2020

1. **Date** : 08 January 2020
Presenters : Andrés Simón-Moral (NUS)
Theme : Has Singapore urbanization increased heavy rainfall?

Abstract
Singapore has been subject to an increase in heavy rainfall events in the last 20 years. At the same time, Singapore has doubled its built-up areas in the last few decades. Such urbanization process suggests an implication on the increase of heavy rainfall events, as has been alluded to in earlier studies on other cities of the world. High resolution simulations with and without urban areas are performed and compared in order to understand the role urbanized Singapore has on the diurnal cycle of rainfall over the region. Results show an increase of precipitation over Singapore and Johor Bahru when built-up areas are considered. During this talk, the mechanisms behind this increase and the role anthropogenic heat flux has on it will be explored.

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2. **Date** : 22 January 2020
Presenters : Dr CHUA Xin Rong (CCRS)
Theme : Cold surges and weather regimes in a high-resolution GCM

Abstract
My thesis examines aspects of the effects of greenhouse gases and absorbing aerosols on tropical precipitation. This talk will focus on a GCM study on the effects of surface warming on cold surges over the Maritime Continent, as well as a case study of using the weather regime technique (Hassim and Timbal 2018) as a tool to evaluate GCMs. The results suggest that cold surge rainfall could become more intense under surface warming, especially when strong Arctic amplification is present.

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3. **Date** : 29 January 2020
Presenters : Dr Dhrubajyoti Samanta (NTU)
Theme : La Niña's Diminishing Fingerprint on the Indian Summer Monsoon

Abstract
Historically, wetter conditions of the Indian summer monsoon (ISM) during June to September of La Niña years are important for water resources in particular groundwater recharge. Observations from recent decades, however, show a reduction of 6–8% in ISM rainfall during post-1980 La Niñas relative to pre-1980 La Niñas, which is a serious concern for regional water resources and stability particularly if the trend continues. Using a suite of atmospheric model experiments, we replicate this observed phenomenon and attribute it to weakening La Niña events combined with a strongly warming tropical Indian Ocean. Model simulations indicate that 50%

reduction in ISM rainfall during post-1980 La Niñas can be attributed to changes in the spatial pattern and intensity within the tropical Pacific Ocean. The tropical Pacific east-west atmospheric circulation pattern (Walker circulation) is crucial for deep convection over the South Asian region. We show that warmer eastern equatorial Pacific Ocean temperatures during post-1980 La Niñas weaken the Walker circulation, resulting in inhibition of deep convection over the Indian subcontinent, thereby reducing ISM rainfall. Furthermore, we demonstrate that ISM rainfall over central India during La Niña years is likely to decline with increasing tropical Indian Ocean warming, which has several important implications for agriculture and economy of the Indian subcontinent. These results suggest that we must revisit the impact La Niña on South Asian rainfall in a global warming scenario.

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4. **Date** : 05 February 2020
Presenters : Efthymia Pavlidou (WSD/MSS)
Theme : Automated smoke plume monitoring using satellite imagery

Abstract
Accurate detection of smoke plumes is important for atmospheric quality monitoring. Off-the-shelf products derived from satellite imagery are available, but not at the temporal and spatial resolution that is desired to support operations. Current operational haze monitoring practice is therefore based on visual interpretation of satellite RGB composites.
This presentation reports on the development of automated workflows for smoke plume detection and monitoring, using traditional and machine learning-based methodologies on hyperspectral satellite imagery. The studied approaches include:
(a) Threshold-based image processing techniques with application of zonal statistics,
(b) Image classification using a Random Forest algorithm, and
(c) Application of a Convolutional Neural Network architecture for plume pixel identification.

After a short presentation of the above methodologies, preliminary results will be discussed with respect to validation and follow-up research potential.

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5. **Date** : 12 February 2020
Presenters : Ragi Rajagopalan (CCRS)
Theme : Particulars on the poster presentation "Simulation of convective storm in idealized SINGV and WRF Models"

Abstract
The 4th convective scale modelling workshop at Boulder, Colorado summary and updates. A few interesting presentations and key takeaways from the convection

processes and physical parametrizations sessions. My poster presentation with the comments and suggestions received and the future plans

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6. **Date** : 14 February 2020, Friday (11:00 – 12:00)
Presenter : Jeffrey Adie (NVIDIA)
Theme : HPC Model Development and AI Model Development

Abstract
Performance Evaluation of the Weather Research and Forecasting (WRF) Model on the DOE Summit Supercomputer

- Using Deep Learning to Extract Regions of Interest (ROI) in Real-Time from Geostationary Satellite Data (Joint with NOAA)
- Deep Learning Approach for the Detection of Areas Likely for Convection Initiation (Joint with NOAA)
- AI2ES: Alpha-Institute: Artificial Intelligence for Environmental Sciences (Joint with OU, Google, CSU, others)
- Deep Learning for Automated Feature Detection in Climate, Weather, and Space (NVIDIA 1st author)
- Developing Deep Learning for Solar Feature Recognition in Satellite Images (Joint with NASA GSFC)

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7. **Date** : 19 February 2020
Presenter : Claudio Sanchez (UK Met Office)
Theme : Ocean atmosphere coupling at convection permitting scales in tropical environments

Abstract
Most of the main drivers of Tropical meteorology are sensitive to Sea Surface Temperature (SST) changes, e.g. land-sea breezes, local convection over sea, Tropical Cyclones (TCs) intensity or the Madden-Julian Oscillation (MJO). Moreover, these drivers acts on small scales (few kilometers) whose representation in Numerical Prediction Systems (NWP) is rather important for their adequate simulation. Thus the importance of atmosphere-ocean coupled convective permitting systems over the tropics have led to the development of three different systems: the mixed-layer KPP coupled to 4.4km South East Asia (KPP-SEA) model, the fully coupled (3-D NEMO) at 4.4km over the India domain (Indian Ocean north of the equator to the Himalayas) and the in-house fully coupled system over the Maritime Continent.

This talk introduces the three coupled systems and details preliminary results from a series of case studies: TC Hagibis in KPP-SEA, the High Impact Weather event of the Kerala floods in August 2018 in the India coupled system, and the MJO event of November 2019 for the CCRS coupled system

8. **Date** : 5 March 2020, Thursday (11:00 – 12:00)
Presenters : Dr Matthew Hort (UKMO)
Theme : Atmospheric Dispersion and Air Quality Prediction at the UK Met Office

Abstract
This talk will provide an overview of the Atmospheric Dispersion and Air Quality (ADAQ) group at the UK Met Office. It will cover an introduction to the NAME and AQUM models being developed, and the various applications areas including services for government and external projects.

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9. **Date** : 11 March 2020
Presenters : Marvin Xiang Ce Seow (CCRS Intern)
Theme : Impacts of tropical remote forcing on the South China Sea winter cyclonic anomaly and cold tongue variabilities

Abstract
Under the strong air-sea coupling, over the South China Sea (SCS) during the boreal winter, a distinct climatological feature is a cool sea water pool over the western basin, known as the cold tongue, forms under the influence of regional northeast monsoon. The cold tongue region experiences high sea surface temperature (SST) variability, as modulated by an aloft lower tropospheric cyclonic anomaly variability. This talk will investigate how various tropical remote forcing, namely the tropical Pacific air-sea coupling, tropical Indian Ocean air-sea coupling and internal atmospheric variability, influence the SCS cyclonic anomaly and cold tongue variabilities at timescales longer than intraseasonal scales. 1982-2015 monthly mean reanalysis and observational products are used to identify the contributions of each tropical ocean basin and internal atmospheric variability. A series of SST sensitivity coupled model experiments are performed to isolate the individual contributions of various tropical remote forcing.

Seminars were suspended due to COVID19 restrictions.

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10. **Date** : 2 June 2020, Tuesday (15:00 – 16:00) (WEBINAR)
Presenter : Kia Suan (NTU)
Theme : Evaluation of Satellite-Based Precipitation Products With Bias Correction

Abstract
The goal of this project is to evaluate the satellite precipitation products with reference to the ground observation data (rain-gauge). Rainfall observations on the ground (rain-gauge) are sparsely distributed, especially in remote regions where maintaining rain gauges are difficult or not cost-efficient. Rainfall estimations from satellite data therefore have the potential to complement ground observations or as a backup when the latest ground observation is not available. World Meteorological Organization (WMO) Space Programme launched the Space-base Weather and Climate Extremes Monitoring Demonstration Project (SEMDP) in East Asia and Western Pacific . SEMDP objective is to better utilize and improve the monitoring of weather and climate extremes from space. Satellite precipitation products are available for participating members to explore and evaluate.
In this presentation, the below results will be shared.
1) Satellite precipitation products are evaluated to quantify its limitations/errors.
2) Bias correction of the satellite precipitation products to minimise its limitations/errors.

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11. **Date** : 22 July 2020 (WEBINAR)
Presenter : Ryan Kang (CCRS)
Theme : The Art and Science of Seasonal Forecast Forum's Consensus Rainfall Prediction

Abstract
This talk will provide an overview of the prediction performance of Seasonal Forecast Forum's Consensus Rainfall for Singapore from 2015 to 2019. I will also provide an in-depth assessment of monthly rainfall predictions for Singapore for the year 2019. Two case studies for the months of June 2018 and January 2019 will also be analysed retrospectively, using the ECMWF operational extended-range real-time forecast. Finally, new upcoming developments in ECMWF Extended-range Prediction System and the future work will be discussed.

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12. **Date** : 5 August 2020 (WEBINAR)
Presenter : Song Chen (CCRS)
Theme : Urban impacts on weather forecasting and regional climate modelling

Abstract
Urban areas can affect weather and climate at local, regional, and global scales, which leads to city residents more vulnerable to extreme events like heavy rainfall and heat stress. This presentation targets to provide an overview of urban impacts on weather and climates. It will start with physical phenomena in cities such as the urban atmosphere and urban heat island. Urban canopy representation methods in urban modelling will then be reviewed and the current urban surface scheme MORUSES in

uSINGV will be introduced. We will also share the recent work and progress on urban modelling at CCRS. Finally, the plan for future work will be discussed.

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13. **Date** : 17 September 2020, Thursday (14:30 – 15:30) (WEBINAR)
Presenter : Linnea Lei Ng Johansson & Rachel Ong (Imperial College London)
Theme : Will wet and dry spells over Singapore get worse in the future?

Abstract
Climate information on the future characteristics of rainfall over Singapore is crucial for adaptation planning. One aspect that is of interest to infrastructure and water resource managers are the likely changes in wet and dry spells. In this study, we explore the potential changes to seasonal wet and dry spells in Singapore using daily data from regional climate model projections obtained from Singapore's 2nd National Climate Change Study (V2). We first examine historical daily rainfall (Singapore-wide average) to characterise wet (consecutive days >= 1mm) and dry (consecutive days < 1mm) spells in different seasons (ONDJ, FM, AM and JJAS). The seasons are chosen to represent the known alternating wet and dry periods of the year. Modelled characteristics of wet and dry spells for the annual time scale and in the different seasons are then compared across four 30-year time periods from 1980 to 2099 for both RCP8.5 and RCP4.5 scenarios, to determine the extent to which the frequency, duration and intensity (for wet spells only) change in the future. The results of this study further complement findings reported in V2 by focusing on another aspect of future rainfall behaviour for Singapore.

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14. **Date** : 30 September 2020 (WEBINAR)
Presenter : Wee Leng Tan (CCRS)
Theme : The development of new methodologies for satellite-based rainfall estimation over Africa

Abstract
Optimal estimation of rainfall from gauges and satellites is especially challenging in regions, such as Africa, where the rain gauge records are inconsistent in space and time. This is especially the case now that humanitarian organisations depend on satellite-based rainfall estimates to identify regions at risk of food insecurity. The TAMSAT (Tropical Applications of Meteorology using SATellite data and ground based observations) group is involved in the satellite-based rainfall estimate over Africa. Over the last three years, the TAMSAT group has been developing a new methodology for rainfall estimation that integrates gauge observations into the well-established TAMSAT daily satellite-based rainfall estimates. This presentation will demonstrate the performance of the TAMSAT rainfall estimate and how it compares with the new

merging methodology. Cross-validation method is done to evaluate the new rainfall dataset for selected regions of Africa and how the skill of the estimation method varies with meteorological regime and region.

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15. **Date** : 11 December 2020, Friday (15:30 – 16:30)
Presenter : Tjoa Chin Hong (Nanyang Technological University)
Theme : Where do we find intense convection over Singapore and its surrounding area?

Abstract

Severe convective weather events (a.k.a. intense thunderstorms) have the potential to cause flash flooding and bring strong damaging winds. In 2020, there were four cases of very intense rain events that resulted in flash flooding at various locations around Singapore. Given the impacts of such severe rainy weather, we ask the question: where does intense convection happen around Singapore? Are there any preferred locations of occurrence i.e. 'hotspots'?

In this study, we utilise 5-min gridded radar reflectivity data at 2.5 km altitude from 2011-2014 to map out the spatiotemporal distribution of convective intensities within ~120 km of the Changi weather radar. The analysis was done for each calendar month and for the eight weather regimes identified for Singapore by Hassim and Timbal (2019). The present work is an extension of the hourly climatology produced by Hassim (2018).

Consistent with qualitative observations, our findings confirm that the warm and moist inter-monsoon months of April-May (dominated by the Moist Quiescent R1 regime) produce more frequent convective areas above 45 dBZ than in the wet NE monsoon months of December-January. Remarkably, the warmer and relatively drier weather regimes of the SW monsoon (Dry South-Westerly, R2, and Dry Southerly, R7) were found to produce the highest convective intensities above 45 dBZ out of all the regimes. In contrast, the cool Moist North-Easterly regime (R4) predominant in December produced the largest mean daily convective area, overall. The cooler and drier NE monsoon regimes (Dry Northerly, R3, and Dry North-Easterly, R5) exhibited the lowest mean convective areas. The reasons for these findings are discussed. We also discuss whether there *are* spatial 'hotspots' of intense convection over Singapore.

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