2018

1. Date : 15 Jan 2018
Presenter : DOAN Quang Van (CCS, university of Tsukuba)
Theme : Numerical Study on the Impact of Urbanization and Future Climate Projection for Greater Ho Chi Minh City, Vietnam

Abstract

In this study, we evaluated the impact of the rapid urbanization in Greater Ho Chi Minh City, Vietnam, on the change in its the urban heat island (UHI) effect from the late 1980s, using the high-resolution WRF model coupled with a single-layer urban canopy model. The results show that the increase in average surface air temperature is about 0.3 - 0.6 ° C due to the past urbanization. It is likely that, the temperature increase due to urbanization corresponded to the haft of total temperature increasing observed for the last decades.

In addition, we projected the future urban climate when considering the impacts of both global warming and the local future urbanization. The pseudo-global-warming method is used to create future atmospheric boundary conditions from the outputs of each three GCMs for two emission scenarios RCP 4.5 and RCP 8.5. According to the projected results, the air temperature of the city is expected to increase averagely 1.6 - 2.2 ° C for emission scenarios, respectively, and the contribution of future urbanization is estimated to be 20 - 30%. This implies that urbanization is still significant factor of future urban warming and there is a room for an appropriate adaptive urban design for UHI mitigation.

Furthermore, we assessed the effectiveness of several UHI mitigation methods using the one-way nesting system between the WRF and a multi-layer urban canopy model, which was originally developed. The results show that the applying of green roofs is the most effective way to mitigate UHI effect. On the other hand, the applying of external insulation materials for buildings is expected to reduce nighttime air temperature by -0.21 ° C.

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2. Date : 17 Jan 2018
Presenter : Dr. Tan Tai Hung Nguyen, STUD
Theme : A linear dynamical systems approach to streamflow reconstruction reveals history of regime shifts in northern Thailand

Abstract

Catchment dynamics is not often modeled in streamflow reconstruction studies; yet, the streamflow generation process depends on both catchment state and climatic inputs. To explicitly account for this interaction, we contribute a linear dynamic model, in which streamflow is a function of both catchment state and paleo-climatic proxies. The model is learned using a novel variant of the Expectation-Maximization algorithm, and it is used with a paleo drought record---the Monsoon Asia Drought Atlas---to reconstruct 406 years of streamflow for the Ping River (northern Thailand). Results on the instrumental period show that the dynamic model has higher accuracy than conventional linear regression; all performance scores increase by 40--67%. Furthermore, the reconstructed trajectory of the state variable provides valuable insights about the catchment history---e.g., regime-like behavior---thereby complementing the information contained in the reconstructed streamflow time series. The proposed technique can be used as a replacement of linear regression, since it only requires information on streamflow and climatic proxies (e.g., tree-rings, drought indices); furthermore, it is capable of readily generating stochastic streamflow replicates. With a marginal increase in computational requirements, the dynamic model brings more desirable features and value to streamflow reconstructions.

3. **Date** : 24 Jan 2018
   Presenter : Anurag Dipankar (CCRS)
   Theme : Understanding biases in simulating diurnal cycle of convection over western coast of Sumatra- comparison with pre-YMC observations
   Abstract :

Simulation of diurnal cycle of precipitation over tropics is a challenging problem. The most obvious reason perhaps is the model's inability to properly capture the diurnal cycle of convection that is known to vary from region to region in the tropics. The western coast of Sumatra is one such example, which has drawn particular interest in the research community in recent years leading to the formation of an international project (Young Maritime Continent, YMC) to conduct intensive observation campaign in the region for the period 2017 to 2019. As a pilot program, Pre-YMC was launched in the late 2015 to conduct observation campaign in the western coastal area of Sumatra Island (Yokoi et. al. 2017).

Main aim of Pre-YMC was to observe the offshore migration of the precipitation for which two observation sites located on the coastal land and coastal water were set up. High frequency surface measurements were conducted together with 3-hourly radiosondes
observations on both the sites.

In this study, we have used these observational data to understand the biases in simulating diurnal cycle of convection, both in land and offshore, using the limited area version of UK Met Office model (UM) at 1.5km resolution. Preliminary results show that at this convection permitting resolution, the model is capable to broadly capture the diurnal cycle of precipitation, and the mechanism by which the precipitation zone migrates from coastal land to the coastal water is also in agreement with the previous studies. Biases are found when the results are analyzed in details. In the presentation, we will discuss the model results and the reasons behind the observed biases.

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4. **Date** : 31 Jan 2018
   Presenter : Erik Velasco (CENSAM)
   Theme : How to battle air pollution and climate change in Singapore?
   Abstract :

The atmosphere over tropical cities is not well researched and represents an opportunity for Singapore to expand its agenda in environmental research and development. In this context, the Center for Environmental Sensing and Modeling (CENSAM) of Singapore-MIT Alliance for Research and Technology (SMART) was during ten years an excellent platform to generate scientific information for devising new regulations to improve the local air quality and climate change mitigation. Unfortunately, CENSAM stopped its activities last December.

This talk reviews the research work on air quality and greenhouse gas emissions conducted at CENSAM. These studies included topics on air quality monitoring, smoke-haze, personal exposure, carbon emissions and urban micrometeorology. A close collaboration with journalists was achieved and we were able to communicate our findings to the society and contribute to changes in the local air quality management and climate change mitigation. Our experiences on this regard will be shared.

5. **Date** : 7 Feb 2018
   Presenter : Bertrand Timbal (CCRS)
   Theme : The science of climate change and it relevance to Singapore: an overview- Part I The basic of the science
   Abstract :

The Centre or Climate Research Singapore (CCRS) has established itself as the leading organisation within the Singapore government to provide advice on the science of Climate Change. This is a popular topic and CCRS receives frequent requests to provide some form of overview on the topic targeting various audience and level of expertise. Recently, the Climate Modelling & Prediction (CMP) Branch has renewed the material provided to explain the science as part of a module organise by the Singapore Environment Institute (SEI) and accessible within the National Environment Agency (NEA): the module covers 1) basic ground such as the difference between weather and climate or the relevance to the climate science before aiming to 2) more challenging areas such as the interplay between climate variability and change, the external forcings to the climate system and the tool of choice (GCM) to tackle the issue and finally 3) discussing the findings of the science and their relevance to Singapore.

Come along if the topic is of interest to you and you want to provide some feedbacks on the content, you may even learn a few facts here and there on a well rehearse topic.

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6. **Date** : 14 Feb 2018
   Presenter : Bertrand Timbal (CCRS)
   Theme : The science of climate change and it relevance to Singapore: an overview- Part 2: The implication for Singapore
   Abstract

The Centre or Climate Research Singapore (CCRS) has established itself as the leading organisation within the Singapore government to provide advice on the science of Climate Change. This is a popular topic and CCRS receives frequent requests to provide some form of overview on the topic targeting various audience and level of expertise. Recently, the Climate Modelling & Prediction (CMP) Branch has renewed the material provided to explain the science as part of a module organise by the Singapore Environment Institute (SEI) and accessible within the National Environment Agency (NEA): the module covers 1) basic ground such as the difference between weather and climate or the relevance to the climate science before aiming to 2) more challenging areas such as the interplay between climate variability and change, the external forcings to the climate system and the tool of choice (GCM) to tackle the issue and finally 3) discussing the findings of the science and their relevance to Singapore.

Come along if the topic is of interest to you and you want to provide some feedbacks on the content, you may even learn a few facts here and there on a well rehearse topic.

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7. **Date** : 21 Feb 2018
   Presenter : Muhammad Eeqmal Hassim (CCRS)
   Theme : Annual rainfall trends over Singapore and the Maritime Continent from the perspective of large-scale weather regimes
   Abstract

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8. **Date** : 28 Feb 2018
   Presenter : Elaine Gao (CCRS)
   Theme : Neodymium isotopes as a tracer for ocean circulation in the Boreal Sea during the Late Cretaceous
   Abstract :

The role of oceanography in long-term climatic cooling during the Late Cretaceous is poorly understood. During the Campanian, the Atlantic Ocean was gradually opening and sea level was higher than at present, with large parts of north-western Europe covered by shallow epicontinental chalk seas. Reconstructed upper-ocean circulation patterns are based on scarce records that have often been assembled from multiple localities. Here we present a high-resolution continuous record of neodymium-isotope ratios (εNd) of bulk carbonate and fish debris from the Trunch borehole of Norfolk, England, to reconstruct the evolution of upper ocean waters of the Boreal-Tethyan epicontinental shelf during the Late Cretaceous (87.6-72.8 Ma). We observe a slight offset in Nd-isotope values obtained by leaching ferromanganese oxide coatings from those obtained from fish debris, although rare earth element profiles support a sea-water origin for both records. Overall, average Campanian εNd values of -12 from the Trunch borehole are more unradiogenic than mid-Cretaceous (Cenomanian–Turonian) records from the European chalk sea, consistent with a gradual restriction of low-latitude Pacific–Tethyan gateways and a decline in the influence of the equatorial Tethyan Circumglobal Current.

We compare our εNd values to detailed carbon-isotope stratigraphy, to reconstructed sea-level curves and to lithological indicators of local sea-level variations. Our results indicate that local sea-level change is the main driver of short-term εNd variability, by modifying the input of relatively unradiogenic Nd from nearby continents. This finding contrasts earlier interpretations of Campanian shallow-water Nd-isotope values from the European chalk sea, which have mainly attributed εNd variation to circulation changes. Instead, the observed strong spatial variability in εNd across the European shelf during the Campanian may highlight the importance of local processes, such as continental inputs of Nd and boundary exchange, in modifying water-mass chemistry. The overall stability of εNd values throughout the Campanian suggests that circulation patterns in the Boreal realm were relatively stable and likely did not contribute to the long-term global cooling trend.

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9. **Date** : 14 Mar 2018
   Presenter : Jerry Liu (CCRS)
   Theme : HPC Usage - Consistency of Floating-Point Results
   Abstract

Binary floating-point representations of most real numbers are inexact, and there is an inherent uncertainty in the result of most calculations involving floating-point numbers. Programmers of

floating-point applications typically have the following objectives: Accuracy, Reproducibility, Performance. These objectives usually conflict. However, good programming practices and judicious use of compiler options allow you to control the trade-offs.

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10. Date : 28 Mar 2018
Presenter : Yang Junhua (CCRS)
Theme : Monsoon Wind Pattern Recognition and Characterization with Artificial Neural Networks

Abstract:

Artificial Neural Network is a type of machine learning technique and is typically used for performing classification and regression task. In this talk, basic concepts of Artificial Neural Network including popular network architectures like the Convolutional Neural Network (CNN), Long Short Term Memory (LSTM) network and the Autoencoder (AE) will be briefly presented. To illustrate the use of these networks, two simple toy example applications will be presented: 1) A Monsoon Wind Pattern Classifier that is trained to recognize monsoon wind pattern using manually labelled example data (supervised learning).

2) Characterization of the monsoon wind pattern using the Variational Autoencoder (unsupervised learning).

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11. Date : 6 April 2018
Presenter : Erik Andersson (Deputy Director of Forecasts, ECMWF)
Theme : Operational forecasting at ECMWF

Abstract:

In my talk I will be highlighting recent advances in ECMWF's forecasting system as well as our clear direction for the future, as laid out in the ECMWF Strategy to 2025.

Our goal is that ensemble forecasting, at a resolution of 5 km globally, will deliver reliable predictions of the likelihood of occurrence of high-impact, severe weather events up to two weeks ahead. We expect that upgrades of the forecast model will improve the accuracy of typhoon intensity forecasts, as well as other strong wind and heavy rainfall events leading to storm and flood damage.
An Earth system modelling approach is being adopted in order to better incorporate the influence of the oceans, land surfaces, snow, sea ice, lakes and dust aerosol on weather.
Modelling is also focusing on weather patterns in the tropics and their influence on the subsequent development of large-scale weather-regime transitions in Europe, and more generally in the mid-latitudes, as these are associated with heat waves, cold spells and periods of drought or extreme precipitation.

To serve our Member States, ECMWF is developing products in response to user needs. Large volumes of forecast data are easily accessible to a variety of forecast users.

The Asian weather markets are expanding rapidly. The interest in ECMWF weather forecast products from Asian companies is increasing, especially in the renewable energy sector. ECMWF has engaged with Asian partners in a research project seeking to maximise the benefit of weather forecasts in the wind power generation. There is enormous untapped potential to exploit also in other sectors such as solar power, water management, and flood protection.
ECMWF provides global, real-time weather forecast products from the high-resolution model, the 50-member ensemble, as well as seasonal forecasts.

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12. Date : 11 April 2018
Presenter : Raizan Rahmat and Thea Turkington (CCRS)
Theme : **MSS' Regional Initiatives to Enhance Climate Information & Services**

Abstract:
National Meteorological and Hydrological Services' (NMHSs) core business is to serve the public community at large by providing timely and reliable weather, climate, and related information. In the area of weather, the exchange of weather information, international cooperation, and supporting infrastructure have been well established since the launch of WMO's World Weather Watch (WWW) Programme in 1963, which was further enhanced by the Public Weather Services (PWS) Programme in 1991. In the climate area, however, there were gaps in coordination and cooperation at international and regional levels, which are especially critical due to the large-scale nature of significant climate events and their far-reaching impacts. Recognising these gaps, the WMO initiated the Global Framework for Climate Services (GFCS) in 2009 and the plan was later adopted in 2012. The GFCS is a global partnership of governments and organisations, who are producers and users of climate information and services. The objective is to enable researchers and the producers and users of information to consolidate resources to improve the quality and quantity of climate services worldwide, particularly in developing countries.

In Southeast Asia, especially, the gaps in coordinated climate information and services were evident. In other parts of the world, significant developments have been made through initiatives like the Regional Climate Outlook Forum (RCOFs) and the Regional Climate Centres (RCCs). Thus MSS, with the support of the WMO and collaboration with its international and regional partners, embarked on a series of initiatives to lead the region in providing and enhancing climate services and prediction capabilities in the region, which included the ASEAN Climate Outlook Forum (ASEANCOF), the Regional Capability Building Programme in Subseasonal to Seasonal Predictions for Southeast Asia (S2S-SEA), the Southeast Asia Regional Climate Centre Network (SEA RCC-Network), and others. This talk will bring you through MSS' journey in this area of its work - how it started, the activities conducted, challenges faced and overcame, and the vision for the future of Southeast Asia's climate information and services.

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13. Date : 2 May 2018
Presenter : Isaac Tan (CFO, MSS)
Theme : The Relationship Between Rainfall Characteristics and the Atmospheric Conditions over Singapore

Abstract :

Detailed findings on the spatiotemporal distribution of rainfall over Singapore were obtained by analysing the interaction between large-scale atmospheric parameters (Monsoon, ENSO, IOD, MJO) and fifteen weather regimes using historical data over 28 ground-based stations from 1980-2011. The regimes were firstly clustered into northerly and southerly components through meridional winds at 850 hPa, and then constructed with the aid of k-means clustering. Each regime has unique rainfall characteristics that is largely influenced by local-scale conditions (U and V winds, RH, Dew-point temperature and Dry-bulb temperature) recorded by Upper Air Observation (UAO) soundings. Spatiotemporal maps were produced for each combination of atmospheric parameters to analyse the mean daily rainfall intensity (mm/day) over different parts of Singapore, the daily risk of heavy rain rate (≥50mm/hr) occurrences, and the probability of rainfall (≥1mm) for each 3-hr time period within a diurnal cycle. Individual rainfall regimes were also differentiated based on quantitative thresholds from UAO data, along with existing maps of synoptic scale conditions such as wind patterns at 850 hPa and 500 hPa, and RH patterns at 600 hPa. This should ultimately provide additional guidance in improving rainfall forecasts over Singapore.

14.Date : 9 May 2018
Presenter : Erik Becker (CCRS)
Theme : Nowcasting with Weather Radar Data - The Value Chain

Abstract :

In an operational environment such as the Met Services the end goal for any Nowcasting product derived from weather radar data is to be as accurate and reliable as possible. However, in order to provide clients and the public with reliable nowcasts; data quality and availability is just as important as the nowcasting algorithms/models themselves. It then becomes important to consider the entire data processing value chain, as one “weak link” in the chain can result in undesirable outcomes. The value chain can be broken down into 4 main components. The first is the observation component. This includes all processes surrounding the network design, instrument calibration, maintenance, quality control and monitoring. The second part is the data modelling component. These relate to value added products such as CAPPI extraction, radar compositing, optical flow vector calculations, vertical integrated liquid content, hail mass aloft, precipitation estimation, etc. The third component is the forecasts that are produced. These involve extrapolation and machine learning based techniques, deterministic and probabilistic techniques as well as model blending techniques to produce seamless 0-6 hour forecasts. Finally the forth component is the service delivery to the client. This includes verification to promote user confidence and tailored impact based forecast for user specific needs. This presentation will look into the different components of the value chain and how a weather radar nowcasting product can fit into this model using examples from South Africa.

15.Date : 16 May 2018

Presenter : Dr. Srivatsan V Raghavan (TMSI)
Theme : An Analysis of the influence of the Indian Ocean Dipole on Singapore rainfall
Abstract :

The influence of the Indian Ocean Dipole (IOD) on the inter-annual and the intra-seasonal variability of the rainfall over the Singapore region has been investigated for the period 1982-2014. This coincides with the inter-monsoon period (February to April) when the IOD events predominantly occur. The relationship between IOD and Singapore rainfall during the FMA months does not correspond to the general IOD phenomena that +IOD brings about weakened convection and reduced precipitation over the maritime continent. Therefore, this study investigates how negative SSTs (+IOD) off Sumatra can lead to heavy rainfall, especially during these months when heavy rainfall and sometimes, flash floods in the city, are not uncommon. The findings of the study suggest that the +IOD role induces precipitation surplus over the Singapore region during March and April which is the reverse of well-known features that IOD causes weakened convection and possible droughts over the maritime continent. We conclude that a cold (warm) SST anomalies off Sumatra lead to the reduction (increase) in moist static energy around the eastern Indian Ocean accompanied by a marginal northward (southward) energy flux equator during the ITCZ transit period from the Southern Hemisphere to the Northern Hemisphere. Such modified meridional energy flux brings about ITCZ transitions that are largely responsible for the regional rainfall changes. The findings could help to improve seasonal outlook skills when we consider SST with relatively higher predictability as a rainfall predictor and to understand inter-annual and intra-seasonal changes in precipitation.

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16. Date : 22 May 2018
Presenter : Sherralin Quek (Department of Geography, NUS)
Theme : Examining the effect of urbanisation on long-term temperature data in Singapore
Abstract :

Inhomogeneities in observed climatic data can prevent the accurate estimation of the long-term climate signals. A large source of inhomogeneities is increased urbanisation, which can lead to station relocation and influence observed climatic data through the urban heat island (UHI) effect. As such, it is important to analyse the impact of urbanisation on observed climatic data. First, land use and land cover (LULC) changes surrounding official Meteorological Society Singapore (MSS) weather stations from 1960 to 2016 is examined and classified using the Local Climate Zone system developed by Stewart and Oke. Second, the long-term temperature trends are identified through graphs. Last, statistical tests are used to derive an estimate of the urban influence on temperature cycles through difference testing of derived cooling rates and diurnal temperature ranges (DTR) at each MSS station. By separating the impact of urbanisation from climatic effects, it contributes to potential improvements in depiction of large-scale natural occurrences of variability (e.g. ENSO and other tropical phenomenon) on Singapore temperature, and expose underlying long-term climatic changes due to anthropogenic global warming. The results of this study show that the urban signal in Singapore's temperatures is strong. Stations that underwent huge changes to their land cover and had intensified land use and human activity showed increase in mean temperatures, maximum and minimum temperatures, and showed statistically significant decreases in their mean nocturnal cooling rates and DTR as compared to stations that remained largely rural. The results from this research indicate that inhomogeneities contribute to significant warming biases in the Singapore temperature

record. With increasing urbanisation and development in Singapore, it will be hard to acquire sites that can accurately reflect solely the climatic effects on Singapore's temperature.

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17. Date : 30 May 2018
Presenter : Andrew Kruczkiewicz & Melody Braun (IRI)
Theme : Co-developing a system for specific climate sensitive decision making processes: An example for flood and landslide risk in south-east Bangladesh.

Abstract :
More than 693,000 Rohingya refugees have fled Myanmar in the ongoing humanitarian crisis and are living in precarious conditions in ill-equipped camps across the border in south-east Bangladesh. The speed and scale of this crisis is unprecedented; shelters have been hastily erected on hilly terrain which, due to deforestation and soil erosion, are now vulnerable to landslides and flooding during heavy rainfall events. Humanitarian aid agencies managing the camps (such as the International Organization for Migration (IOM) and the United Nations High Commission for Refugees (UNHCR) are faced with competing urgent demands for protection, healthcare, food security, education and sanitation, limiting resources available to respond to environmental threats.

The risk for significant rainfall increases throughout May, highlighting the vulnerability of refugees at risk of landslides and flooding, and the urgent and time-sensitive nature of risk mitigation efforts, such as relocation of vulnerable refugees, reinforcing infrastructure and strengthening shelters. Stakeholder access to and use of timely, appropriate information to support critical decision-making, prioritization of needs, and effective use of limited financial resources are crucial to averting further risk of impact in the different camps and surrounding host communities throughout Southeast Bangladesh.

In this session we will discuss how IOM and the Inter Sector Coordination Group is working with IRI, NASA and University of Chicago to co-develop a system to tailor geophysical information to specific climate sensitive decision making processes.

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18. Date : 13 June 2018
Presenter : Stan Posey (NVIDIA HPC Program Manager)
Theme : Earth System Modelling and GPU Application. HPC and AI in Weather and Climate
Abstract :
Stan will be covering and detailing Nvidia ESM Program Overview covering Climate, Weather and Ocean. He will also be sharing how GPU have been benefiting for various Numerical Models like MPAS, WRF, COSMO and UM. Further he shall also be discussing on challenges for HPC and AI in Weather and Climate and how AI in Weather application is helping solve many of them. As part of his discussion he shall be sharing cross agency use cases in this regard and how they have benefitted using GPU in ESM.

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19. Date : 27 June 2018
Presenter : Manjunath Doddam (Accenture)
Theme : Integration of PBS Pro with a weather workflow modelling tool Cylc
Abstract

Weather and climate modelling is a complex workflow process with dependencies among tasks in the workflow. A vanilla HPC scheduler do work for weather modelling but it is not efficient and user friendly.

To address this gap, Altair along with BoM Australia is working jointly to integrate PBS Pro with a weather workflow modelling tool called Cylc and many other components. Altair is actively discussing the Cylc implementation and its benefits with other weather sites worldwide. (e.g. FNMOC, NOAA, Environment Canada, etc.).

Altair has made significant progress in this project and following are the current accomplishments.

Security

- Development of a deployment architecture for Cylc suited to the Supercomputer operating environment and SHARP security requirements
- SSH whitelisting for Cylc
- SELINUX compatibility

Cylc Modifications

- Job abort with a custom message that can be sent to an event handler (then to Kafka etc.)
- New "custom" task event support, and a corresponding custom event.
- Support for arbitrary user-defined suite and task metadata.
- General external triggering support.

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20. Date : 4 July 2018
Presenter : Chua Xing Rong (Princeton University)
Theme : Investigating the direct effect of atmospheric heating on precipitation intensities and boundary layer energy balance using a cloud-resolving model
Abstract

As global climate models parameterize clouds, we lack confidence in their predictions of the direct effect of atmospheric heating on tropical precipitation intensities. Using a cloud-resolving model, we find that an atmospheric radiative heating preferentially weakens low (< 400 mm/day) rather than high intensity precipitation events in radiative-convective equilibrium. This asymmetry occurs because free-tropospheric radiative heating decreases latent heat fluxes by increasing boundary layer moisture, which increases precipitation intensities. Also, free-tropospheric heating raises boundary layer temperatures mainly via a reduction in rain re-evaporation. Without rain re-evapration, convective organization occurs despite the simultaneous inclusion of multiple factors known to inhibit organization. The results improve our understanding of how cloud processes shape the response of temperature and precipitation to heating.

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21. Date : 13 July 2018
Presenter : Chen Chen (University of Chicago)
Theme : Future changes in precipitation characteristics revealed by feature tracking
Abstract

Future precipitation is expected to change markedly in a warmer climate under higher CO2 levels. Zeroth order physics, and results from multiple models, suggest that overall precipitation rises with temperature (by ~1--2%/K), but that individual precipitation events become significantly more intense (by ~7%/K). This discrepancy means that other characteristics of precipitation events must also change, but until recently, analysis methods have not been able to determine how. In this study, we use high-resolution simulations of current and future climate over the continental United States and an algorithm for identifying and tracking individual precipitation events to show that future precipitation events become stronger but smaller in area. We examine the physical drivers of this trade-off response by comparing with present-day interannual variations between wet and dry years. We find that characteristics change in a wetter future is not an analog to a wetter present year when the precipitation events are stronger, larger in size, and more numerous. We then compare the future response with present-day seasonal variations from winter to summer when precipitation events are stronger but smaller. We find precipitation changes from present to 2100 under a business-as-usual scenario become more "summer-like", resembling the seasonal evolution from June to July in present climate. This similarity suggests that future changes in precipitation characteristics and the trade-off between intensity and size are more temperature-driven and rooted in fundamental physics of convection.

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22. Date : 25 July 2018
Presenter : Peter Heng (CCRS)
Theme : Update on the SINGV Data Assimilation System
Abstract

SINGV-DA is MSS's data assimilation system for convective-scale numerical weather prediction. This talk assesses SINGV-DA's precipitation forecast skill in recent months and suggests ways to improve the performance of the system.

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23. Date : 1 Aug 2018
Presenter : Mok Jia Wen (NTU)
Theme : 1.5C vs 2.0C of global warming: Implications for future climate extremes over Singapore and Southeast Asia
Abstract

One of the major headline goals of the 2015 Paris Agreement was to limit the increase of mean global warming to below 2C (2GW) above pre-industrial levels, while pursuing efforts to restrict warming to 1.5C (1.5GW).

In this project, the implications of a 0.5C warming difference on future seasonal temperature and precipitation extremes are explored under two Representative Concentration Pathway (RCP) scenarios (RCP8.5 and RCP4.5), using data generated by the 2nd Singapore Climate Change Study. In addition, I have also looked at how extremes at 1.5GW and 2GW compare with end-of-century projections when mean global and Singapore warming are expected to reach at least 4C, in a worst case scenario. Does an extra 0.5C warming between 1.5C and 2.0C make a substantial difference to the frequency and severity of seasonal temperature and precipitation extremes that we potentially experience? Do come along and find out.

24.Date : 8 Aug 2018

Presenter : Teo Pei Yun (NUS)
Theme : Cool Spells in Singapore
Abstract

January 2018's cool spell events led to huge media interested which resulted in this study, which seeks to understand more about cool spells in Singapore, including determining its duration and frequency, and observing if there are any emerging trends by examining historical records. Other phenomenons such as El Niño Southern Oscillation (ENSO) and Madden-Julian Oscillation (MJO) are also studied to observe their impact on cool spell events. ECMWF ERA-Interim data are also used to see how the values of different variables change in the region during cool spell event.

Presenter : Sharmaine Toh (NUS)
Theme : Sub-seasonal to Seasonal Forecasting of the Johor Catchment
Abstract

Extreme weather conditions in the Johor Catchment will inevitably affect the Johor River Basin and water supply to Singapore. Knowledge of these extreme weather conditions with the use of sub-seasonal to seasonal (S2S) forecast allows for a better understanding of such events at a timescale of 2 weeks to 2 months beforehand, enabling better planning and implementation of mitigation efforts. This project analyses selected extreme hydro-meteorological events in the Johor Catchment and their prediction based on the S2S forecast. Background meteorological conditions such as the Madden Julian Oscillation (MJO), El Niño-Southern Oscillation (ENSO) state and cold surges, are also studied.

25.Date : 29 Aug 2018
Presenter : Benjamin Grandey (SMART)
Theme : Investigating aerosol-climate interactions using a global climate model
Abstract

Atmospheric aerosol particles are responsible for some of the largest uncertainties in projections of future climate change. Over the past six years in SMART-CENSAM, we have used the Community Earth

System Model (CESM) to investigate how aerosols influence climate. We have considered various emissions sources, including wildfires, shipping, coal-burning, and phytoplankton blooms; we have considered various processes, including non-linearity in aerosol-cloud interactions; we have considered various sources of uncertainty, including background conditions and the representation of aerosols. Improving understanding of aerosol-climate interactions remains a key challenge.

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26. Date : 5 Sep 2018
Presenter : Joshua Qian (CCRS)
Theme : Multi-Scale Climate Processes and Rainfall Variability in the Maritime Continent
Abstract

Two mechanisms associated with multi-scale climate processes of ENSO, monsoon and diurnal cycle are found important for rainfall variability over the Maritime Continent: 1) Monsoonal damping effect over narrow islands such as Java and North Borneo - an inverse relationship between the monsoonal wind speed and the intensity of diurnal cycle of land-sea and mountain-valley winds; 2) Wake effect over wide islands such as South Borneo - the diurnal cycle is stronger on the wake- or lee-side than the windward side of the island or mountain ranges in respect to the low-level monsoonal winds.

The mechanisms for the spatial heterogeneity of climate variability over Java Island have been studied. Besides the well-known anomalous dry conditions that characterize the dry and transition seasons during an El Niño year, analysis of regional model output reveals a wet mountainous south versus dry northern plains in precipitation anomalies associated with El Niño over Java during the peak rainy season. Modeling experiments indicate that this mountains/plains contrast is caused by the interaction of the El Niño–induced monsoonal wind anomalies and the island/mountain-induced local diurnal cycle of winds and precipitation. During the wet season of El Niño years, anomalous southeasterly winds over the Indonesian region oppose the climatological northwesterly monsoon, thus reducing the strength of the monsoon winds over Java. This weakening is found to amplify the local diurnal cycle of land–sea breezes and mountain–valley winds, producing more rainfall over the mountains, which are located closer to the southern coast than to the northern coast.

The interannual variability of precipitation over Borneo Island in association with ENSO has been studied by using the satellite and reanalysis data. Analysis of the GPCC precipitation shows a dipolar structure of wet southwest versus dry central and northeast in precipitation anomalies associated with El Niño over Borneo Island during the austral summer. The spatial distribution of rainfall over Borneo depends on the direction of monsoonal winds. Weather typing analysis indicates that the dipolar structure of rainfall anomalies associated with ENSO is caused by the variability in the frequency of occurrence of different weather types. Rainfall is enhanced in the coastal region where sea breezes head against off-shore synoptic-scale low-level winds, i.e., in the lee side or wake area of the island, which is referred to here as the "wake effect." In the December-February of El Niño years, the northwesterly austral summer monsoon in South Borneo is weaker than normal over the Maritime Continent and easterly winds are more frequent than normal over Borneo, acting to enhance rainfall over the southwest coast of the island. This coastal rainfall generation mechanism in different weather

types explains the dipole pattern of a wet southwest versus dry northeast in the rainfall anomalies over Borneo Island in the El Niño years.

Some ideas of multi-scale climate processes in the western Maritime Continent around Singapore will also be discussed.

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27. Date : 12 Sep 2018
Presenter : Dr Hidde Leijnse (KNMI)
Theme : Towards optimal use of weather radars at KNMI
Abstract

KNMI has two C-band radars that are used for precipitation monitoring. Because of the investment involved in such instruments, KNMI aims to optimally use these radars. This means that on the one hand we try to maximize the number of users of weather radar data by designing specific products for specific groups, and on the other hand we continuously improve the quality of our radar products. Highlights of efforts to improve the quality of products, and to design new and unexpected radar products are presented.

The recent upgrade of the Dutch radar network gave KNMI the opportunity to reconsider choices regarding the requirements for the radar network. These choices have a large influence on the potential for designing new radar products and improving radar data quality. The new radars will be presented along with how they will help KNMI in reaching our goals. The development of high-quality quantitative precipitation estimates (QPE) will also be presented. This is a project in close collaboration with local and national water managers, which ensures that the resulting products will be of direct use to them.

Collaboration with other agencies that operate radars, as well as scientists working on radars are essential for making effective use of new developments in radar technology. The way KNMI collaborates on radar issues and the mutual benefits of these collaborations are presented, in particular the European OPERA network and the collaboration with BMKG in Indonesia.

Finally, new and promising developments such as rainfall estimation from the infrastructure used for communication between cellphones, precipitation from hobby weather stations in the Netherlands, and bird migration monitoring using weather radars are presented.

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28. Date : 19 Sept 2018 (11:00 – 12:00)
Presenter : Yujia He (University of Manchester)
Theme : Determining the local onset and retreat dates of the monsoon and inter-monsoon periods over Singapore
Abstract

Singapore receives a substantial amount of rainfall throughout the year due to its near-equatorial tropical location. The island experiences two main monsoonal periods that are generally defined by the seasonal reversal of the prevailing low-level wind direction. The wetter boreal (northern hemisphere) winter monsoon typically occurs from December to March and is locally known as the northeast (NE) monsoon. The relatively drier boreal summer monsoon typically happens during June to September and is termed the southwest (SW) monsoon. The two local monsoon seasons are interspersed by the shorter inter-monsoon (IM) between April-May (IM1) and October-November (IM2), respectively.

While it is convenient to define the monsoon and inter-monsoon periods based on set months, in reality, the onset and retreat dates of each season vary from year to year. As yet, there is still no formal or objective definition for the local start and end dates of each monsoon and inter-monsoon period over Singapore.

In this study, a simple Singapore seasonal index (SSI) is suggested based on daily weather regime classifications between Jan 1981 – Dec 2014 previously obtained by Hassim and Timbal (in review). The SSI is firstly used to objectively define the climatological onset and demise dates for each monsoon/inter-monsoon period, and is subsequently applied to diagnose the start and end of each individual season between 1981-2014. This first part of the talk will explain the development of the SSI, highlight some of the issues faced and proposes the notion of monsoon 'bursts' and 'breaks' to help explain the behaviour of the SSI using some example years. The second part of the talk will discuss the influence of ENSO on season length and variability.

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29. Date : 26 Sep 2018
Presenter : Sun Xiangming (CCRS)
Theme : A prototype high-resolution fully coupled regional model using SINGV and NEMO
Abstract

A prototype atmosphere-ocean coupled model was developed and tested in 2017 through the collaboration with UK Met Office and NUS. The seminar will share the system configuration, preliminary simulation results and future plan of this on-going project

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30. Date : 3 Oct 2018
Presenter : Joshua Lee (CCRS)
Theme : The effect of the Quasi-Biennial Oscillation on the Madden-Julian Oscillation in the Met Office Unified Model Global Ocean Mixed Layer configuration
Abstract

Using multi-decadal simulations, we investigate the relationship between the Quasi-Biennial Oscillation (QBO) and the Madden-Julian Oscillation (MJO) in the Global Ocean Mixed Layer configuration of the Met Office Unified Model (MetUM-GOML1) at two horizontal resolutions (200km and 90km at the equator). MetUM-GOML1 produces a weak and insignificant correlation between QBO winds and mean MJO amplitude in boreal winter, in contrast to the significant anti-correlation in

reanalysis. While reanalysis shows the easterly QBO favors stronger Maritime Continent MJO activity, MetUM-GOML1 displays stronger West Pacific MJO activity. The biased QBO-MJO relationship in MetUM-GOML1 may be due to weak QBO-induced temperature anomalies in the tropical tropopause layer, or to errors in MJO vertical structure.

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31. Date : 10 Oct 2018
Presenter : Pavel Tkalich (NUS)
Theme : Sea level trend and variability in Singapore Strait and around Peninsular Malaysia
Abstract

Sea level rise due to the climate change is nonuniform in time and space, necessitating regional estimates. To examine the variability and trend of sea level rise around the Peninsular Malaysia, tide gauge records and satellite altimetry were analysed, and sea level anomalies due to different phenomena have been delineated. During the tide instrumental observation period 1986–2013, average relative rates of sea level rise in Malacca Strait and along the east coast of the Peninsula is estimated at 3.6-3.7 mm/yr. The geocentric rates are about 25% faster than those measured at tide gauges. Sea level variability along the Peninsular Malaysia is influenced by various regional phenomena native to Indian and Pacific oceans, including Asian Monsoon, El Niño–Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) and Pacific Decadal Oscillation. South China Sea basin-wide storm surges are found to be a major culprit behind coastal floods regularly observed along Singapore's East Coast during northeast monsoon.
Experience and results of regional downscaling of IPCC-run global ocean model results will be shared. These include storm surges, astronomic tides, and wind-waves models.

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32. Date : 17 Oct 2018
Presenter : Chew Boon Ning (CCRS)
Theme : Introduction to Fire Research in Southeast Asia
Abstract

This talk introduces the audience to the biomass burning phenomenon in Southeast Asia and various aspects of fire research. It also puts into perspective some of the earlier works of the Hazard Impact & Risk Assessment Unit (HRU; now Applied Modelling Branch).

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33. Date : 24 Oct 2018
Presenter : Teo Chee Kiat (CCRS)
Theme : Introduction to a multiplicative cascade of rainfall
Abstract

Rainfall is arguably the most important parameter that meteorologist needs to grapple with working in the tropics. For example, forecasting of high intensity rainfall remains challenging for high resolution NWP due in part to the highly stochastic nature of the phenomena. In this talk, I will present a brief introduction to a multiplicative cascade model of rainfall intensity which potentially can reproduce the multi-fractal and intermittent nature of rainfall. It is hope that through the presentation, some practitioners may find the concept of multiplicative cascade framework useful when dealing with rainfall prediction and evaluation.

34.Date : 31 Oct 2018
Presenter : Sun Xiangming and Peter Heng (CCRS)
Themes and Abstracts

A subjective and objective evaluation of NWP forecasts of Sumatra Squall events (Xiangming)

The performance of SINV-DS forecasts for 63 past squall events were evaluated using a subjective evaluation by forecasters and an objective evaluation based on the Fractions Skill Score. The study investigates whether an objective procedure can reproduce the main results of the subjective evaluation.

SINGV-DA: Recent Developments and Outstanding Issues (Peter)

This talk reviews recent developments relating to the data assimilation (DA) scheme of the SINGV numerical weather prediction system and their impacts. A couple of outstanding issues are highlighted as areas that may warrant further investigation

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35.Date : 7 Nov 2018 (11:00 – 12:00)
Presenter : V. Prasanna (CCRS)
Theme : Performance of SINGV model over the Maritime continent and Singapore domain from the preliminary climate runs.
Abstract

This talk focuses on the performance of SINGV model over the Maritime continent (MC) and Singapore Centred domain (SINGV), run on long term mode (climate mode). The model is forced by ERA-5 reanalysis data for a period of 1 month (Jan-2001) with regular update of SST at 3-hr interval. The model is tested for its performance at different resolutions, namely 9km (Convection Parameterized and Explicit), 4.5km and 1.5km (Explicit representation of Convection). The model results are compared with the gauge assimilated satellite precipitation products (CMORPH, CHIRPS and TRMM 3B42-V7) and the model biases in precipitation at different resolutions are examined. The model's ability in capturing the diurnal cycle of precipitation during the month of January over the Land and Ocean points in the MC-domain and SINGV domain are examined. The representation of light rainfall,

moderate rainfall and extreme rainfall in the model grid points are compared with CMORPH and TRMM-3B42-V7 Precipitation products. The spatial representation of extreme rainfall (95 percentile rain) in the model is compared to observation (TRMM-3B42-V7) at different resolutions.

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36. Date : 14 Nov 2018
Presenter : Avester Lau (CFO)
Theme : A review 21st century heat-driven changes of the global ocean, and new experimental methods to quantify this.
Abstract

This seminar begins by briefly reviewing ocean heat uptake and its impact in the 21st century, citing findings from IPCC AR5 as well as new research since.

With that in mind, new geochemical methods involving Rare Earth Elements were used to investigate and quantify these impacts across the global ocean, pioneered by researchers in the University of Oxford, a project I was engaged in during my time as a Masters student. The second half of this seminar will thus showcase our experimental methodology, as well as discuss some of the findings.

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37. Date : 28 Nov 2018
Presenter : Johnson Ng (CCRS)
Theme : Data retrieval using Climate Data Management System
Abstract

Climatology and Climate Studies (CCS) section awarded the tender for the implementation the Climate Data Management System in MSS in early 2017. Some of the features of the system include system quality checks, station metadata management and the flexibility to customise reports/products. The system is expected to be made available for all users to access in the second half of 2019. In this talk, I will demonstrate the different ways users can extract quality checked data from the database. The users will also learn how to access the available weather parameters for each stations as well as the metadata of all local stations. (Actual training will be provided for all users in the first half of 2019)

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38. Date : 12 Dec 2018 (10:00 – 12:00)
Presenter : Peter Heng, Xiangming Sun, Muhammad Hassim, Venkatraman Prasanna (CCRS)
Theme : 3rd Convective Scale Modelling Workshop debrief
Abstract

The 3rd Convective Scale Modelling Workshop (CSMW) was held in Darwin, Australia, 13-16 Nov 2018 which focused on convective scale regional model development and its application in day to day weather services in UK Met Office and UM partners. Four colleagues from CCRS (Xiang Ming, Peter, Muhammad and Prasanna) who attended the workshop will be sharing what they have learned from the workshop including status/plan of regional model development, forecaster's involvement, interesting approaches/conclusions from the UM community and proposals for our future actions.

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39. Date : 19 Dec 2018 (11:00 – 12:00)
Presenter : Dr. Josuha Qian (CCRS)
Theme : Multi-scale climate processes and rainfall variability in Sumatra, Malay Peninsula and Singapore associated with ENSO
Abstract

The impact of ENSO (El Niño-Southern Oscillation) on the rainfall variability over Sumatra, Malay Peninsula and Singapore has been investigated by using station, satellite and reanalysis data, from the perspective of multi-scale processes of diurnal cycle, daily Weather Types (WTs), monsoon and ENSO. The rainfall variability associated with ENSO is not spatially coherent in both September-November (SON) and December-February (DJF) in this region. In SON, there are more weather WT2 and fewer WT3 in El Niño years, thus the seasonal rainfall anomaly pattern in SON is similar to that of WT2, with wet anomalies in western Malay Peninsula and northern Sumatra, and dry anomalies in southern Sumatra. In DJF of El Niño years, there is an area of wet anomalies in the southern tip of Malay Peninsula, including Singapore, and in central Sumatra, and slightly dry anomalies in central Malay Peninsula and northern Sumatra. There are more days of WT4 and fewer days of WT3 and WT5 in the DJF of El Niño years. In the early northeast monsoon season (Dec-Jan) when the ITCZ is still north of or near the equator, the El Niño-enhanced easterly wind anomaly on 850 hPa favors more frequent WT4 with more zonally oriented east-northeasterly winds, which propagate rainfall from the area of above normal SST in the southern South China Sea toward Singapore and adjacent seas to produce above normal rainfall. In February, however, more frequent WT4 will not enhance rainfall in the vicinity of Singapore because the ITCZ has already moved to the southern hemisphere, and upstream area in the South China Sea is quite dry. This explains why the Singapore station observation shows dry anomalies in SON, wet anomalies in December and January, and dry anomalies again in February in El Niño years.
