RMetS Virtual Student & Early Career Scientists Conference 2020

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Session 1 – Observations

2016 Indian monsoon cloud development observed using doppler weather radar
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Convective cloud development during the Indian Monsoon is responsible for moistening the atmospheric environment and driving the monsoon trough northwards each year, bringing a large amount of India's annual rainfall. Therefore, an increased understanding of how convection develops on large spatio-temporal scales during the Indian Monsoon will inform model development. In this study, 139 days of Indian Meteorological Department Doppler Weather Radar data is analysed for 17 sites across India during the 2016 monsoon season.

Convective cell top heights (CTH) are objectively identified for all sites through the season and compared alongside near-ground (at 2 km height) cell size and precipitation. These variables are analysed over the main timescales of variability during the monsoon, such as the diurnal cycle, active-break cycles, and the progression of the monsoon itself.

We find that higher clouds typically have a larger surface area and precipitate more. CTH exhibits a diurnal cycle at several sites. The phase of this diurnal cycle depends on the surface type being land or ocean, with ocean cells more likely to exhibit an early morning peak compared to those over land.

In addition, CTH is smaller on average for monsoon break periods compared to active periods over the central India region. These intraseasonal drivers appear to be the dominant signal in CTH for our study period. Our initial findings confirm that Indian monsoon cloud regimes are at least partly regulated by the large-scale synoptic environment they are embedded within.

Investigating air-sea interaction in the Tropical North Atlantic using a novel combination of autonomous vehicles
Elizabeth Siddle
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Improving our ability to model the Earth's climate and extreme weather events has been the focus of much recent research. In order to generate better models, we need to collect better oceanic and atmospheric observations to verify and parameterise the unresolved processes in these models. Autonomous techniques are increasingly being used to collect these observations.

At UEA we use a novel combination of autonomous vehicles - a wave-propelled autonomous surface vessel (AutoNaut) and a profiling autonomous underwater vehicle (Seaglider). Our AutoNaut, known as Caravela, has been equipped with meteorological and oceanographic sensors, as well as having the ability to carry and deploy the Seaglider in remote locations.

To enhance our understanding of the interaction between the atmosphere and the ocean, we deployed this technology as part of the EUREC4A campaign off the coast of Barbados, during January and February 2020. EUREC4A is a large international project with the aim of better understanding the relationships between clouds, atmospheric convection and

circulation and ocean-atmosphere interaction. We collected atmospheric and oceanographic measurements from Caravela. Oceanographic measurements from the Seagliders provided complementary information on conditions in the ocean's uppermost 1000 m. Observations collected by the autonomous platforms were collated with those from ships, aircraft and dropsondes to study air-sea interactions of heat and momentum and calculate the local ocean mixed layer heat budget.

Goldmine or bust? Crowdsourced meteorological data for atmospheric science

Jonathan Coney
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A high-density network of meteorological observations allows the effects of small-scale phenomena such as gust fronts, urban heat islands and snowfall to be observed. These events cannot usually be seen on traditional observation networks, due to the low spatial resolution of such networks. One possible source of high-resolution meteorological observations is to use data from novel sources, such as crowdsourcing the data. Although crowdsourced observations may be less accurate than the ones from a station owned by a weather service, the sheer number of observations and the ability to assess which observations are inaccurate may outweigh the lesser accuracy of crowdsourced data. Crowdsourced data has been valuable for previous studies into urban rainfall monitoring, storm spotting and urban heat islands. Companies such as Netatmo sell home weather stations, and these stations can automatically upload their weather data to the internet.

There are over 5000 of these smart home weather stations in the UK, mostly in urban areas, and these could be used to drastically increase the number of observations that forecast centres can use in their models. Before this can happen, the accuracy and characteristics of the data from the stations needs to be quantified. This research investigates the accuracy of data from these weather stations in an atmospheric chamber; some methods to process the data to ensure good quality of data (for example: remove stations that had been placed indoors or in direct sunlight); as well as creating a data set of Netatmo observations from UK stations.

Uncertainty assessment of open source gridded precipitation dataset; A case study at Bole synoptic station.

Gertrude Gyamfi
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Observations Precipitation greatly influences the livelihood of people in Ghana. In this study, we assessed the uncertainty of open source gridded precipitation datasets at the Bole synoptic station from the period 1983-2013. We compared seven different datasets to the reference data (GMET). Three different statistical tools were used in analysing the data on the seasonal scale namely; correlation, standard deviation and root mean squared error for pattern, variability and error respectively. On the seasonal, monthly and annual timescales, the uncertainties between the datasets were assessed and it was observed that there was a significant difference in terms of variability and pattern. On the seasonal scale, GPCC had the least uncertainty in the temporal pattern for most of the seasons; winter (0.09), spring (0.17), summer (0.18) and autumn (0.09). It also exhibited the best performance in terms of the temporal variability, being 0.14, 0.31, 0.09,0.13 for winter, spring, summer and autumn respectively. ERA-INTERIM gave high values of uncertainties in terms of the temporal pattern in most of the seasons (0.82 in spring and 1.11 in winter).

With the exception of ERA-INTERIM, most of the datasets were able to reproduce the unimodal rainfall pattern at Bole; as represented on the time series graph on the monthly time scale. On the annual scale, all the datasets performed well in mimicking the observed data with the exception of ERA-INTERIM giving the worst representation. Overall, GPCC showed least uncertainties in terms of the temporal pattern and variability, therefore, it is recommended for the validation of model outputs and other climate studies at Bole.

Uncertainty Assessment of an Open Source Gridded Precipitation Datasets. A Case Study at Ada-Foah Synoptic Station.

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The uncertainties associated with seven (7) open source gridded precipitation data sets over Ada-Foah synoptic station were assessed based on a monthly, annual and seasonal time scales. On the annual cycle, all the data sets reproduced the bi-modal rainfall pattern of the region with GPCC and ERA-INTERIM having the least and highest uncertainties respectively. All the open source gridded data sets underestimated the rainfall peak with the exception of CRU and ERA-INTERIM in the major raining season. However, these data sets overestimated the rainfall peak with the exception of ARC in the minor raining season. On the seasonal scale, we measured the root mean square error, correlation and standard deviation. GPCC had the least uncertainties in the temporal pattern of most seasons (7% in both autumn and summer and 21% and 28% in winter and spring respectively). Moreover, it contains the least uncertainty in the temporal variability of 20% in autumn and 21% in spring. On the other hand, ERA-INTERIM had the highest uncertainty in the temporal pattern in most of the seasons (59% and 85% in winter and summer respectively). In general, GPCC data set showed least uncertainties on all the three-time scales (monthly, annual and seasonal), hence it is highly recommended for climate studies over Ada-Foah synoptic station.