Geophysical Research Abstracts
Vol. 21, EGU2019-14531-1, 2019
EGU General Assembly 2019

ATDNet Lightning Flash Density Observations to Verify Flash Flood Forecasts from the ECMWF Ensemble

Calum Baugh, Christel Prudhomme, and Florian Pappenberger
ECMWF, Reading, United Kingdom (calum.baugh@ecmwf.int)

Developing flash flood forecasting systems at continental or global scales also relies upon the availability of observational data collected at similar spatial scales to perform verification. Conventionally these data are sourced from media, emergency responders and trained spotter reports. However, these rarely provide spatially continuous coverage, leaving many areas unobserved. Furthermore, there is a scale mismatch between these reports of flooding impacts at the point scale, whereas forecasts driven by global scale Numerical Weather Prediction (NWP) models represent the grid box scale.

Gridded lightning flash density observation datasets could be more suitable to perform the verification. They offer spatially continuous coverage by gridding data collected across a monitoring network. The spatial resolution is also of a similar scale to that of NWP models. One example is the Arrival Time Difference Network (ATDNet) operated by the UK Met Office across Europe.

We present the results of a one year flash flood verification experiment between ECMWF total precipitation ensemble forecasts and ATDNet lightning flash density observations in Europe. Forecasts of 24-hour total precipitation out to 5 days lead time were used to calculate the Extreme Forecast Index (EFI). Flash flood forecasts were created by applying a threshold to the EFI forecast, different threshold values were tested.

Before the verification, the ATDNet data were compared against heavy rain reports from the European Severe Weather Database (ESWD) which mentioned flooding impacts. The lightning data captured over 70% of the ESWD reports, showing a good ability to represent flash flood locations.

Verification results showed a much greater skill level than was achieved when verifying solely against flash flood report locations. Flash flood forecast skill correlated strongly with the occurrence of lightning flashes. For example, the highest skill occurred during summer and autumn seasons and in regions such as the Alps, the eastern Mediterranean and the Iberian Peninsula. These seasons and regions are associated with elevated levels of lightning flash densities. Meanwhile the opposite is true during the winter season and the Scandinavian and the United Kingdom regions. Flash floods in these seasons and locations are not necessarily driven by convective processes which in turn are associated with lightning occurrence. Therefore, a different verification dataset may be required in these situations. We conclude by discussing solving this issue by utilising long term gridded precipitation re-analysis datasets such as MSWEP or ERA5.