

Improving predictions of tropical cyclones in Southeast Asia

WCSSP Southeast Asia

Tropical cyclones are amongst the most powerful and destructive weather systems on earth. Each year 80 to 100 develop over tropical oceans around the world, some of which make landfall and cause considerable damage to property and livelihoods.

Southeast Asia is one of the most active areas for tropical cyclones in the world. For example, Typhoon Haiyan struck the Philippines in November 2013 killing over 7000 people, leaving 1.9 million people homeless and leading to an overall economic impact estimated at over £3 billion¹.

Accurate and reliable forecasts of tropical cyclones, which are effectively communicated in a timely manner, can allow people, businesses and governments to take action to mitigate these impacts to help protect lives, livelihoods and infrastructure.



What WCSSP Southeast Asia is doing

The Weather and Climate Science for Service Partnership (WCSSP) Southeast Asia is a regional scientific research project supported by the UK Government's Newton Fund, matched by monetary and in-kind support from partner countries. The partnership harnesses scientific expertise in weather and climate from Indonesia, Malaysia, the Philippines and the UK. WCSSP Southeast Asia aims to jointly develop and improve underpinning capability in global and regional forecasting systems and advance the understanding of high-impact weather events such as tropical cyclones in Southeast Asia, in order to provide better advice to help mitigate their socio-economic impacts.

¹ <https://www.bbc.co.uk/bitesize/guides/z9whg82/revision/4>

WCSSP Southeast Asia is enhancing science collaborations and partnerships between the UK and Southeast Asia in many ways such as:

- improving understanding of the accuracy of Met Office models in predicting tropical cyclones in the West Pacific; and
- investigating the role of air - sea coupling for forecasting high impact weather to inform the development of future operational systems in the region.

WCSSP Southeast Asia research, led by the National Centre for Atmospheric Sciences (NCAS) and the University of Reading has found that since 2006, forecasts of western Pacific cyclones have improved by an amount equal to an additional two days' warning of cyclone impacts in the Philippines². In addition, forecasts of western Pacific cyclones are substantially more accurate when the forecast coincides with an active phase of the [Madden-Julian Oscillation \(MJO\)](#) in the western Pacific. These results can provide important advice to forecasters on when they should have more or less confidence in the predicted tracks or intensities of tropical cyclones, based on the current state of the MJO. Indeed, these results have been communicated to weather forecasters from the Philippines.



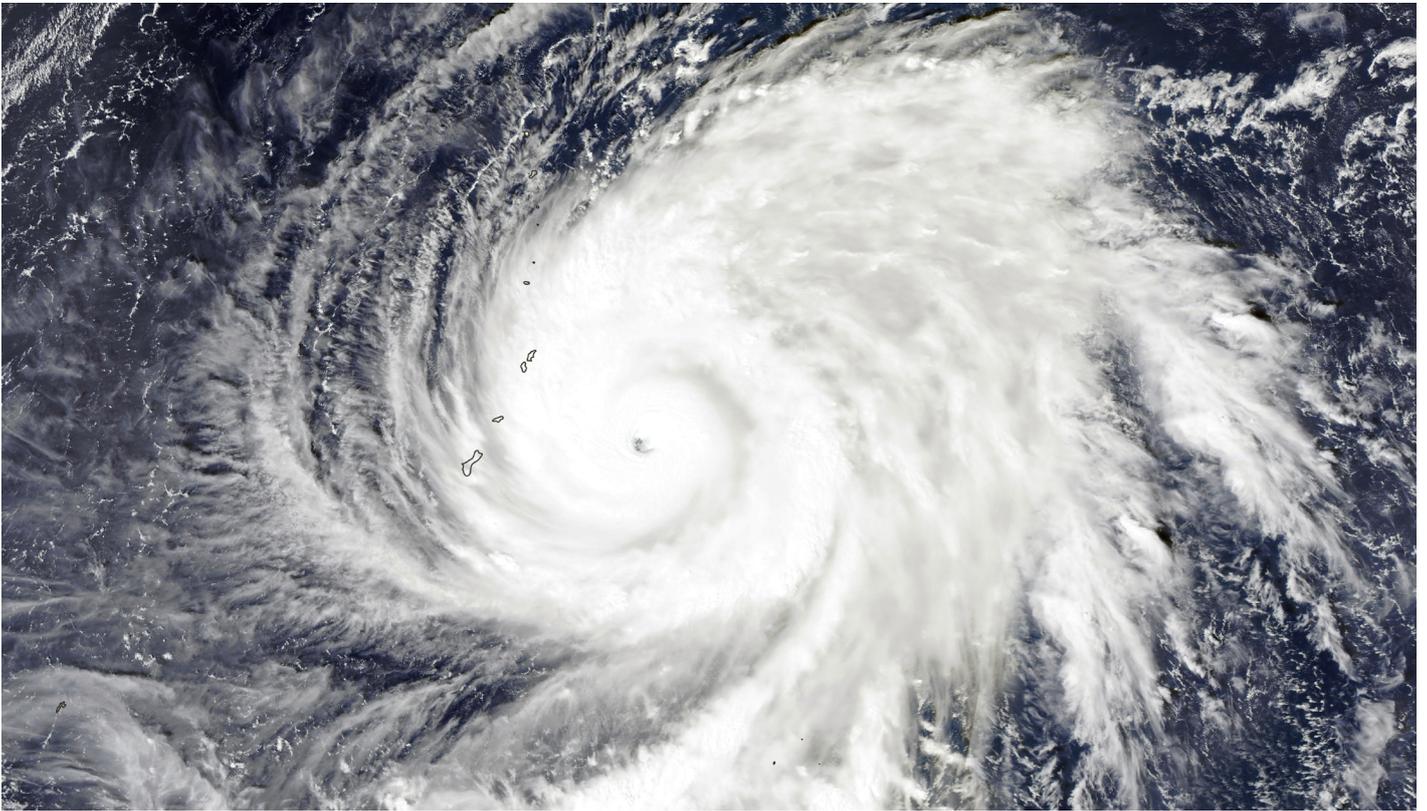
Another WCSSP Southeast Asia paper³ shows that forecasts of cyclone-related rainfall are accurate two days ahead, after which cyclone rainfall is underestimated in the Met Office model compared to the real world. Weather forecasters in the Philippines have identified the underestimation of cyclone rainfall in computer models as a key error that limits their ability to issue effective advanced warnings. Work in WCSSP Southeast Asia has therefore investigated the reasons behind this barrier to effective warnings. The research found that the error in cyclone-related rainfall is due to an underestimation of the rainfall per cyclone, not due to errors in the number of cyclones making landfall. This research is a first step in tackling one of the barriers to effective warnings for forecasters in the Philippines.

Further activities under WCSSP Southeast Asia include developing a version of the Met Office weather model which includes interactions between the atmosphere and ocean surface, to assess whether these interactions improve forecasts of western Pacific cyclones⁴. Results show this version improves forecasts of tropical cyclones. For example, the location of cyclones is improved by up to 100km on average over a 7-day period, compared to the current Met Office weather model. Knowing the importance of having a coupled model for simulating high impact weather over Southeast Asia can inform the development of future operational systems used in these countries.

² <https://journals.ametsoc.org/doi/abs/10.1175/WAF-D-19-0005.1>

³ <https://journals.ametsoc.org/doi/full/10.1175/WAF-D-19-0017.1>

⁴ <https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/qj.3571>



How about forecasts on longer timescales?

Significantly, the Met Office model can capture the impact the MJO has on the amount of rainfall in tropical cyclones in the western Pacific. In addition, a group of computer models have skill in predicting the MJO out to 12-36 days in advance. Therefore, it may be possible to combine these capabilities to generate conditional forecasts of tropical cyclone-related rainfall well beyond weather forecasting timescales.

WCSSP Southeast Asia is building strong science partnerships

WCSSP Southeast Asia is a regional project currently involving three partner countries: the Philippines, Malaysia and Indonesia. The partnership is led in the Philippines by the [Philippine Atmospheric, Geophysical and Astronomical Services Administration](#) (PAGASA), in Malaysia by the [National Disaster Management Agency](#) (NADMA) and in Indonesia by the Meteorological, Climatological and Geophysical Agency ([Badan Meteorologi Klimatologi dan Geofisika Indonesia](#) - BMKG).

Additional WCSSP Southeast Asia partners include:



Supporting the United Nations Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) represent a global commitment to transform the world through a sustainable and resilient path to development, focussing on areas of critical importance for humanity and the planet. With the support of the Newton Fund, the WCSSP programme contributes to the SDGs.



The Newton Fund builds research and innovation partnerships with 17 active partner countries to support their economic development and social welfare, and to develop their research and innovation capacity for long-term sustainable growth. It has a total UK Government investment of £735 million up until 2021, with matched resources from the partner countries.

The Newton Fund is managed by the UK Department for Business, Energy and Industrial Strategy (BEIS), and delivered through seven UK delivery partners, which includes UK Research and Innovation (comprising the seven research councils and Innovate UK), the UK Academies, the British Council and the Met Office.

For further information visit the Newton Fund website (www.newtonfund.ac.uk) and follow via Twitter: [@NewtonFund](https://twitter.com/NewtonFund)

For further information on WCSSP Southeast Asia visit the Met Office website
<https://www.metoffice.gov.uk/research/collaboration/newton/wcssp-southeast-asia>