Huracan GA2, Birmingham November 2024

- Informal chat -

Thursday 21 November 2024

Lizzie Kendon: REPRESA:tropical cyclones over southern Africa

Q from Antje:
Lizzie, sorry I missed this but what SSTs are you using for 4km future simulations? Do these simulations resolve convection or is the parametrisation still active?

A, Lizzie: Thanks for your question. Sorry I did not have time to give details on the simulations. The 4.5km simulations do not have any convective parameterisation - it is completely switched off. For the future simulations we are using the same SSTs as the driving GCM. This is straightforward for the case where driving from CMIP6, where just use CMIP6 SSTs. When driving from atmosphere only N512 HadGA7 the future run uses the observed SST but with a 20-y mean delta added.

> Antje: Thanks Lizzie! I am asking about the convective parametrisation because ECMWF cannot switch off the convective parametrisation completely in their 4km global simulations. They have to use a hybrid approach with a mixture of some parametrisation and some explicit resolution. Are you by any chance in contact with the ECMWF convection team (Tobias Becker)? I'd like to understand why it doesn't work for ECMWF but it does work for others..
>
> Antje: Re SSTs, so that's a simple interpolation of the horizontal resolutions?
>
> Lizzie: Yes SSTs are interpolated onto the 4.5km grid.
> 👍
>
> Lizzie: I am not in touch with Tobias, but interesting to hear about your experience at ECMWF. We are also now running globally with 5km resolution and UM RAL3 physics (with convection scheme off) and also a version with modified UM GA physics (with a modified version of the convective parameterisation). Eventually we are hoping to unify the RAL and GAL configurations, using a scale aware convection scheme (CoMorph) but this is still under development.
>
> > Antje: CoMorph sounds very interesting - thanks.
>
> Lizzie: Our experience is that switching off convection is key to seeing model improvements, and even at convection-permitting resolutions (1-5 km) the model performs well, producing very realistic rainfall patterns. There is a tendency though for heavy rainfall to be too intense, due to convective updrafts being inherently too large.

Antje: Yes, that's what I don't understand with the ECMWF model. If I remember it correctly (it's not my area of research), the updrafts were a problem here too.

John Ma: As discussed ECMWF IFS is hydrostatic, so I think a param is needed to avoid very strong updarfts - see report herehttps://www.ecmwf.int/sites/default/files/elibrary/2010/17457-non-hydrostatic-modelling-ecmwf.pdf

JohnMA: Also too intense rainfall is much better if you look at ths acle the model "resolves (6 grid-points) https://link.springer.com/article/10.1007/s00382-019-04759-4

Q, John from email: Nice work & talk. When you compare things like min-pressure between CP4 & ERA/low-res models , have you done the same comparison on a common coarse grid? Just would be nice to isolate what is improved fine-scale detail and what is improvement on the coarse scale. I think when I asked Josh this before, he hadn't yet.

A, Lizzie: Good question. Not yet - will do.

Question from Ted: The violin plots for high-res future climate looked to have a box-car shape, which doesn't look very physical to me; in most distributions, extreme values are also rare values. Can you comment on this?

A, Lizzie: Yes we noticed this too. For the global models the violin plots are too long tailed, so have very few (maybe only one) relatively intense TC, with the rest being much weaker. It suggests that the models are capable of producing intense TCs (Cat 4 and 5) but only under very rare conditions. For the 4.5km CP4A runs the violin plots for the future indeed look more "boxed" shape. Almost like there is some max TC intensity limit that has been reached. It would be good to explore this further.

A, Lizzie: Odd shape of CP4A violin plots may also just be a sampling issue - there are not many TCs per year in future, and only got few years of data so far. Once we have got more data we may get a different result.

A, JohnMa.What are the obs in that plot (violin plot) please?

A Lizzie: The obs are Reunion.

Leo Saffin: Tropical cyclones in the extratropics

Kelvin Ng: CTOs in the 20thCentury: The UNSEEN hazard

Comment from Ted related to Hayley's question: My suggestion would be to start from proximate drivers (e.g. weather patterns), and see whether UNSEEN is at least a predictor of the effect of the drivers on heavy precipitation (even if the magnitude is too small). The sample

size in UNSEEN will be much larger than in observations so one could regress the conditional relationships in obs against UNSEEN. In other words, treat UNSEEN as a hypothesis and see whether the data supports it. One would hope that UNSEEN would capture the conditional relationships between remote drivers and proximate drivers, although that would need to be checked too (and might suffer from a SNP).
👍

RE Kelvin: This is a good idea but we need to “target” what kind of weather patterns we should focusing on. This is because the data volume is massive although only certain levels/variables are available.

Q from Antje: I thought your plots of the decadal variability of the wind (and rain) impacts were very interesting. It’s somewhat surprising (in a positive sense) to me to see that the impact ratios in the hindcasts are so similar to ERA-20C. The variability though was quite different with stable relationships throughout the century in the model hindcasts. ERA-20C saw an upward trend from ca 1940s - do you know whether this is “real” or more an observational effect?
I think it might be very useful to also look at the backward extension of ERA5 to 1940 and compare it with ERA-20C and the hindcasts as an (imperfect) independent and better dataset.

RE Kelvin: I don’t have too much faith in ERA20C in the earlier period as the CTO count is way too few in the pre-1950. I think using ERA5 to crosscheck this is a good idea. I was trying to use CERA20C as well but did not have time to finish it.

Leo: Definitely looks like there are extratropical cyclones in your set of events. You see them in the most extreme but also in the seasonality you showed skewing more to winter for the models. Why is the seasonality more “correct” looking for ERA20c? The identification is still the same so maybe this is implying that the models are producing more of these odd-looking extratropical cyclones. Or is the identification subtly different?

RE Kelvin: I agree there might be some ETC there as I literally using TRACK as it is. Theoretically, it would be an easy implementation for additional criteria for TC (i.e. more filters) but I am not sure whether fixed intensity threshold based criteria would go well with 20C data as their resolution is relatively low perhaps a dynamic version would be nice(?)… Also I am not sure whether ERA20C is more correct as the distribution is derived from roughly 30 events…

RE RE Stella: I wouldn’t argue for intensity thresholding either, it does not necessarily distinguish TCs and ETCs necessarily anyway. You could use Leo’s CPS+intensification criterion (or my STJ diagnostic but Leo’s is easier to run if you get the CPS from Kevin).

Marjolein Ribberink: Hurricane Ophelia in Alternate Climates

John Methven: Large-scale drivers of CTO variability

Hayley: Very interesting John as this is very much what Paul Davies has been suggesting in terms of the interactions of mid-latitude jet and TCs and the wave breaking that becomes more prevalent in La Nina conditions enhancing this. Perhaps bringing in this meteorological perspective would be useful here and not convinced climate models get this right…

Gregor Leckebusch: Identifying loss-relevant events for UK & Europe

Q from Antje: What's the difference between UNSEEN and PURE?
Antje: ECMWF is preparing for their new seasonal forecasting system SEAS6 which will become operational next year. So now is a very good time to raise any "wishes" for specific data that weren't included in SEAS5 to be archived in SEAS6. Not that I can promise anything .. but if you really would like to see something in the new archive, please do let me know.

Ralf Toumi: IRIS: Imperial College Storm Model

Hayley: and the really interesting thing is you get this same magnification of impacts from rainfall increases to volume of flooding and then damages…

Hayley: The results you show for your model are a little bit different to what we find in Manning et al. 2024 for climate model projections. The wind does become stronger but the big change will be the potential for the development of sting jets in these warm core storms - these cause extensive damages when they occur. The shapiro-keiser type storms (warm type) are found to be increasing in the future projections (esp for CPMs) and wind severity increases (as a footprint) - main increase in impact over GB though actually comes from increase in heavy precipitation and flooding (which I think it the same effect we are also seeing for the TCs this year over the US - unusual that most of the damages are coming from flooding inland). Trajectory of storms also matters and we find that the storms come from a more southerly direction in the future.

Alex Baker: Tropical cyclones in fully coupled global strom-resolving models (nextGEMS)

Antje: How many ensemble members are there in the IFS runs?

Alex: Only 1 member historical and 1 scenario (SSP3-7.0).

Kelvin: Perhaps this paper (https://journals.ametsoc.org/view/journals/bams/102/9/BAMS-D-20-0223.1.xml) might be related to Ralf's comment (different type of RI).

Pier Luigi Vidale: Tropical cyclones in a near-10km model (EERIE)

Kevin Reed: Storyline simulation intercomparison

Antje: I find it quite surprising that the tracks are almost identical for different warming levels. I'd have expected that the underlying warmer SSTs would steer them in some other directions, but that doesn't seem to be the case. Is there a simple explanation for this?

Hayley Fowler: WP4 update & Characteristics of historical TC to PTC transitions in the North Atlantic

Leo: Is the IBTrACS viewer available online. Looks really good (and different from what we have done).

Alex: Viewer's are linked under "browsing" tab here:
https://www.ncei.noaa.gov/products/international-best-track-archive

Grzegorz Muszynski: Using causal methods to identify changes in climate conditions enabling CTOs hitting the UK

Antje: On this slide, perhaps the link between external forcing and natural variability is missing. Might be important for the future, especially as the models and the observed record seem to disagree about the behaviour of ENSO.

Dian-Yi Li: An Environmentally Forced Post-Tropical Cyclone Hazard Model

Colin Zarzycki: Strategies for bridging high-resolution GCMs and statistical hurricane models for climate storylines

Melissa Wood: Early outputs from UK surge modelling

Friday 22 November 2024

Discussion about clustering:

Relevant paper from Suzana Camargo:
https://journals.ametsoc.org/view/journals/mwre/149/11/MWR-D-21-0075.1.xml
which also looks at the impact of large-scale drivers

We did some k-means clustering on time developing MSLP fields for ETCs - could be of interest here:
https://doi.org/10.1127/0941-2948/2008/0266
👍

STORYLINES BREAKOUT subgroup notes

— what should we prioritise?
— can we put forward worst-case event(s)?
— what is the current risk? (—> decision makers)
— use of AI models (e.g., AIFS)?

— jeff brain dump notes from THURS BREAKOUT + dinner conversation.

How are we connecting the WPs? Ted: We can factorise the WPs with causality network and component probabilities. (See Grzegorz presentation)

Surge: Seasonality is important because tides have seasonality. Also there is an 18.6yr "moon" cycle that is worth about 10cm of sealevel. We think that this can be a statistically separable effect.

PL: Focus on solid case studies?
From a UK storm perspective it is hard to know what storms were CTO or not. We have an impacts database to start from: https://www.surgewatch.org/ (needs updating from Aeileen 2017)

What are the high priority Qs?: What will happen in the 20 yr event horizon that decision makers would care about?
Should we consider worse case plausible or different regime events?

High value impact: Rainfall events like Kirk in Valencia

High value impact: Thames Barrier.
Current concern is not about overtopping but too many closures per year (because it is rated to a certain number of operations in its life):
https://www.theguardian.com/environment/2023/jun/30/before-the-flood-how-much-longer-will-the-thames-barrier-protect-london
NB however this is not necessarily a CTO thing, it is a climate change and weather thing.

Storm surge model:
We need gridded surface winds and surface pressure for the events
We can do case studies where we explore perturb around those events (modified met, tides, …)
We can run many simulations where we extract statistics
Our concern was about statistical representivity of rare CTOs.
Leo suggested that there would be lots

Kelvin made persuasive arguments that the UNSEEN simulations could be used to compute return periods. (NB Kelvin and Melissa's method's of calculating return periods may differ)

What about regime/climate change? Can we expect to repeat the analysis with future climate simulations in order to make the contrast between current and future climate impact? Will we have enough tracks to do this (I get the impression that there are many more available tracks reaching the British Isles in the current climate).

Q: Do we need to quantify the difference between CTOs and nonCTOs, in terms of surge impact probabilities?
Q: Do CTO have a different surge manifestation to Extratropical cyclones?
Historically stats per location: https://ntslf.org/storm-surges/skew-surges/england-south (needs updating from 2012) do not pick apart the storm origins

A comment on rainfall/surge HPC usage:
Rainfall: these simulations are computationally heavy - would expect fewer targeted simulations
Surge: computationally light - could do many simulations or (aligned impact) fewer targeted simulations

— END OF JEFF NOTES SECTION —