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Attribution using analogues: a case study of the Western European flood event of July 2021

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In July 2021 a cut-off low pressure system brought extreme precipitation to Western Europe. Record daily rainfall totals led to flooding that caused loss of life and substantial damage to infrastructure in Germany, Belgium, and the Netherlands. By identifying flow analogues – dynamically similar events - in both reanalysis data and large ensembles of climate model simulations we can investigate how the dynamics involved in this event are changing through time. Analogue methods are increasingly used in event attribution, we highlight considerations that must be made when using such methods.

For July 2021, we show that similar low pressure systems are occurring more frequently, and the lows are deepening through time. We find some analogues persist for much longer than was seen in July 2021. These dynamical changes effect surface impacts of such events. Such unprecedented events will become increasingly likely in a warming climate, and society must adapt to reduce future impacts.