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Beyond Regions: Analyzing the Spread of Armed Conflicts in Africa

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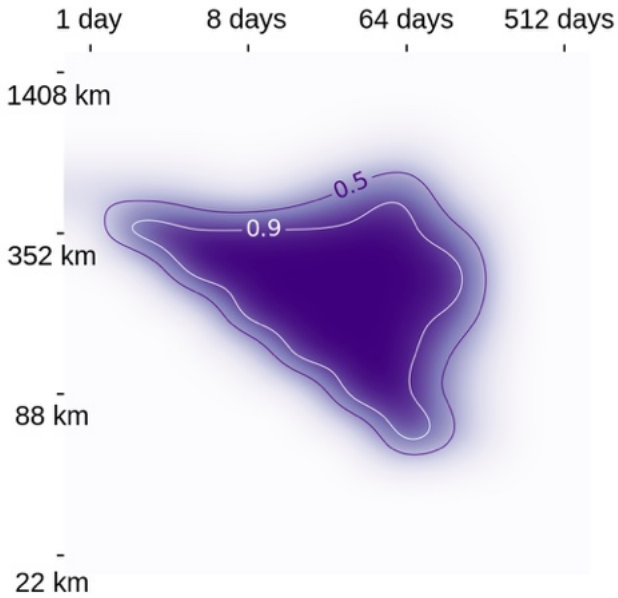
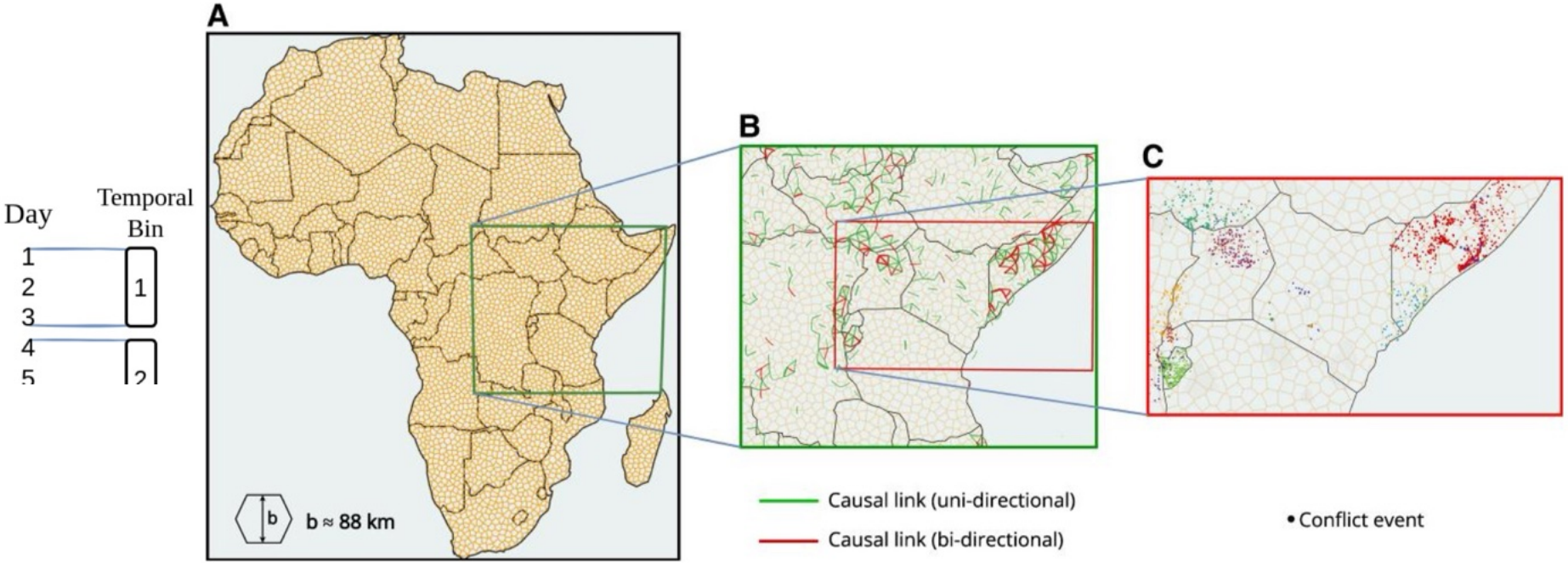
Background

Discovering the mesoscale for chains of conflict (Kushwaha & Lee 2023)

- Paper develops quantitative, systematic definition of conflicts
- Simple procedure to combine unique conflict events leads to meaningful chains of conflict events, avalanches
- Avalanche generation could be improved in order to more closely match social spreading processes



Generating conflict avalanches



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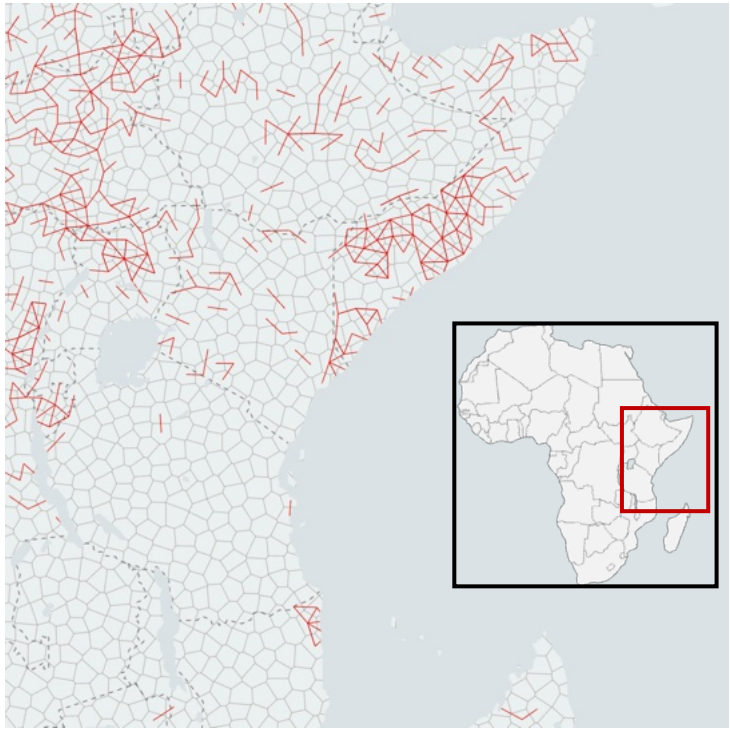
Causal links

$$T[X;Y] = \sum_{x_t, x_{t+1}, y_t} p(x_t, x_{t+1}, y_t) \log \left(\frac{p(x_{t+1}|x_t, y_t)}{p(x_{t+1}|x_t)} \right)$$

- Causal-link if significant Transfer entropy
  - Past activity in Y influences present activity in X
  - Only *adjacent* cells are connected

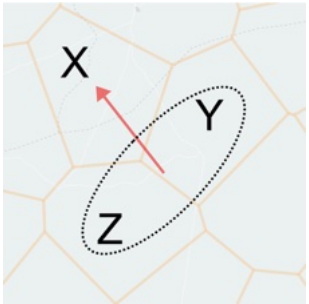
➡ **What if we generalize this?**



Going beyond pairwise dependence

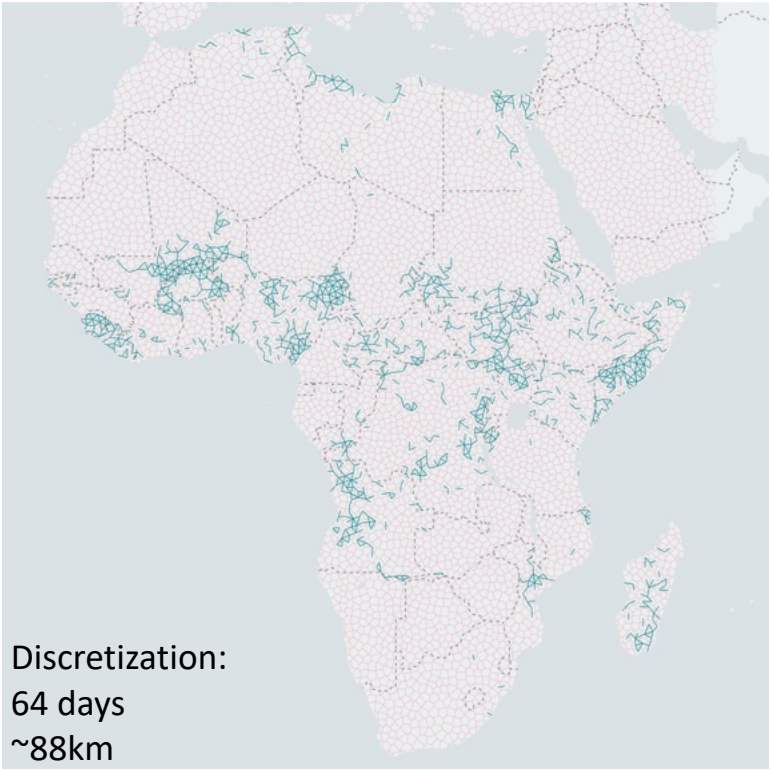
1. Compute TE for connections of higher distance/Spatially distant neighbors
2. Continent-wide connections?
3. Compute TE for triples (X, Y, Z)

$$T[X;Y;Z] = \sum_{x_t, x_{t+1}, y_t, z_t} p(x_t, x_{t+1}, y_t, z_t) \log \left(\frac{p(x_{t+1}|x_t, y_t, z_t)}{p(x_{t+1}|x_t)} \right)$$



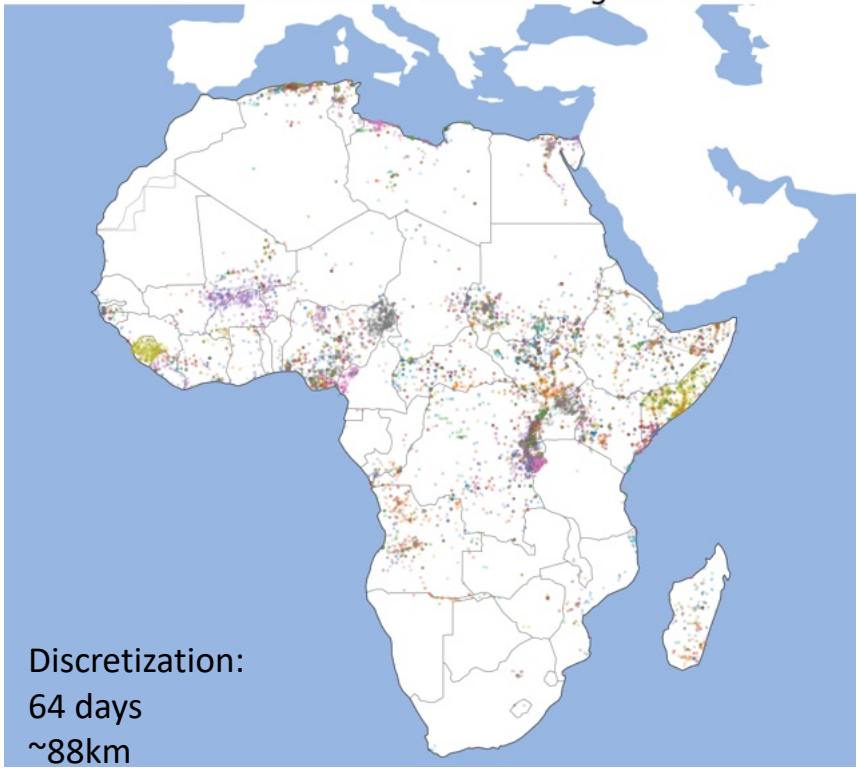
Long range dependence = Incrementing spatial scale

Causal graph constructed for 1-5 degrees of dependence



Discretization:
64 days
~88km

Avalanches from CG with degree=1



Discretization:
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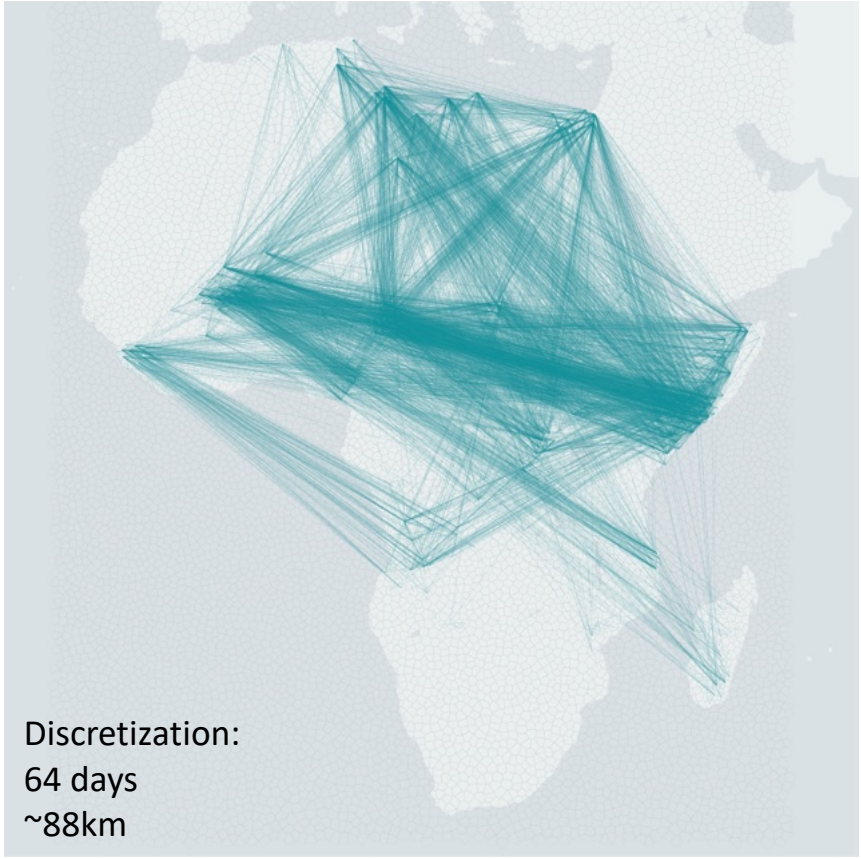
Super long-range dependence



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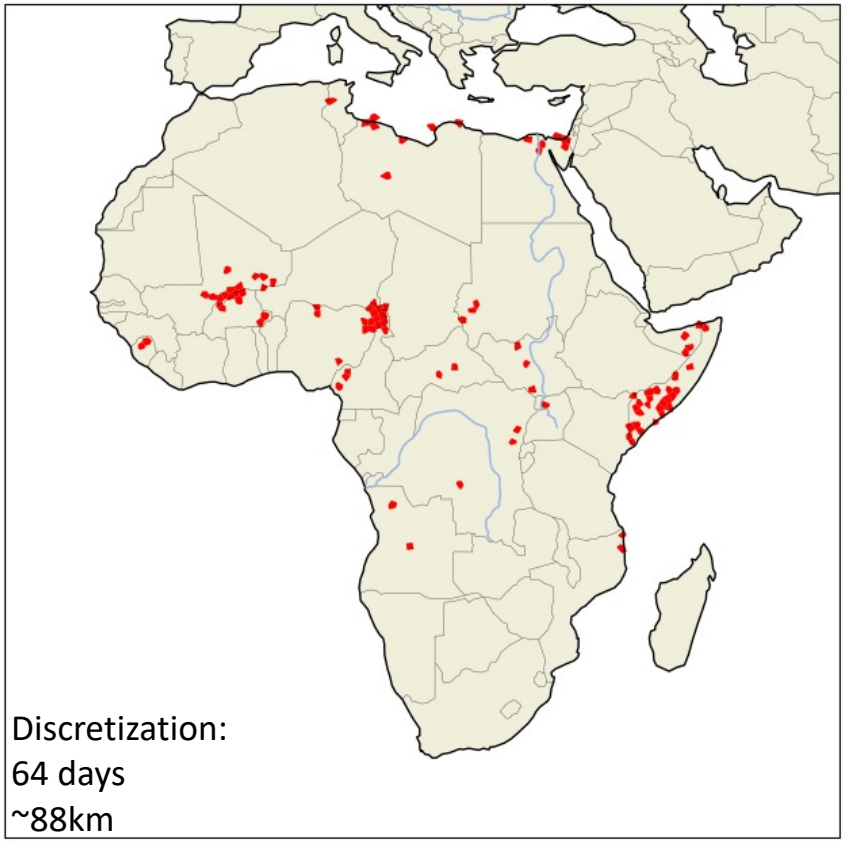
100 conflict sites with highest out-degree



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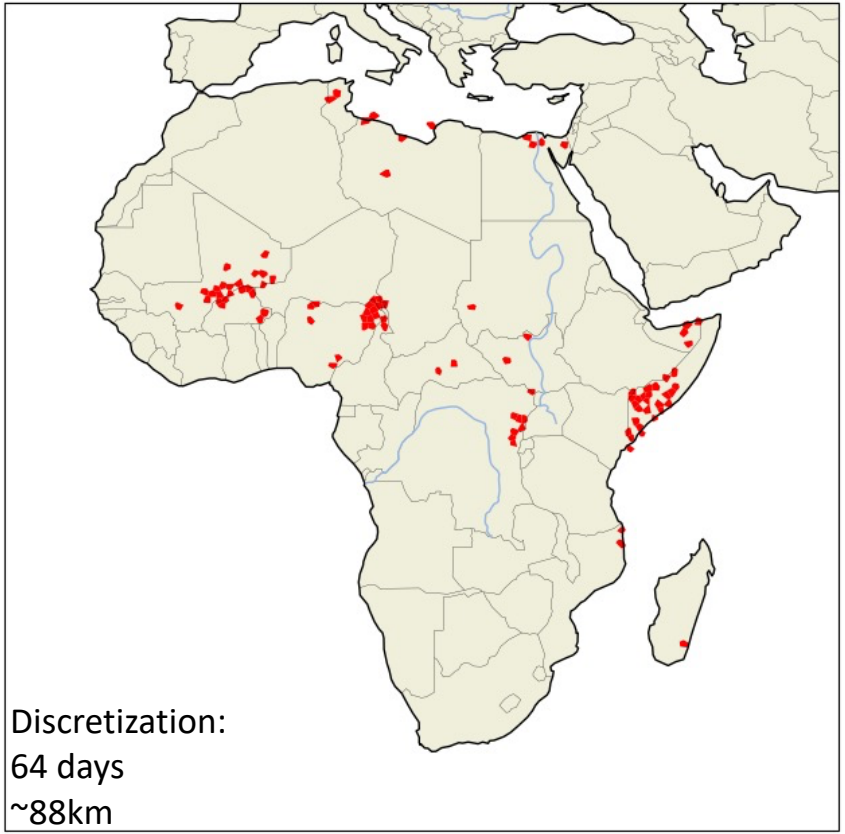

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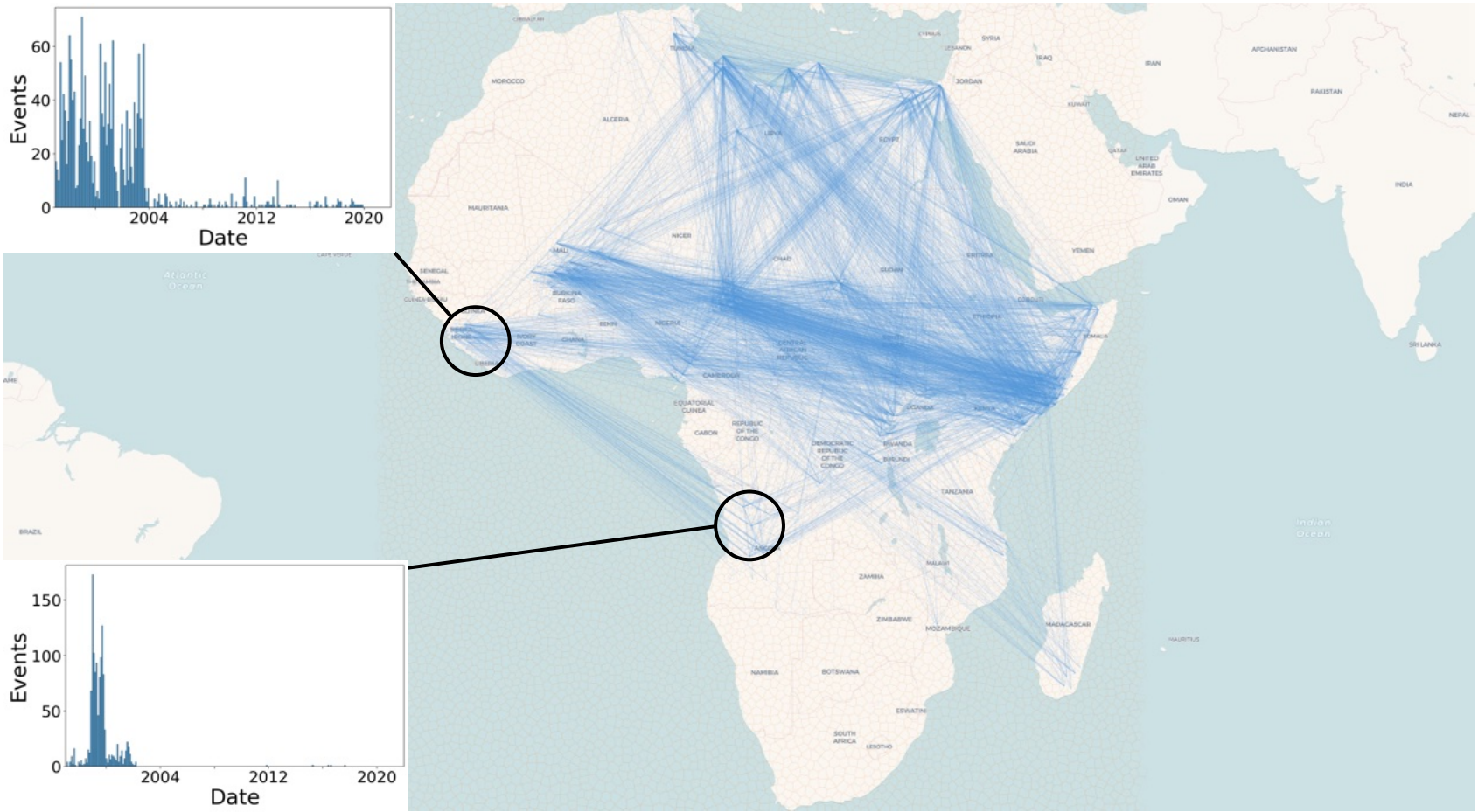

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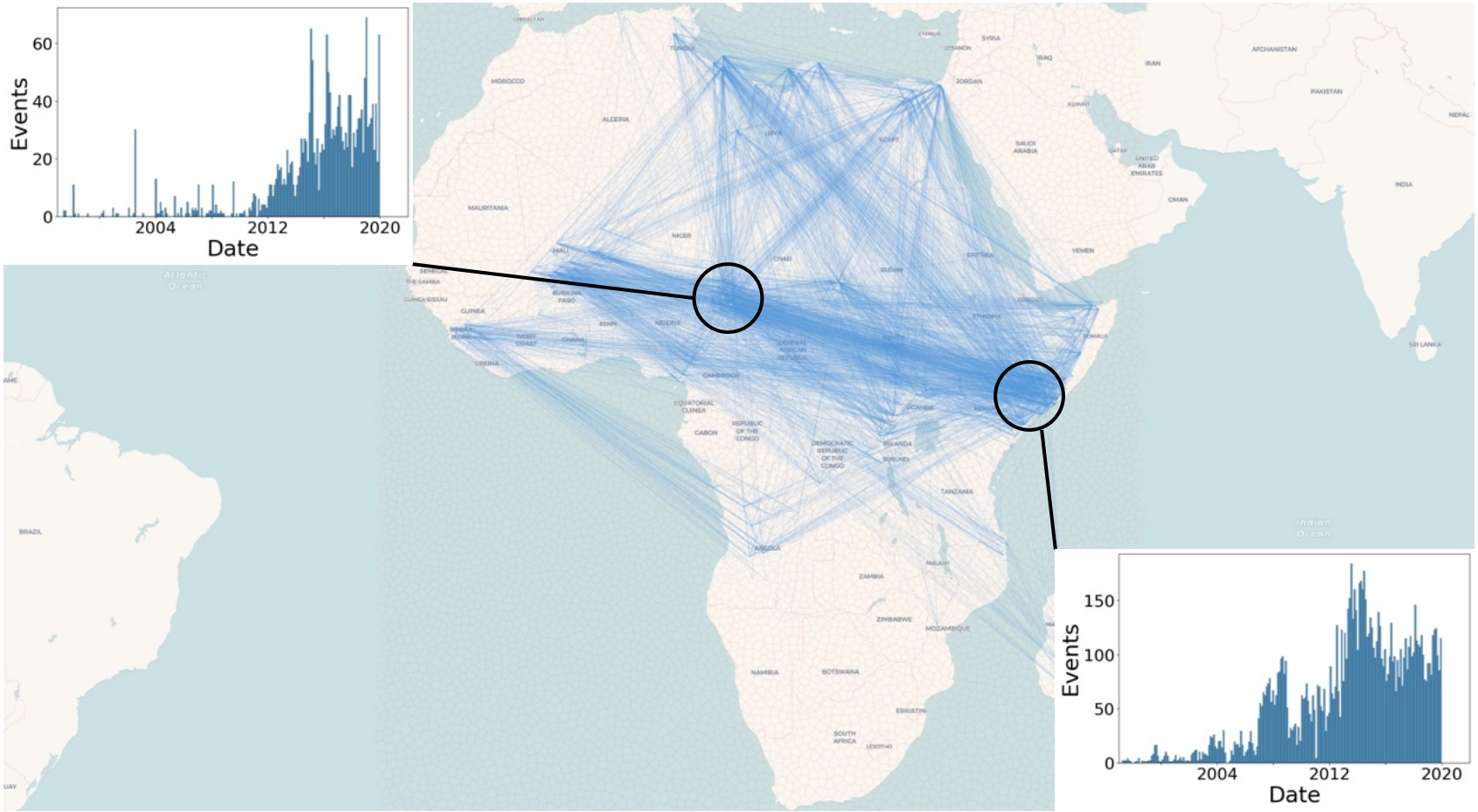

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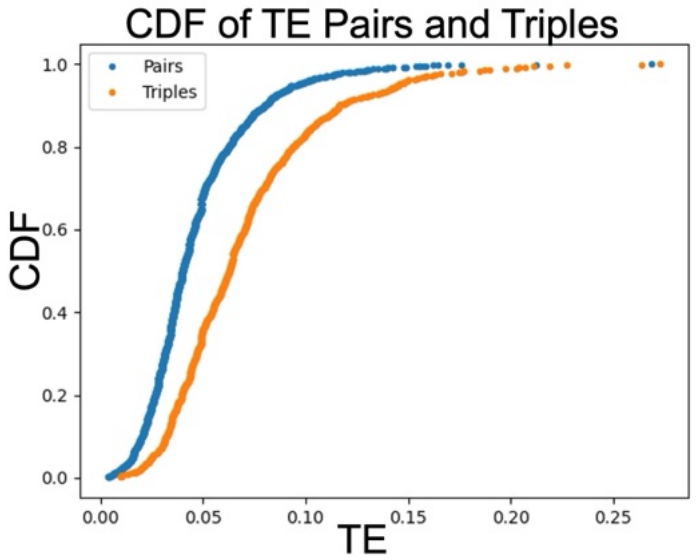
Neighborhood provides extra information



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Conclusion

- There exists strong regional spatial dependence between conflict sites
- Having more information about the neighborhood of conflict can benefit judgements about spatial dependence
- TE for establishing long-range connections might be too simplistic

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Acknowledgements

PoETs Lab:

Eddie Lee

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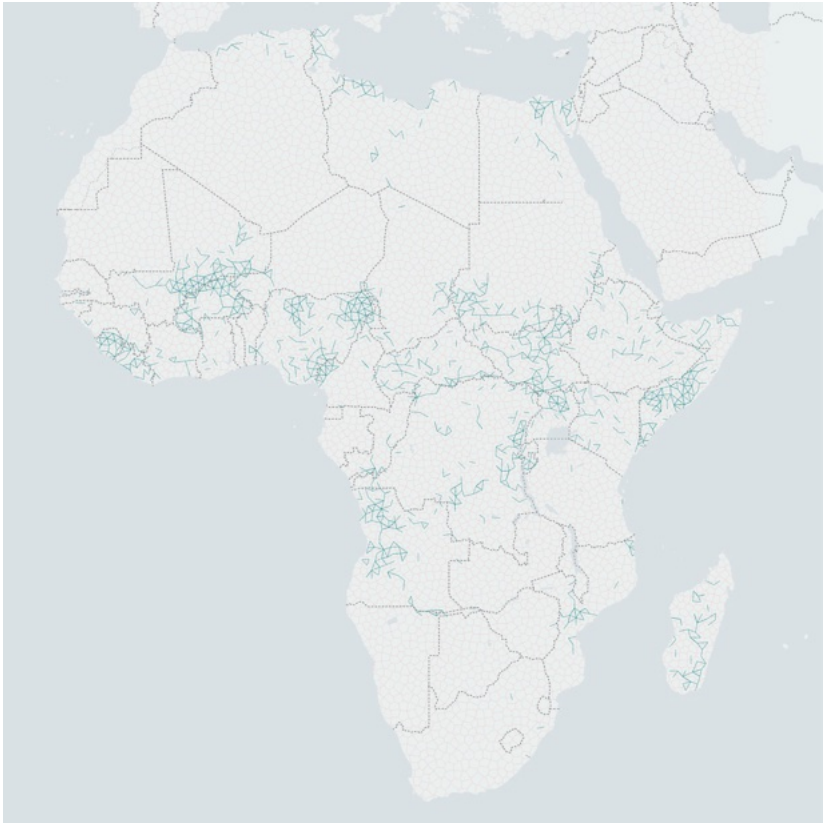
Ernesto Ortega

Gavin Rees

Causal graph up until 16th degree



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