koh unveiled a plaque to officiate the launch of CCRS' new in-house supercomputer 'Utama', which means 'preeminent' in the Malay language. Dr Koh and Mr Loh also toured the Upper Air Observatory which is co-located at CCRS. They were briefed on Singapore's meteorological observing network and how upper-air data collected by balloon-borne radiosonde supports operational weather forecasting and research.

At the CCRS Foyer: (L–R) CCRS Director Prof Dale Barker, Assistant Chief Executive, Meteorological Service Singapore (MSS) Ms Koh Li-Na, Senior Minister of State for Sustainability and the Environment Dr Koh Poh Koon, Permanent Secretary (Sustainability and the Environment) Mr Stanley Loh, and Director-General, MSS Ms Wong Chin Ling

Senior Minister of State for Sustainability and the Environment Dr Koh Poh Koon released a weather balloon at the end of his tour of the Upper Air Observatory.

Colloquium at the National University of Singapore

On 14 September 2022, CCRS Director Prof Dale Barker presented a talk at the National University of Singapore, which attracted more than 100 participants. In his talk titled 'Towards improved understanding of tropical climate and weather affecting Singapore and Southeast Asia', Prof Barker gave an overview of the weather and climate challenges for Singapore and the wider Southeast Asia region. He then shared how CCRS is contributing to this exciting field and highlighted opportunities for further student engagement with CCRS, including internship and career opportunities.

CCRS Director Prof Dale Barker delivered a talk at the National University of Singapore.

Asia Oceania Geosciences Society annual meeting

CCRS scientists convened two sessions and delivered 12 presentations at the Asia Oceania Geosciences Society (AOGS) annual meeting. Conducted virtually this year, the AOGS2022 provided opportunities for scientists to discuss and exchange scientific knowledge to address important geo-scientific issues in the Asia Oceania region.

Focusing on climate and weather research in Southeast Asia, CCRS scientists presented their work on:

- Ultra-high resolution (100m) urban modelling over Singapore
- Impact of assimilating satellite radiance data on tropical rainfall forecasts
- Development of our numerical weather prediction system using cutting-edge data assimilation techniques
- Extreme sea level analysis around the Southeast Asian coast
- Weather and climate events in the Maritime Continent-Southeast Asia region, such as warming-induced changes in ENSO-monsoon teleconnection, extreme rainfall events arising from cold surges, and projected rainfall changes in wet and dry seasons in latest global climate models
- Subseasonal to seasonal forecasts and applications in Southeast Asia, such as threshold-based outlooks for hydrometeorological disasters (e.g. extreme heavy rainfall) for end-users, and evaluation of the outlooks' performance

CCRS scientists presented their research on tropical climate and weather in Southeast Asia at the virtual Asia Oceania Geosciences Society annual meeting 2022.

11th European Conference on Radar in Meteorology and Hydrology

CCRS Research Scientist Erik Becker attended the 11th European Conference on Radar in Meteorology and Hydrology (ERAD2022) on 29 August–2 September 2022 remotely. Organised by the Federal Office of Meteorology and Climatology MeteoSwiss, ERAD2022 brought together over 460 international participants that are responsible for operational radar networks around the world.

In his poster presentation titled 'Development of Radar-based Nowcasting for Intense Precipitation in the Tropics', Erik gave an evaluation of several nowcasting (i.e. in the next 30 minutes) techniques for heavy rainfall events in Singapore using appropriate verification metrics to determine their performance. He also presented future plans on development towards improvements using machine learning based approaches.

Media Highlights

In a Channel NewsAsia podcast 'News In 60 Minutes', CCRS Research Scientist Trina Ng shared the key highlights of her poster presentation at the World Climate Research Programme (WCRP) Sea Level Conference 2022. She also shared the causes for concern for sea-level rise at Singapore and Southeast Asia at various timescales. Finally, Trina shared what could be done to mitigate rising sea levels at the national level (e.g. climate projections from the Third National Climate Change Study that inform policymaking) and individual level (e.g. ways of living more sustainably).

Read this Straits Times article to find out more about the Climate Impact Science Research (CISR) Programme announced during the Conference.

CCRS Research Scientist Trina Ng was interviewed at the World Climate Research Programme Sea Level Conference 2022.

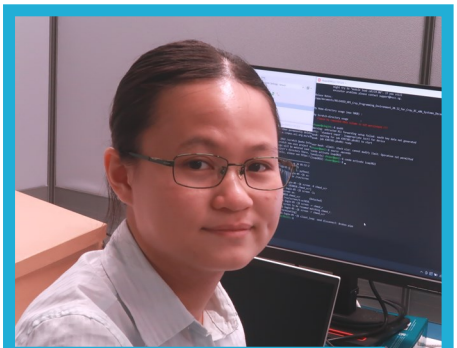
Staff Spotlight

Dr Hugh Zhang
Deputy Director

As the Deputy Director of the Department of Weather Research, I lead my department on the research, development, and transition to operations of our high-resolution and seamless numerical weather prediction (NWP) systems and air quality forecasting.

Prior to joining CCRS in February 2022, I worked at the Bureau of Meteorology (BoM), Australia as a Senior Research Scientist. My research interests were always on using observations and modelling to improve our understanding of weather and climate processes in our region, including impacts of land-air-sea interactions on NWP, coupled seasonal forecast, climate variability and predictability in the Australian-Asia region, and the Australia-Asian monsoon and their teleconnections. Over the years, I have established strong international collaborations and led many collaborative projects.

My department works closely with CCRS' Department of Climate Research, Meteorological Service Singapore's (MSS) forecasters, universities and international organisations. Through strong collaborations and partnerships, and by conducting strategic and applied research to enhance our understanding of tropical weather and climate systems in the Southeast Asia region, my team aspires to better support MSS' weather services and serve stakeholder needs.



Dr Chua Xin Rong
Research Scientist

I joined the Climate Modelling and Predictions Branch, Department of Climate Research in November 2019 as part of the team working on the Third National Climate Change Study for Singapore (V3).

Previously, my research examined the impacts of absorbing aerosols and greenhouse gases on tropical precipitation. My expertise lies in climate modelling and the physical processes that affect tropical precipitation. Currently, these skills support the timely delivery and analysis of V3 climate simulations. My work enables the V3 team to combine different lines of evidence to evaluate the likely changes in climate over Singapore and the region.

For other staff profiles, please visit http://ccrs.weather.gov.sg/our-people/.

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