Development of a New Database of Extreme European Winter Windstorms Derived from Multiple Data Sets

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Motivation for a New Extreme Storm Database

- Winter windstorms are the costliest natural hazard Europe faces
- Characterization of risks and ability to predict losses a high priority

What Is a Storm Footprint?

- Storm footprints map the peak wind magnitudes encountered during a storm event at the locations affected by a given storm
- Peak near-surface wind speed or wind gust typically given as a relative wind – degree of exceedance over a threshold value

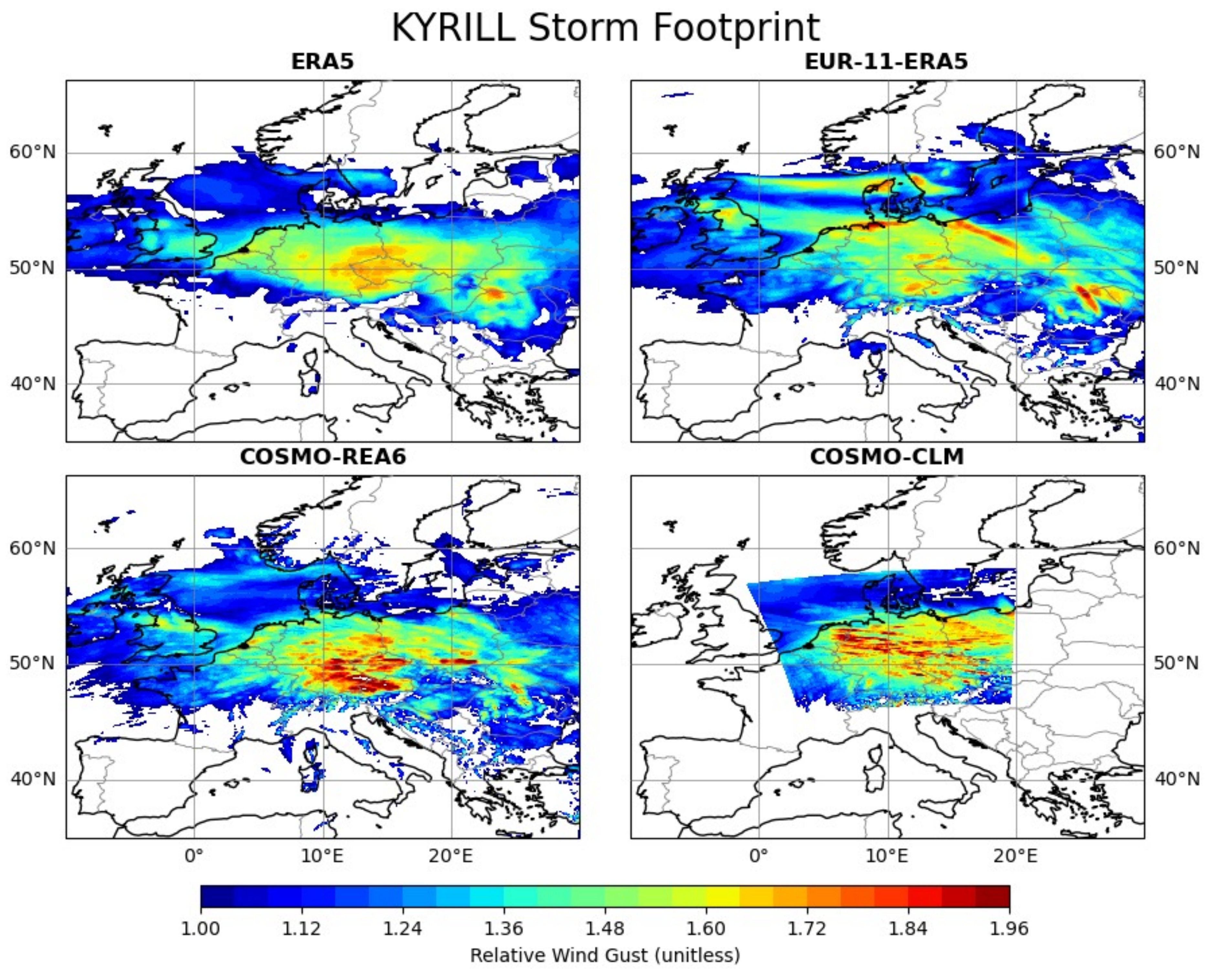


Fig. 1: Storm footprint derived from the input data sets used to construct our database for windstorm KYRILL (19 December 2007). All footprints are plotted at their native horizontal resolution and native domain. KYRILL is the strongest storm in our database.

Database Construction

- Database consists of footprints derived from 4 different input data sets
- Extended winter season (ONDJFM) for the period 1995-2015
- Top 50 most extreme storms from each input selected and included
- Consistent methodology applied across input data sets to identify storms and assess their severity based on storm loss index developed by Pinto et al. (2012) and Karreman et al. (2014)

Input Data Set	Type	Resolution
ERA5	Reanalysis	0.25°
EUR-11-ERA5	CCLM model driven by ERA5	0.11° (~12km)
COSMO-REA6	Reanalysis	0.055° (~6km)
COSMO-CLM	CCLM model driven by ERA5	0.0275° (~2.8km)

Overview of Storm Footprint Database

- 73 unique storms identified in our database
- More storms and damages occur in first half of time record than latter half
- Input data sets generally agree on which winter seasons contain the fewest storms, smallest damages
- More disagreement on which winters contain the most storms, damages across inputs

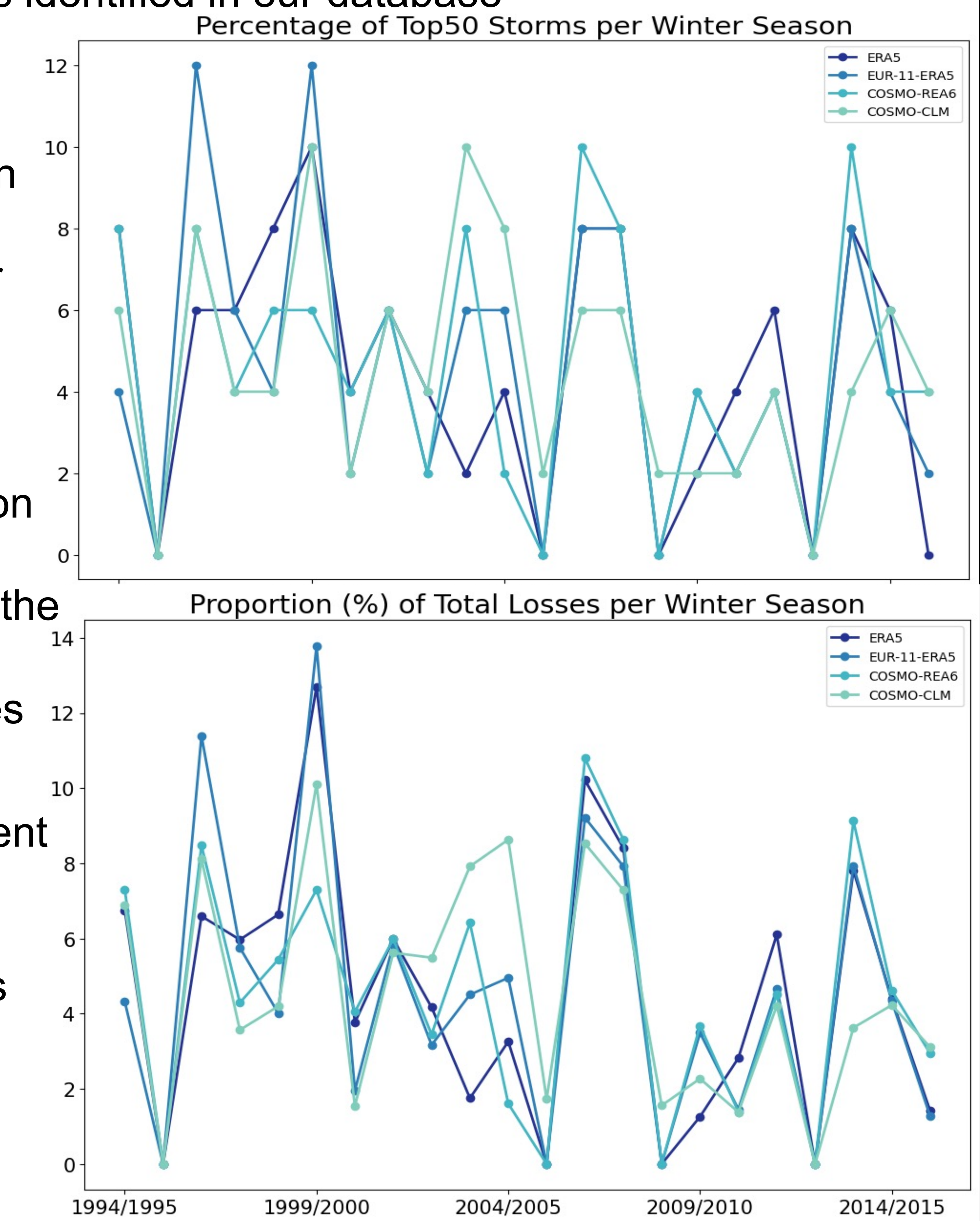
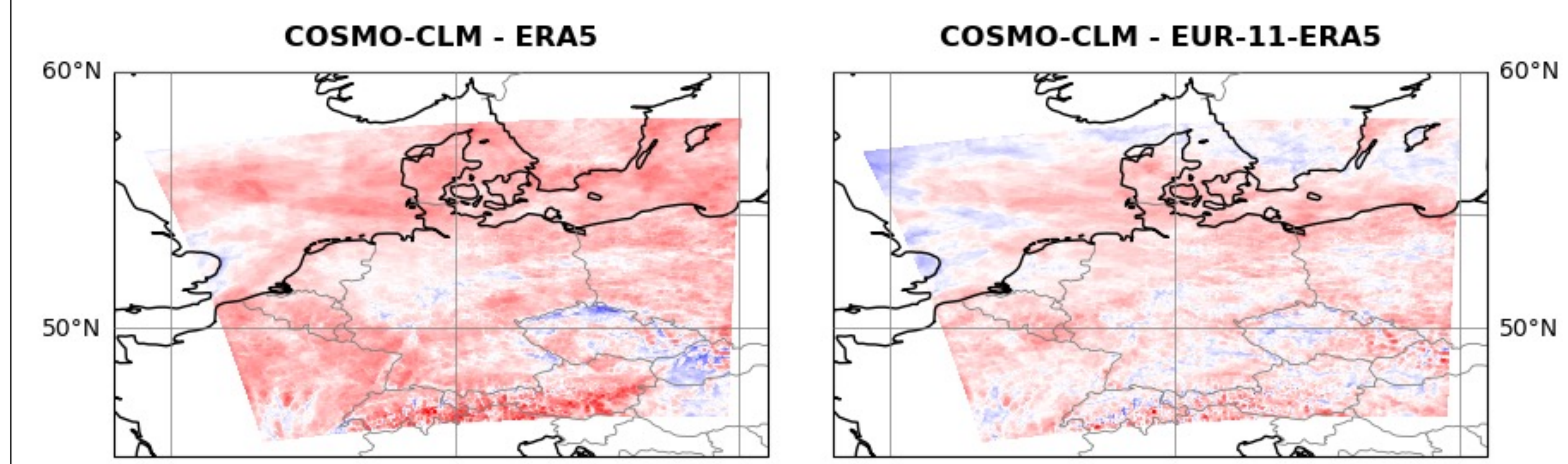


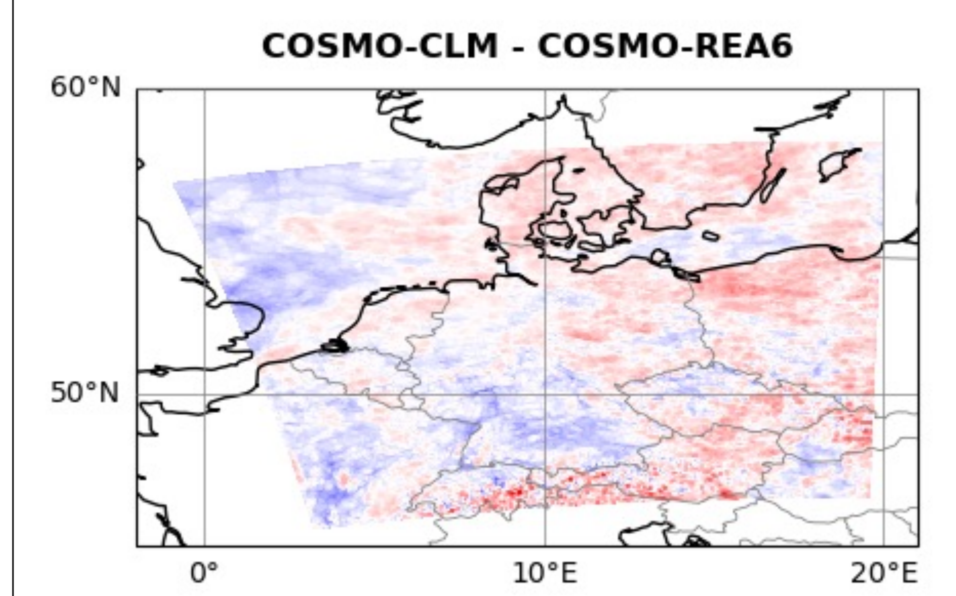
Fig. 2: Distribution of the 50 storms (top) and proportion of the total storm losses incurred (bottom) per extended winter season for each input data set within our database.

Comparison of Common Storms Among Inputs

- 30 storms identified in common across all 4 input data sets
- ERA5 displays largest differences w.r.t. COSMO-CLM
- COSMO-CLM tends to be larger than EUR-11-ERA5 over land, more variable w.r.t. COSMO-REA6
- Important to note that COSMO-CLM is NOT the "ground truth!"

Cumulative Common Storm Footprint Differences





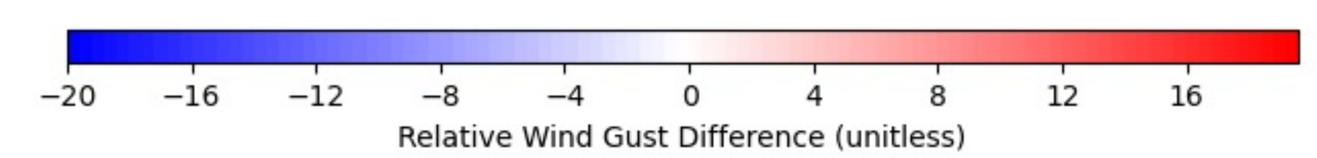


Fig. 3: Cumulative storm footprint differences between COSMO-CLM and the remaining input data sets over the common storms only. Data sets first regridded to the COSMO-CLM horizontal resolution and restricted to its smaller domain before computing differences.

Sharing is encouraged

References

Pinto et al. (2012): https://doi.org/10.3354/cr01111

Karreman et al. (2014): https://doi.org/10.5194/nhess-14-2041-2014

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