

Comparison of spatio-temporal evolution of extreme precipitation events between two high-resolution models (2.2km & 12km) in a northern Europe case study

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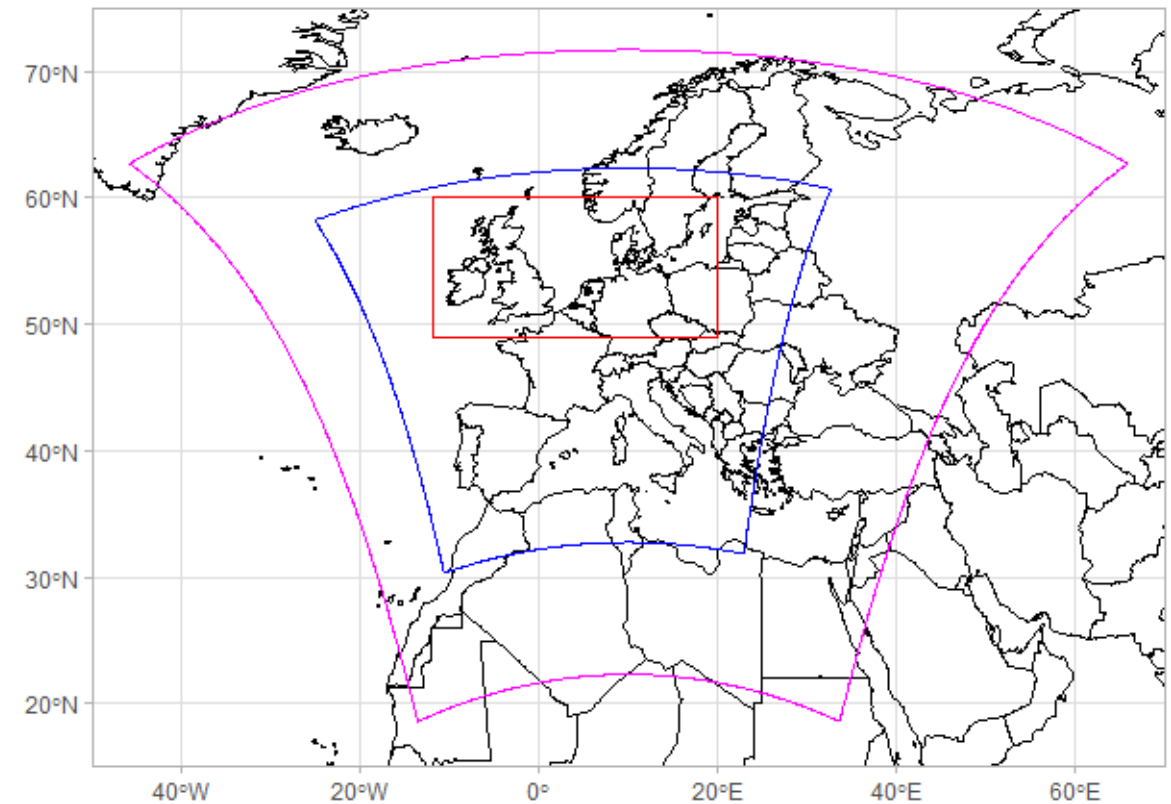
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Comparison of representation of extreme events between a 2.2 km Convection-Permitting Model (CPM) and a 12 km Regional Climate Model (convection parameterised, RCM).

AIM

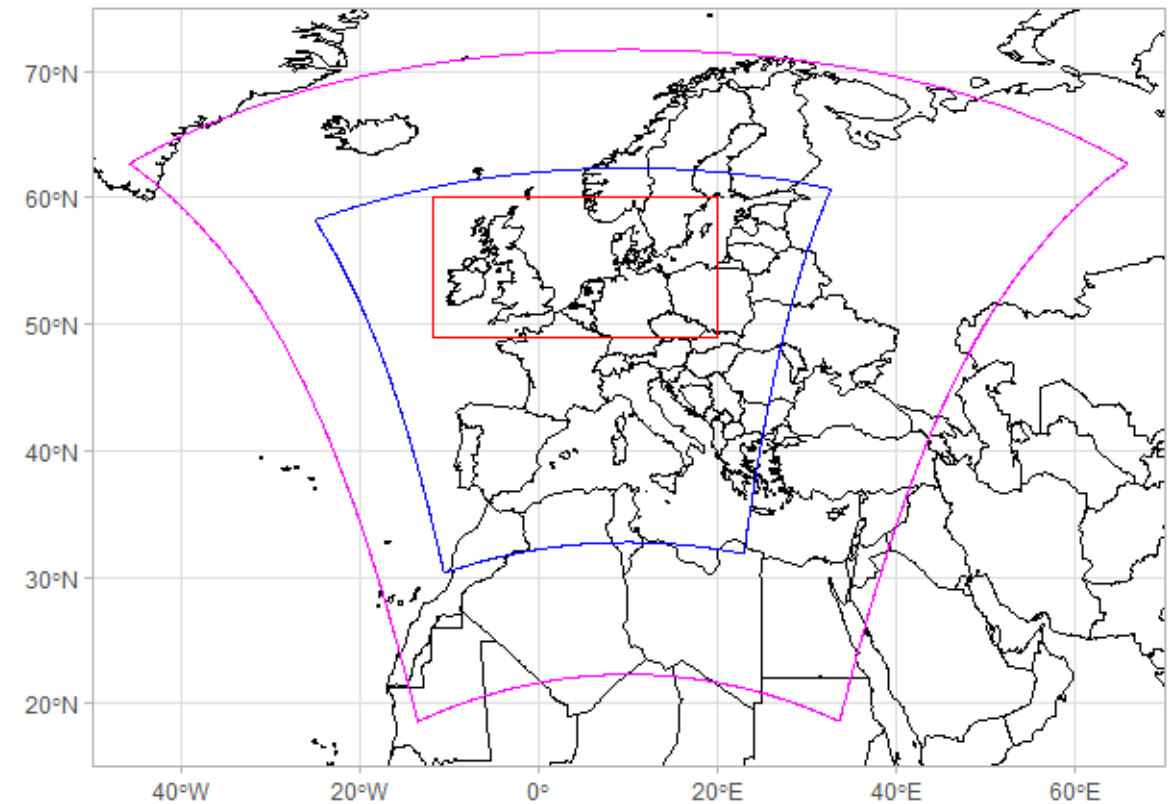
Data

- Both models are from UK Met Office¹ and ERA-Interim driven.
- CPM 2.2 km model is remapped to 12 km resolution on the same grid as the RCM.
- Both models are in hourly time steps.
- Both models cover a pan-European area (pink domain).



Methods

- The DYMECS tracking algorithm² is applied to both datasets (blue domain) between 1999 and 2008.
- The tracking algorithm tracks precipitation fields above a threshold of 1mm/hr. No areal threshold is set.
- Events within a northern Europe case area is analysed (red box).



Events

- Different number of events between the two models.
- More intermittent rainfall in CPM is seen as several independent events in the tracking algorithm.

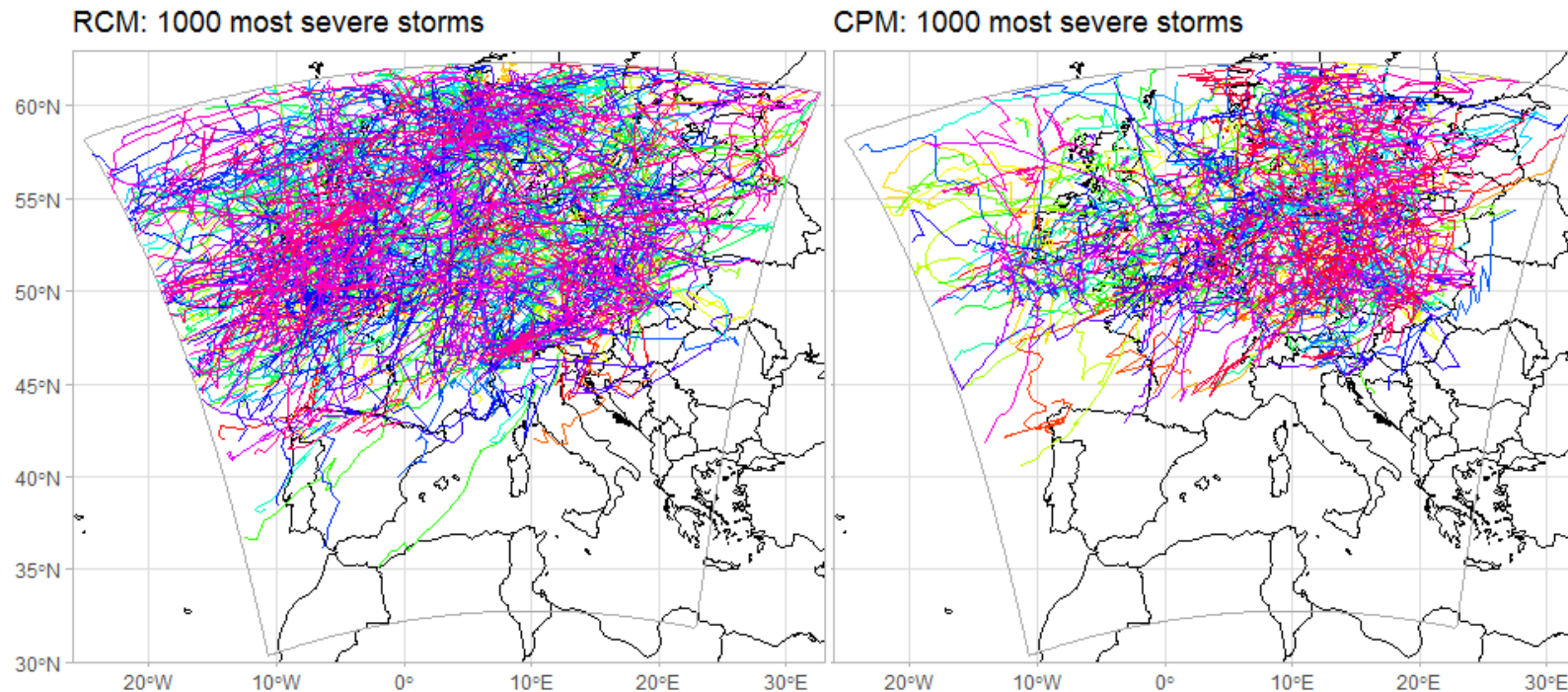
	RCM	CPM
All Events	4,219,064	6,456,733
Events within case area	1,140,859	2,084,733

Extreme events

- Extreme events are defined based on maximum 1-hour intensity for a single grid box within each event.
- Only intensities within the case area are considered.
- The 99.99th, 99.9th and 99th percentiles are analysed.

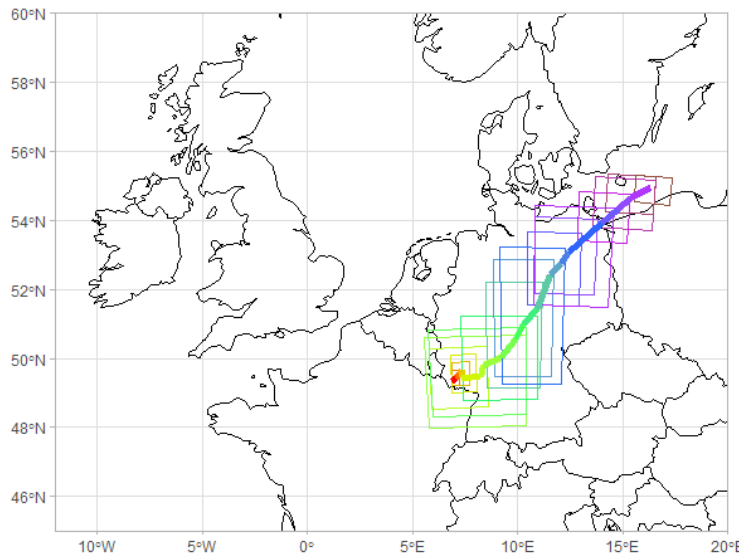
Sampled northern Europe extreme events

- RCM: Large density of event tracks over the British Isles and Atlantic Ocean. West to east moving direction.
- CPM: Large density of event tracks over central Europe and southern Scandinavia. South to north moving direction.

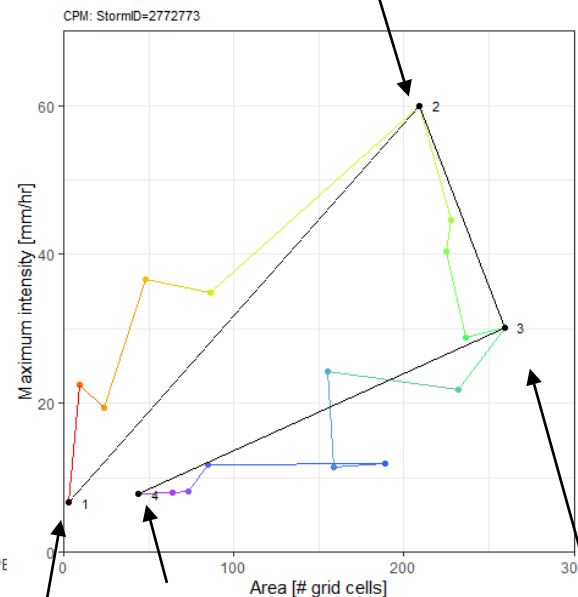


Simplified event evolution

- Event track and spatial extent of a single event (left).
- Simplified evolution based on 1-hour maximum intensity (middle).
- Simplified evolution based on 1-hour mean intensity over the event area (right).

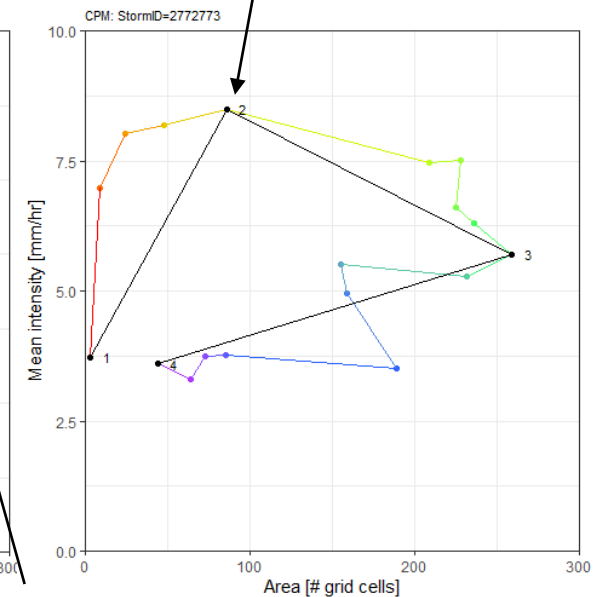


2: Peak **maximum** intensity over event lifetime



1: Birth 4: Death

2: Peak **mean** intensity over event lifetime



3: Maximum area

Median simplified event evolution

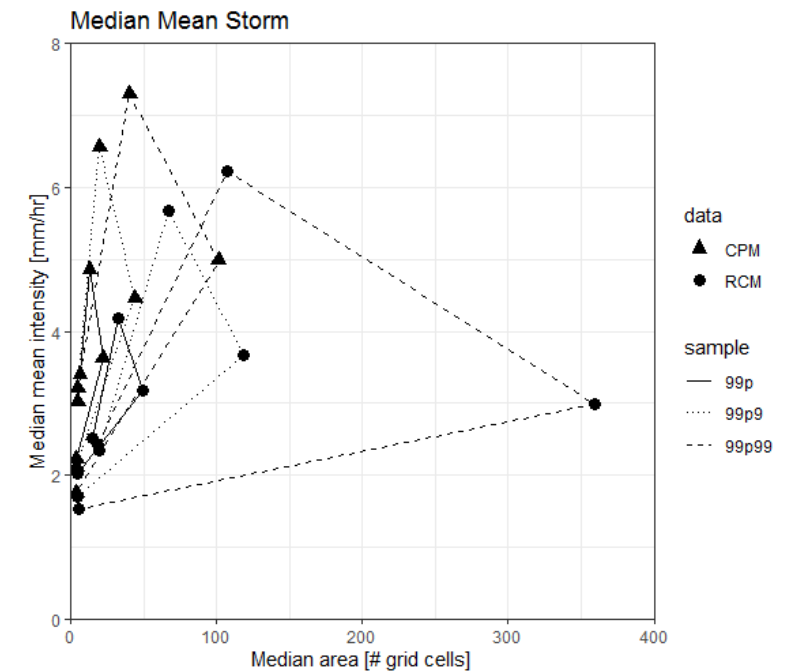
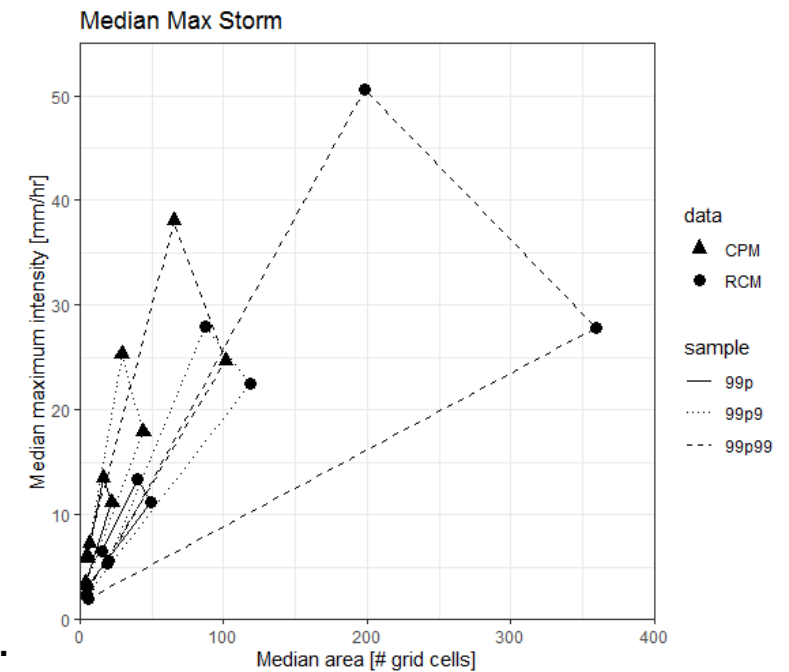
- Median simplified event evolution for each percentile.

MAXIMUM INTENSITY (TOP):

- RCM events larger than CPM events.
- RCM events have larger maximum intensity than CPM events.

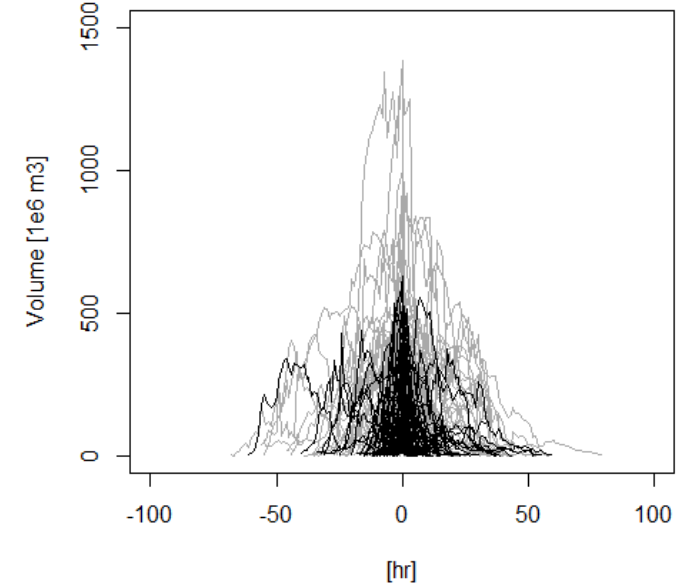
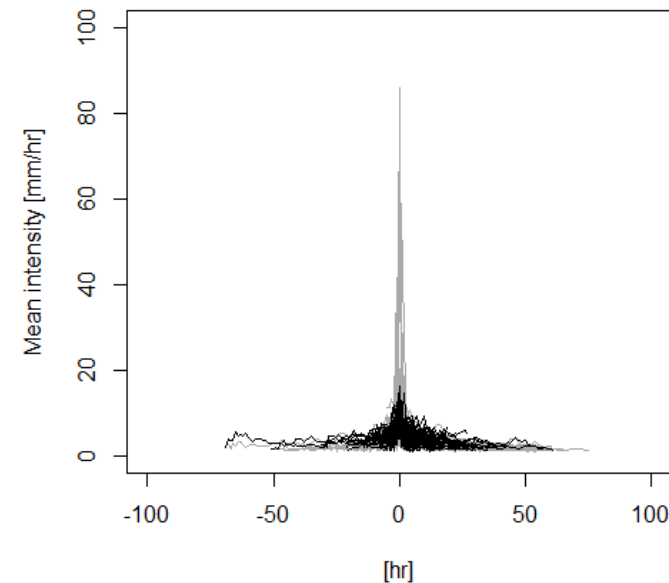
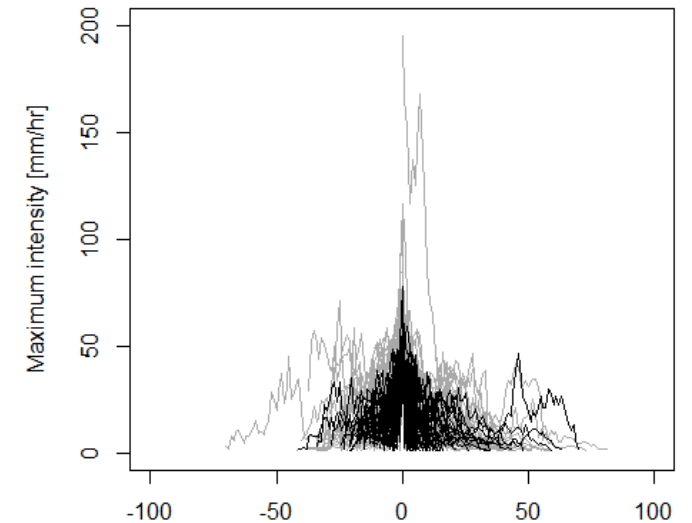
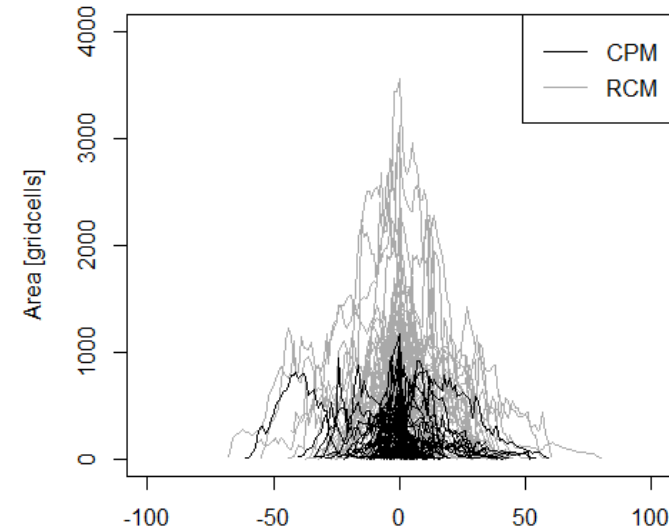
MEAN INTENSITY (BOTTOM):

- CPM events have larger mean intensity than RCM events.



Other variables

- Variables shown for the 100 most intense events (1-hour maximum intensity).
- The life time of the storm is normalised around the hour of peak maximum intensity.



Conclusion (ongoing work)

- Tracks of most intense events differ in location and movement direction between RCM and CPM, indicating very different event types between the two models.
- Representation of extreme events between the two models (CPM and RCM) is very different. The most extreme RCM events are more intense and larger than CPM sampled events.
- The 99.99th percentile most intense events seem to be highly influenced by grid point storms in the RCM data.
- For the highest percentiles (99.99th – 99th) RCM events have higher intensities than CPM events, opposite below the 99th percentile (results not shown).
- CPM sampled events have for all percentiles higher mean intensities compared to RCM events.

References

1: Berthou, S., Kendon, E.J., Chan, S.C. *et al.* Pan-European climate at convection-permitting scale: a model intercomparison study. *Clim Dyn* (2018).

<https://doi.org/10.1007/s00382-018-4114-6>

2: Stein, T.H., R.J. Hogan, K.E. Hanley, J.C. Nicol, H.W. Lean, R.S. Plant, P.A. Clark, and C.E. Halliwell, 2014: The Three-Dimensional Morphology of Simulated and Observed Convective Storms over Sothern England. *Mon. Wea. Rev.*, **142**, 3264–3283, <https://doi.org/10.1175/MWR-D-13-00372.1>