

# A downward counter-factual climate risk analysis of the impact of tropical cyclones on the European Solidarity Fund

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# The RECEIPT Project

This work is part of the H2020 project [RECEIPT](#):  
**REmote Climate Effects and their Impact on European sustainability, Policy and Trade.**

RECEIPT aims at creating plausible **storylines** of Europe's vulnerability to remote climate risks by **connecting climate risks outside Europe with potential consequences for key European socio-economic sectors.**

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# Counterfactuals and Storylines

By **counterfactuals** we refer to events that *could have plausibly happened but did not*. Thus, looking retrospectively, past forecasted hazard events (e.g. tropical cyclones) do represent plausible alternatives to what happened.

As such, combinations of counterfactuals may represent what Shepherd et al. (2018) define as **storylines**: *a physically self-consistent unfolding of past events, or of plausible future events or pathways*.

Storylines:

- improve risk awareness by framing risk in an event-oriented rather than a probabilistic manner
- strengthen decision-making by allowing one to work backward from a particular vulnerability or decision point
- explore the boundaries of plausibility

## Aim of the Study

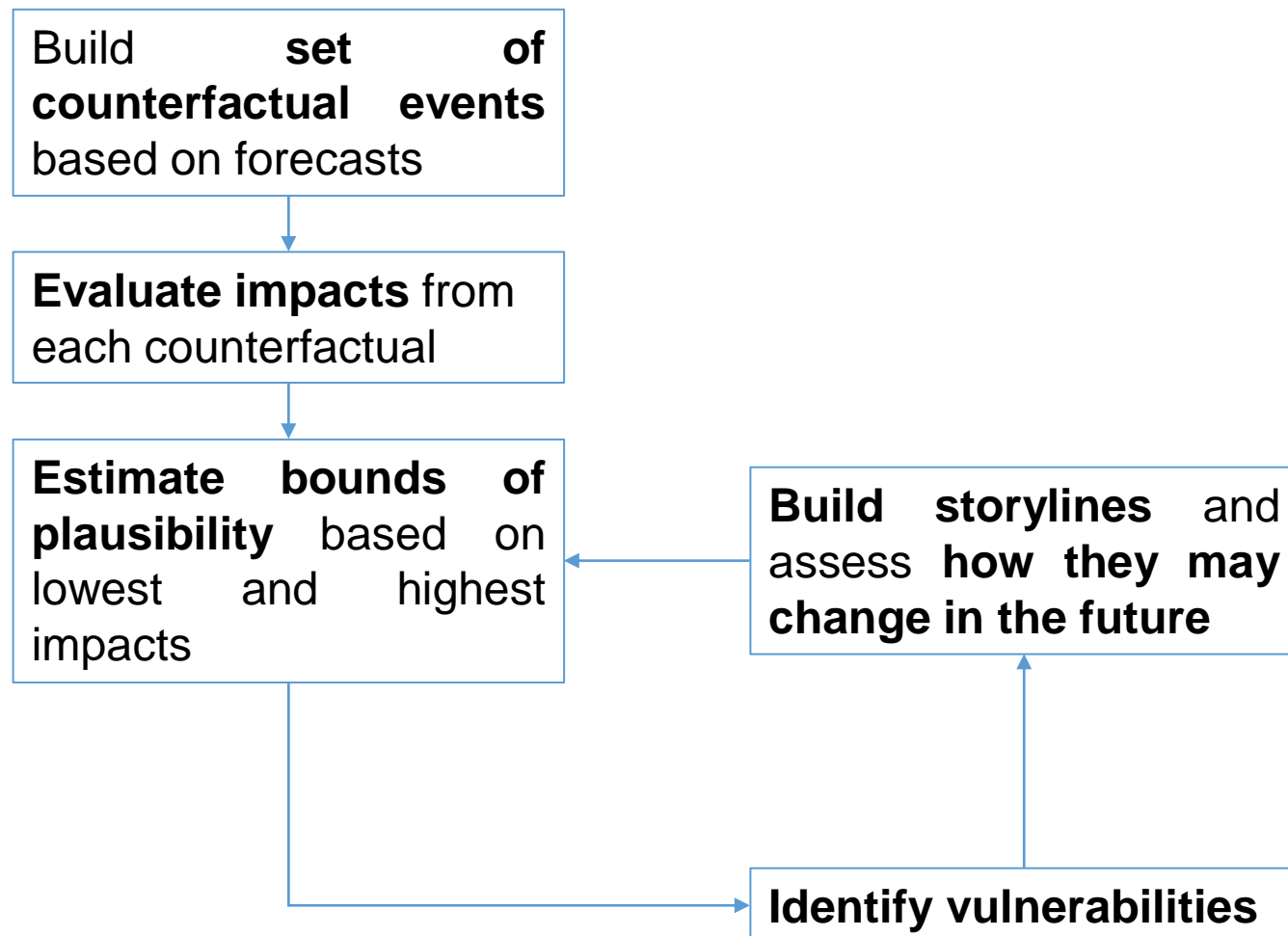
**Estimate** the impact of counterfactual tropical cyclones affecting Europe's outermost regions on the European Solidarity Fund and **identify** storylines which may be critical for the current and future coping capacity of the fund.

## The European Solidarity Fund

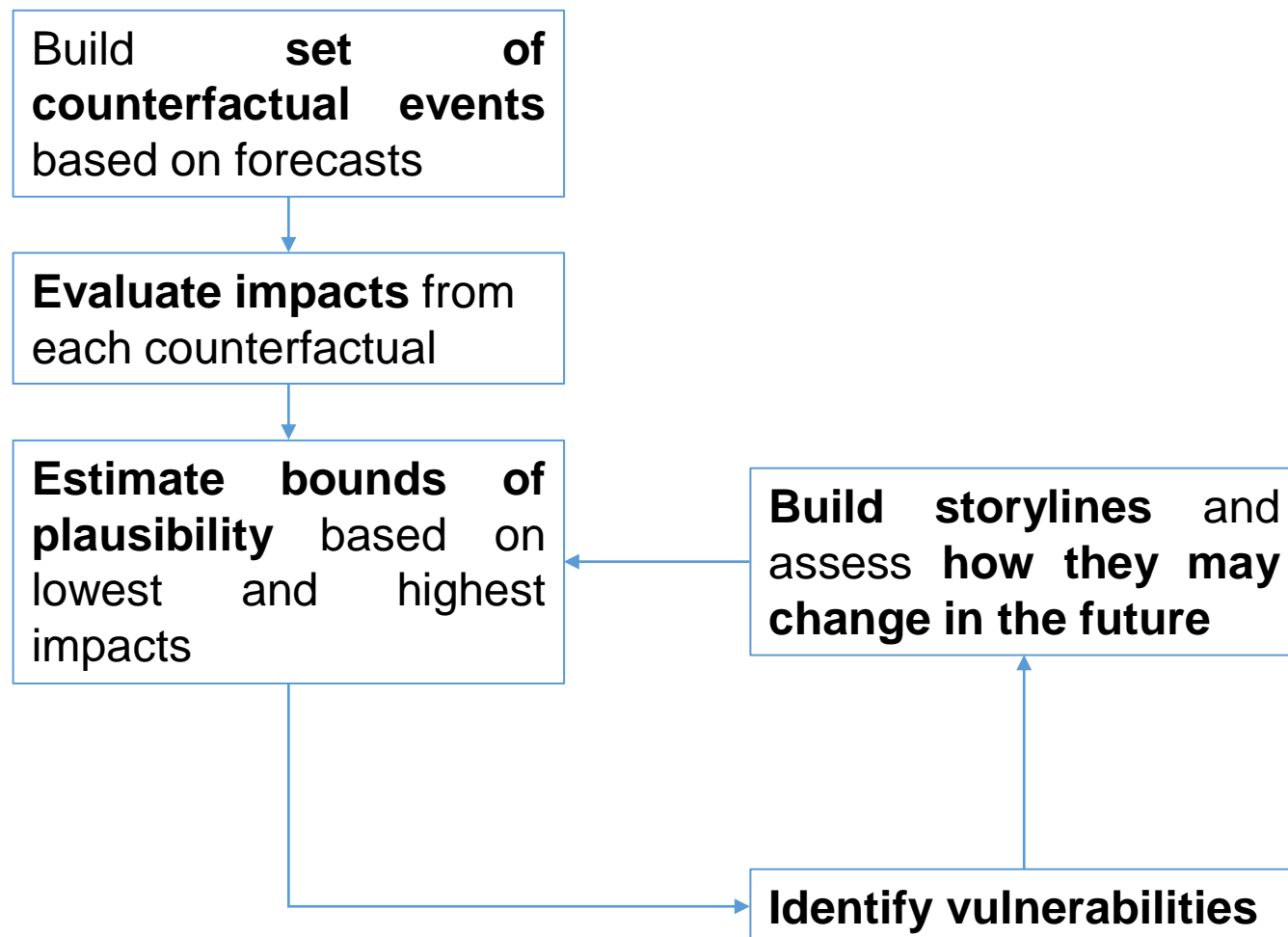
The [European Union Solidarity Fund \(EUSF\)](#) was set up to respond to major natural disasters and express European solidarity to disaster-stricken regions within Europe, including Europe's outermost territories:

Canary Islands, Madeira, Azores, Réunion, Mayotte, French Guiana, Saint Martin, Guadalupe, Martinique

# Storyline Approach - General



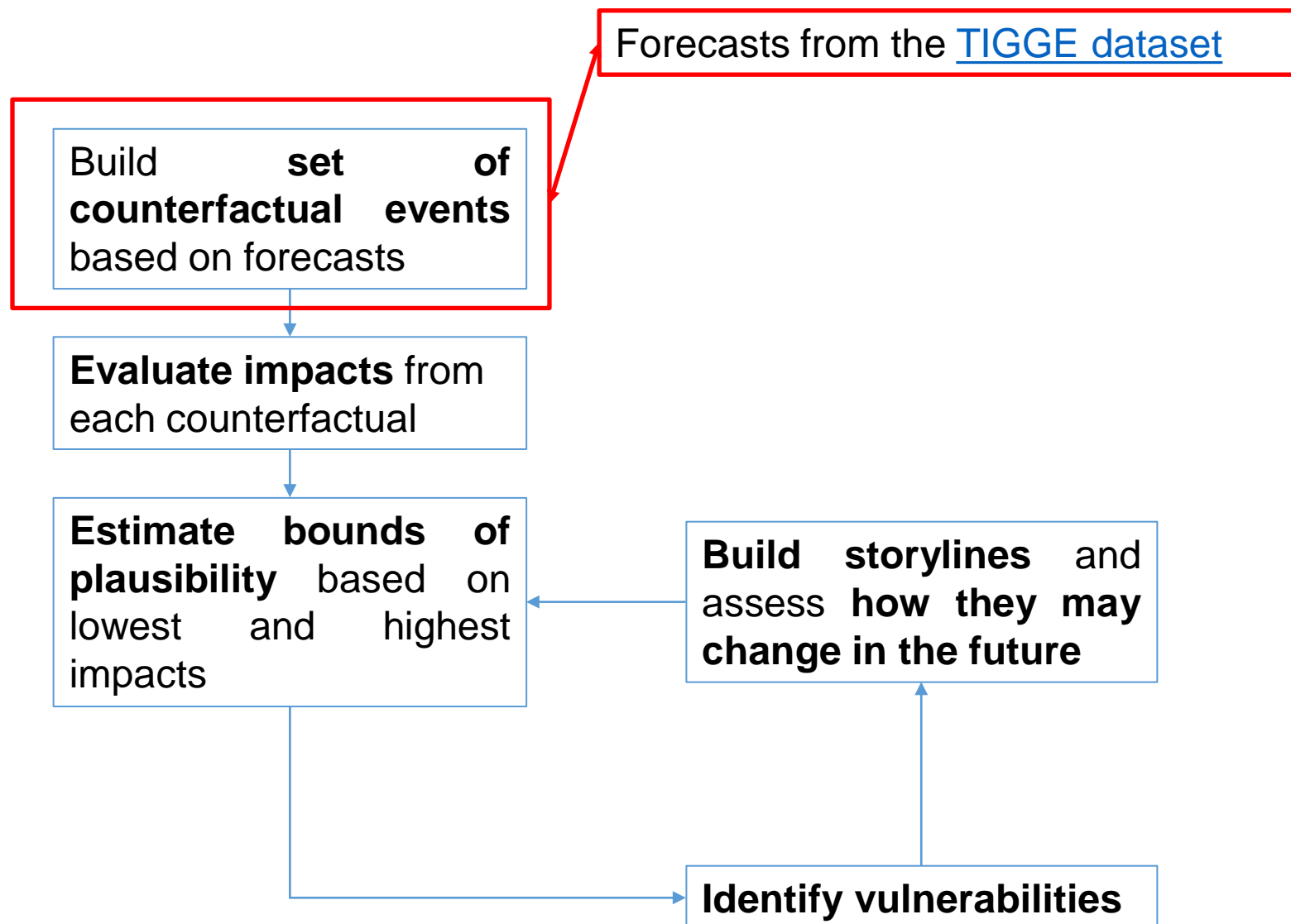
# Storyline Approach - General



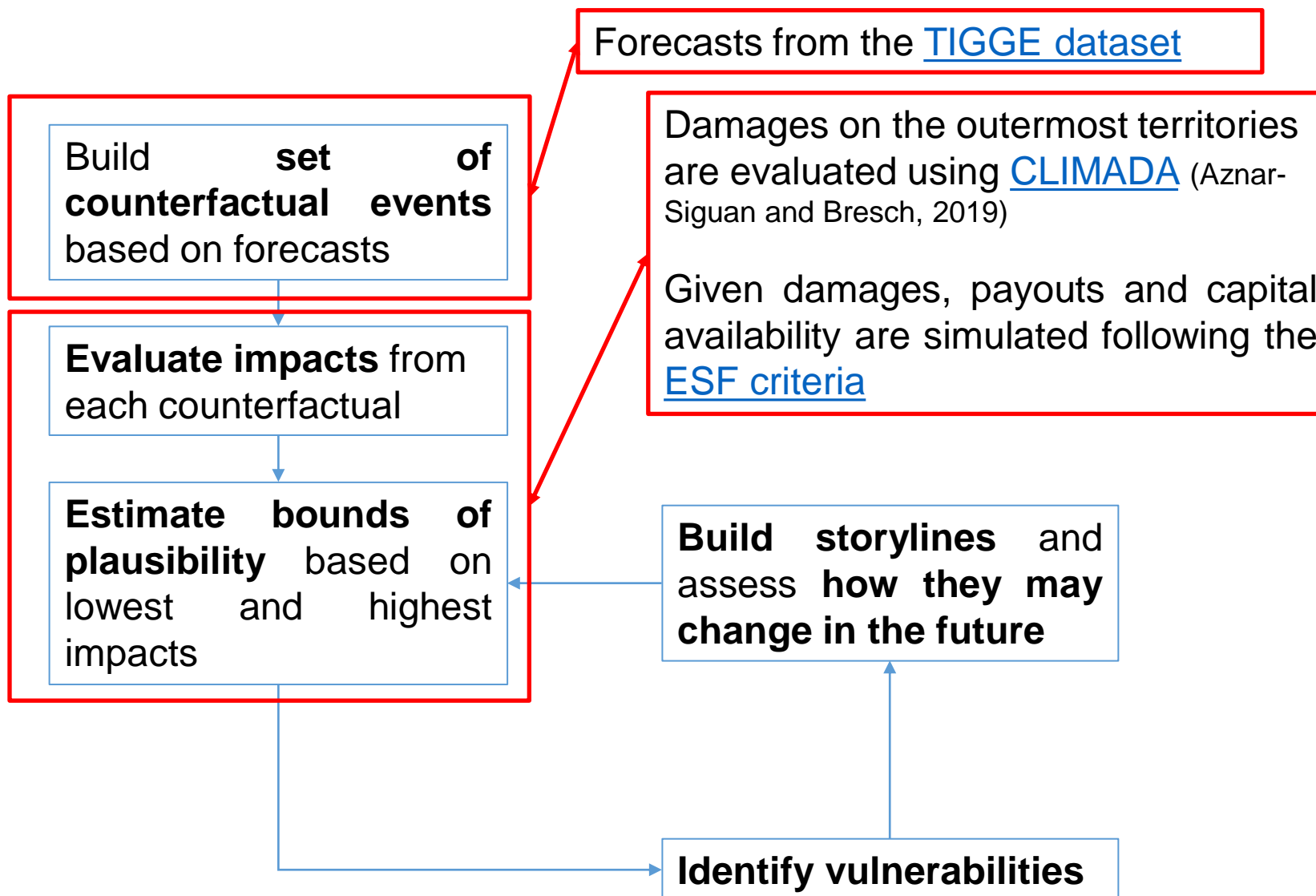
## Key points:

- Iterative: it fosters participation and engagement
- It focuses on impacts and plausibility. If required, only after one evaluates the likelihood of the identified storylines

# Storyline Approach - Application

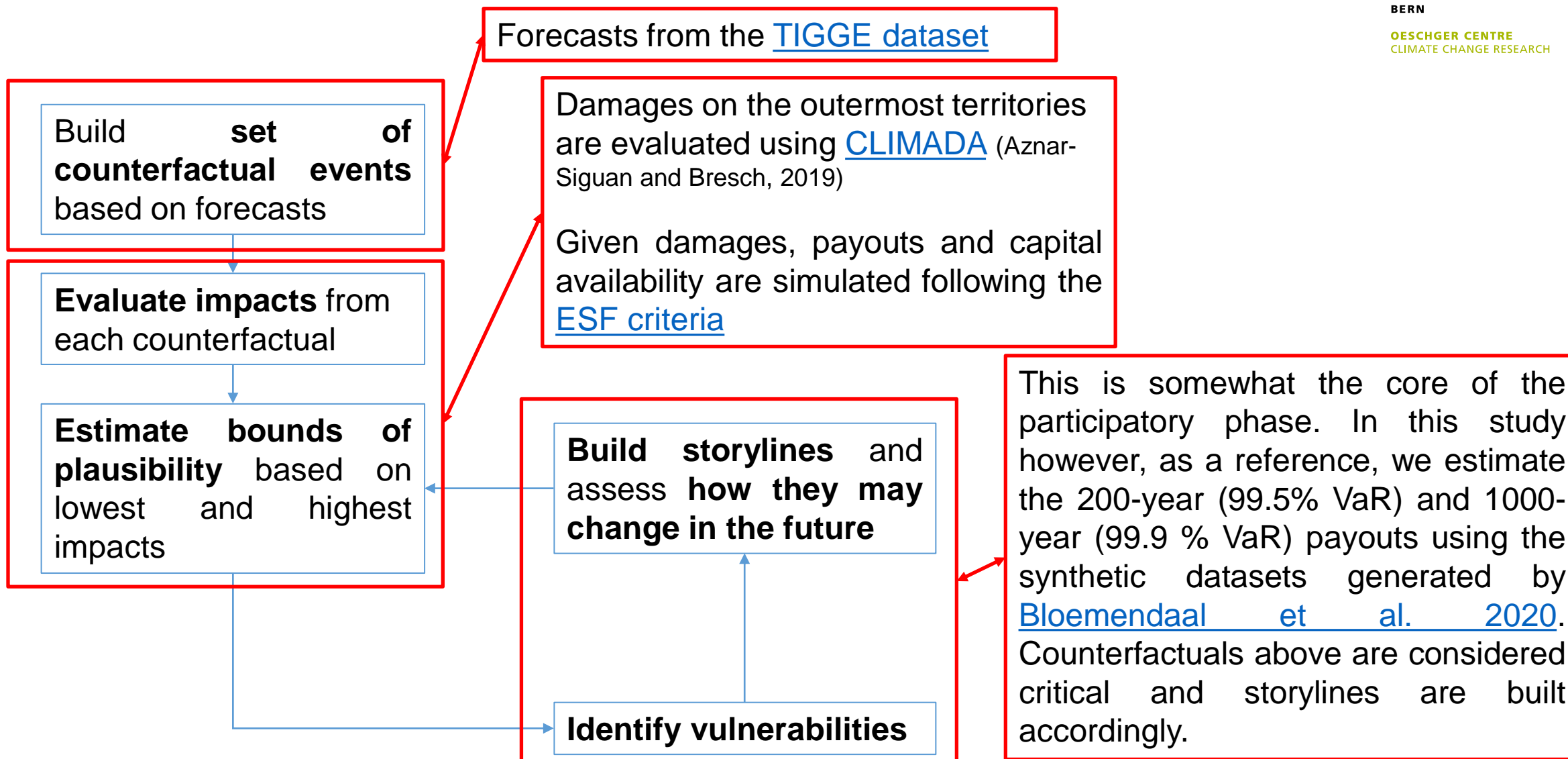


# Storyline Approach - Application



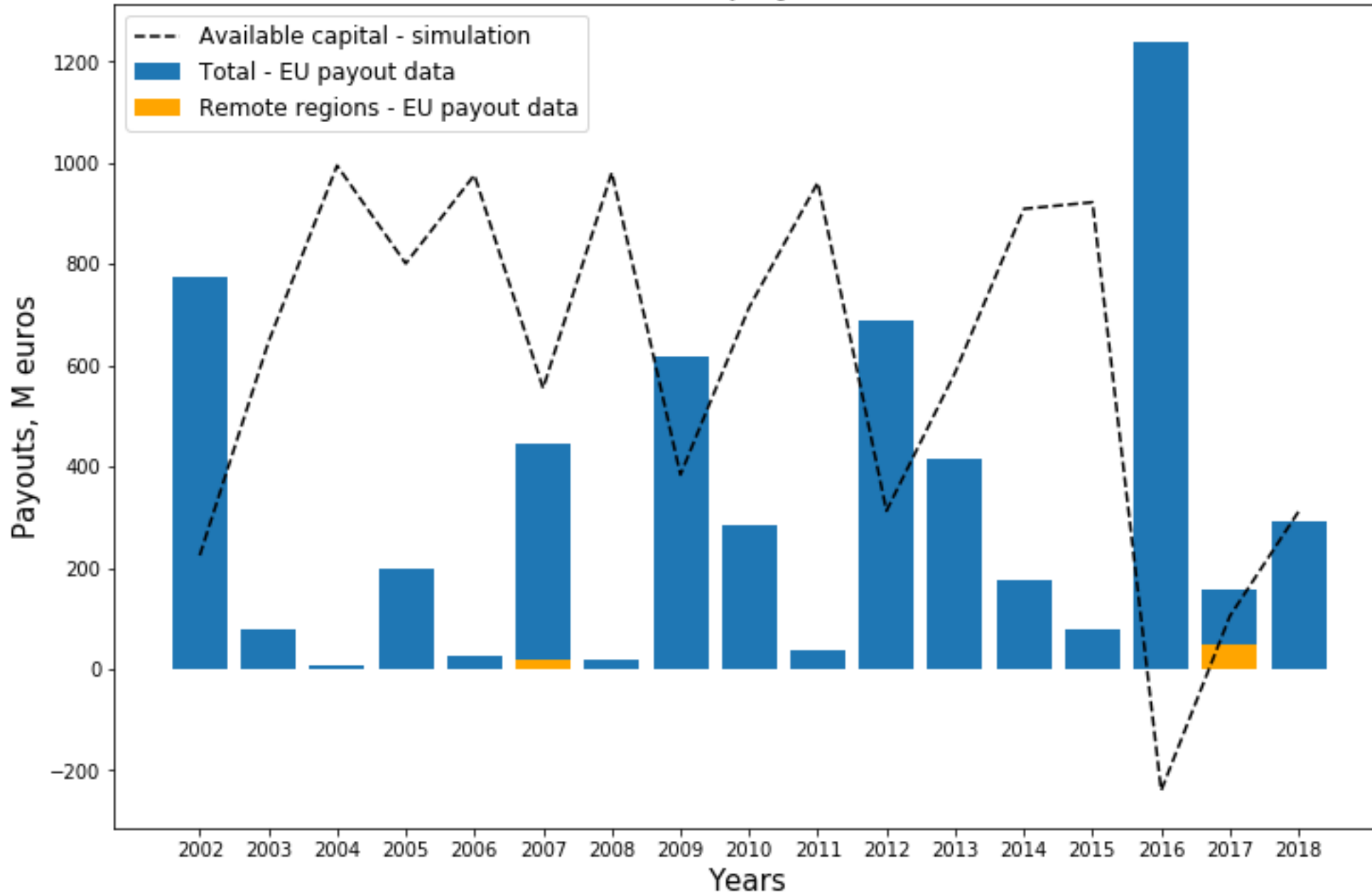


# Storyline Approach - Application



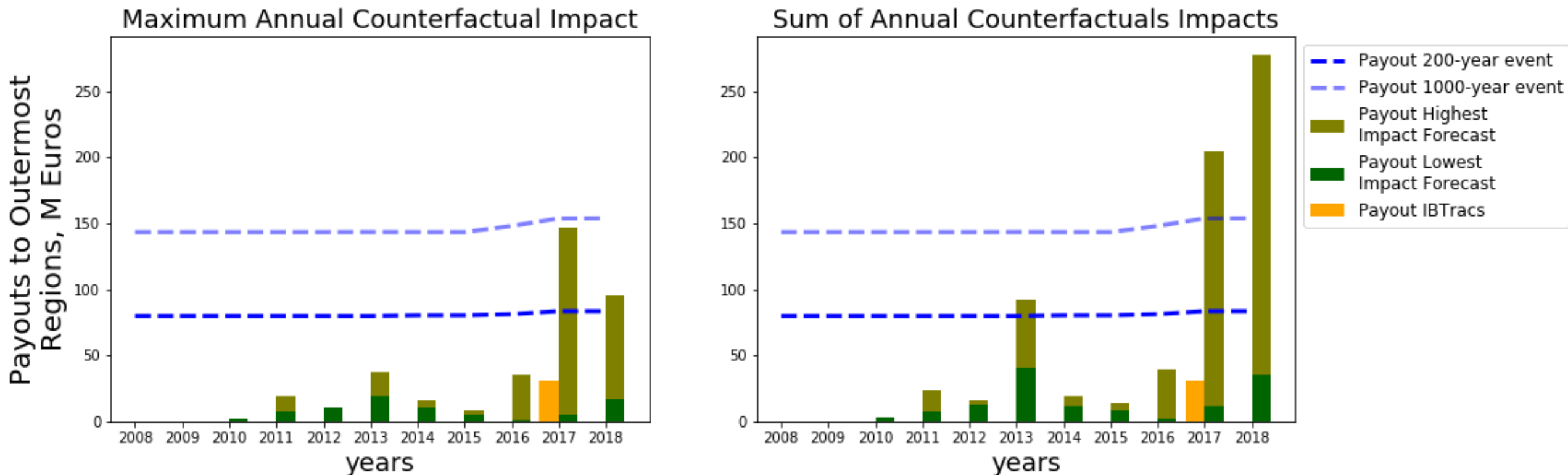
# The ESF: Data

## Total payouts



- Contribution from the outermost regions seems **negligible**. Payouts are few and low in magnitude when compared to losses in mainland Europe
- 2016 critical: Earthquake in Italy

# Payouts Plausibility Range



- History is shown by the orange bar as estimated payouts from IBTracs.
- Each event, e.g. Maria, has many counterfactuals (i.e. forecasts). From each event, one can thus identify the highest and lowest impact counterfactual. The left panel shows the annual maximum of the highest (maximax) and lowest (maximin) counterfactuals across events. The 200-year payout could have been exceeded two years in a row. The right panel shows the annual sum of all highest and lowest counterfactuals. The 200-year payout could have been exceeded three times in five years and the 1000-year payout two years in a row.

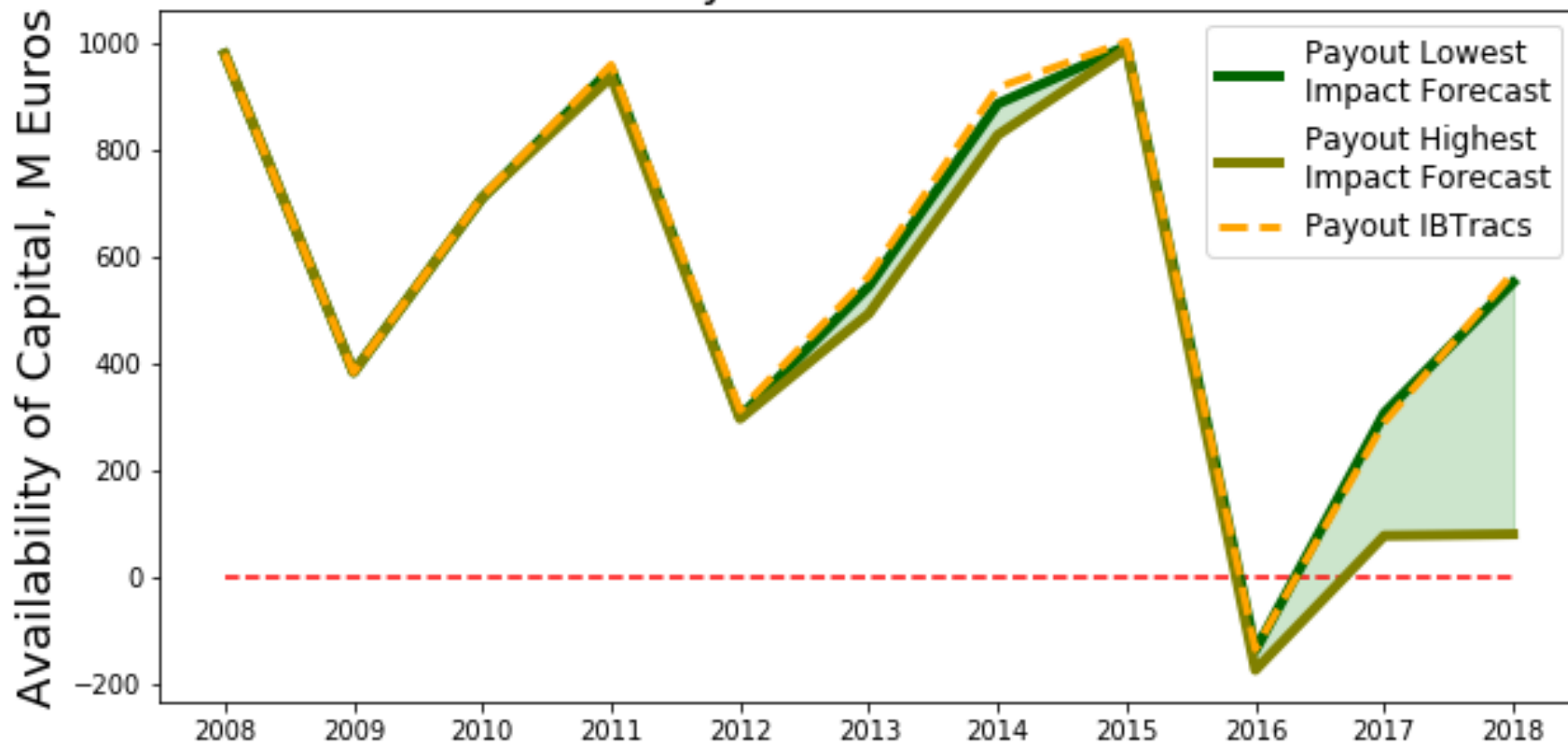
# Simulation of Available Capital

## History vs Counterfactuals

*u<sup>b</sup>*

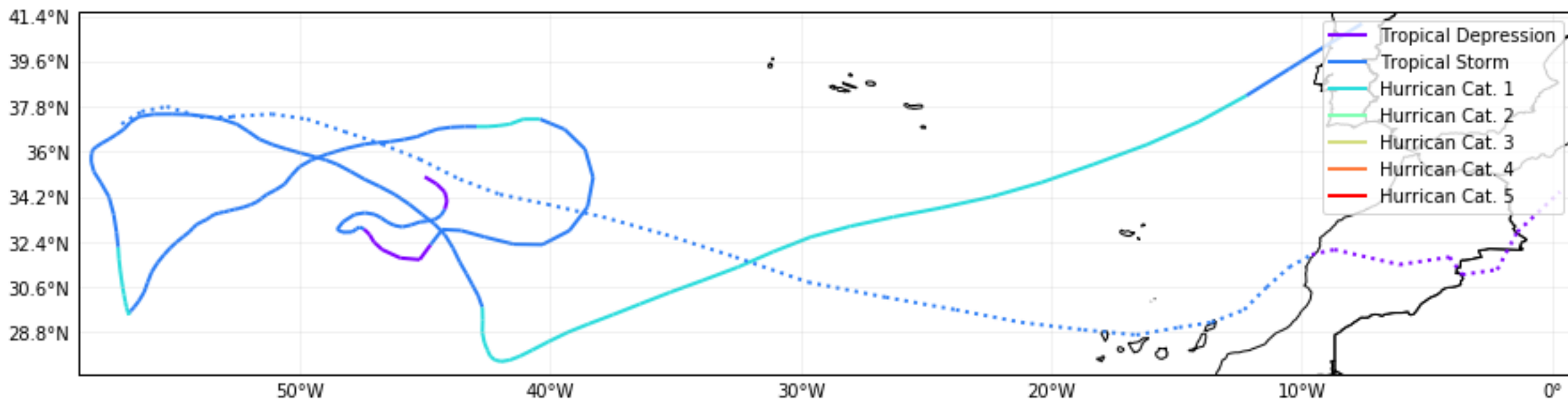
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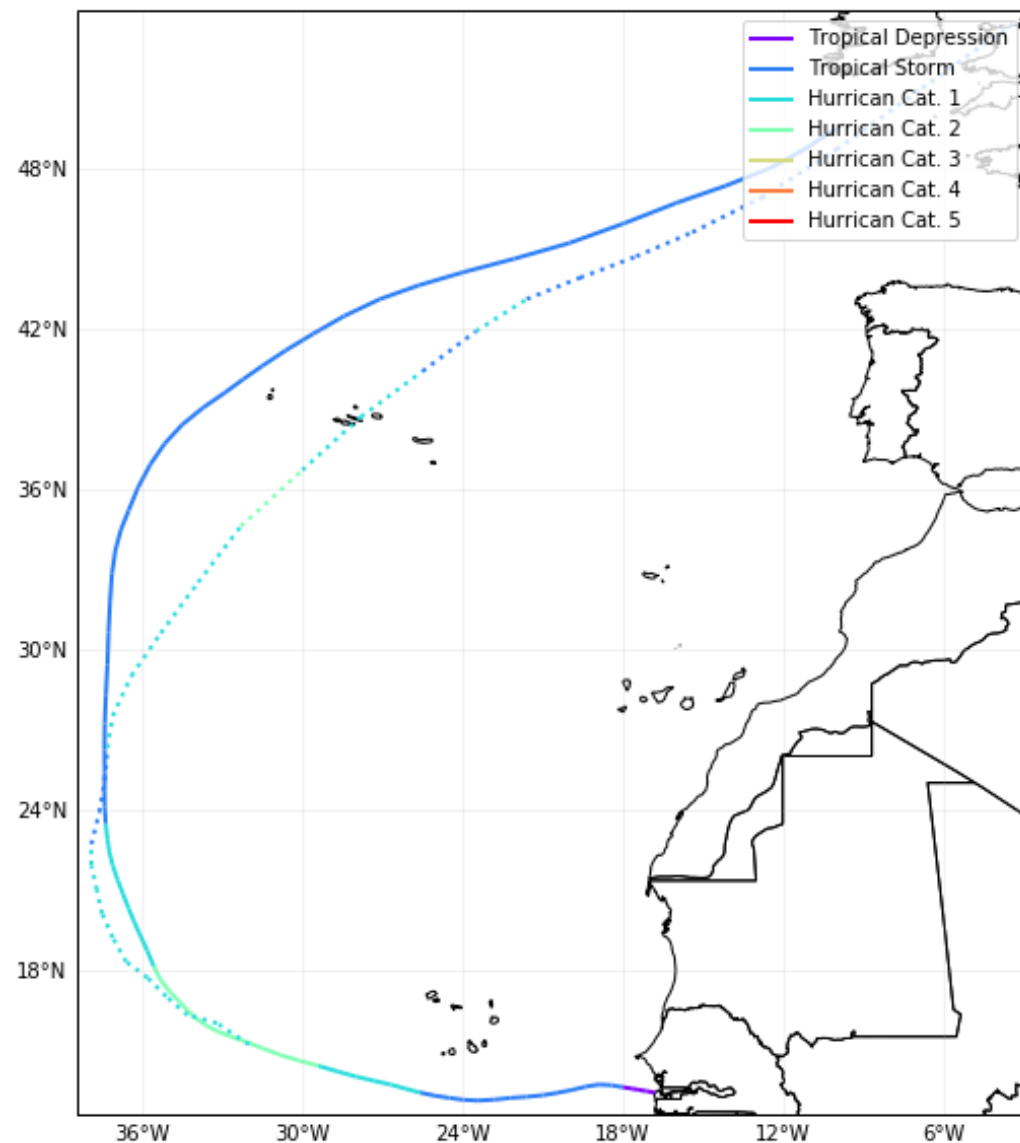
- Simulation of capital by keeping history in mainland Europe as ‘fixed’.
- The outermost regions alone cannot compromise the availability of the fund.
- Should major events in mainland Europe happen, however, e.g. the 2016 Earthquake in Italy, high impact counterfactuals could have hampered a full recovery. This cannot be seen from historic data and it would be deemed very (very) unlikely based on probabilistic estimates (200 and 1000-years payouts).
- Over 3452 and 360 combinations of counterfactuals of each event would have led to levels of capital lower than what estimated by the 200 and 1000-years payouts.

# Few Examples of Critical Counterfactuals: Leslie 2018



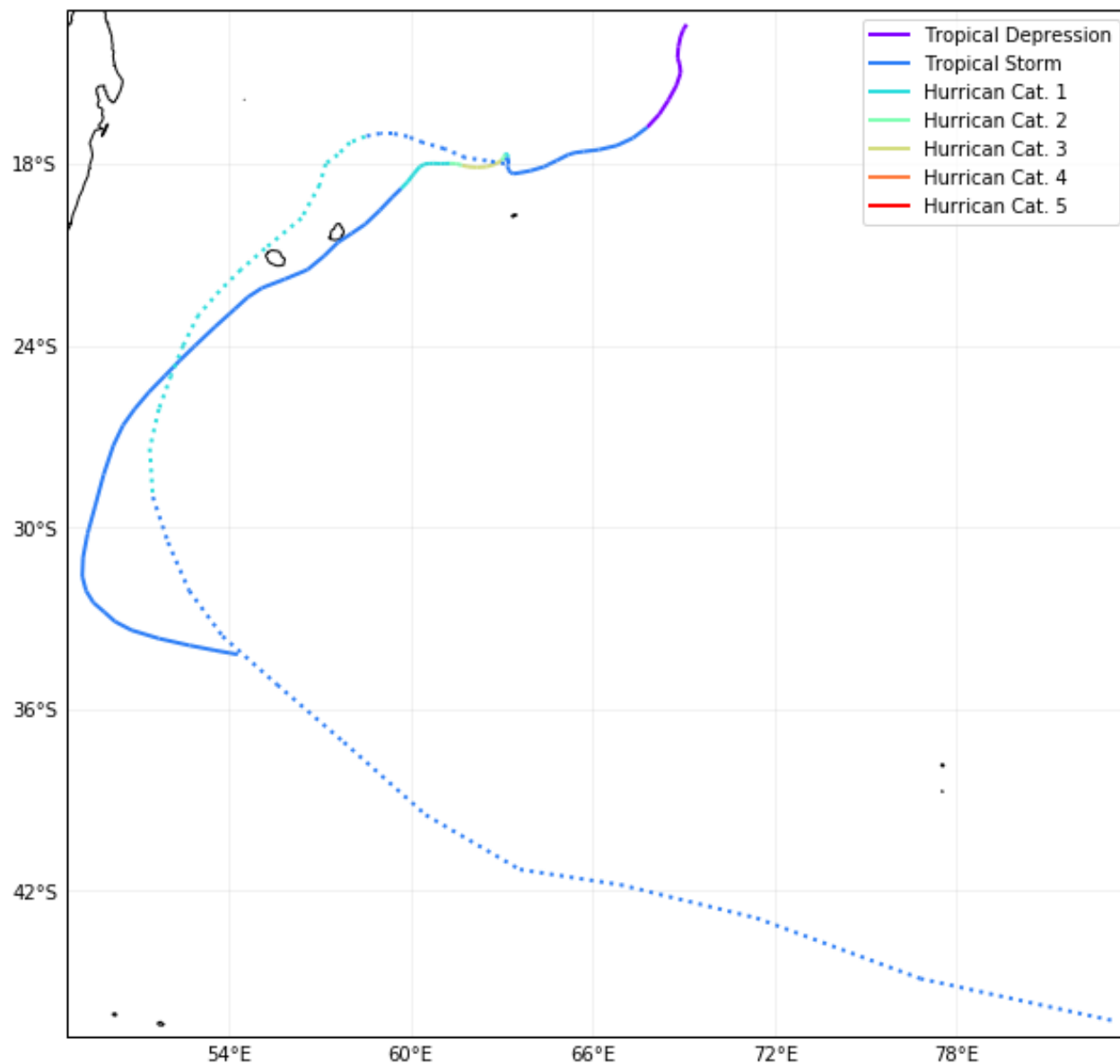
- Continues line is actual track, dotted line is critical counterfactual
- Leslie hits Canary Islands instead of moving north

# Few Examples of Critical Counterfactuals: Helene 2018



- Continues line is actual track, dotted line is critical counterfactual
- Helene hits the Azores and has higher magnitude

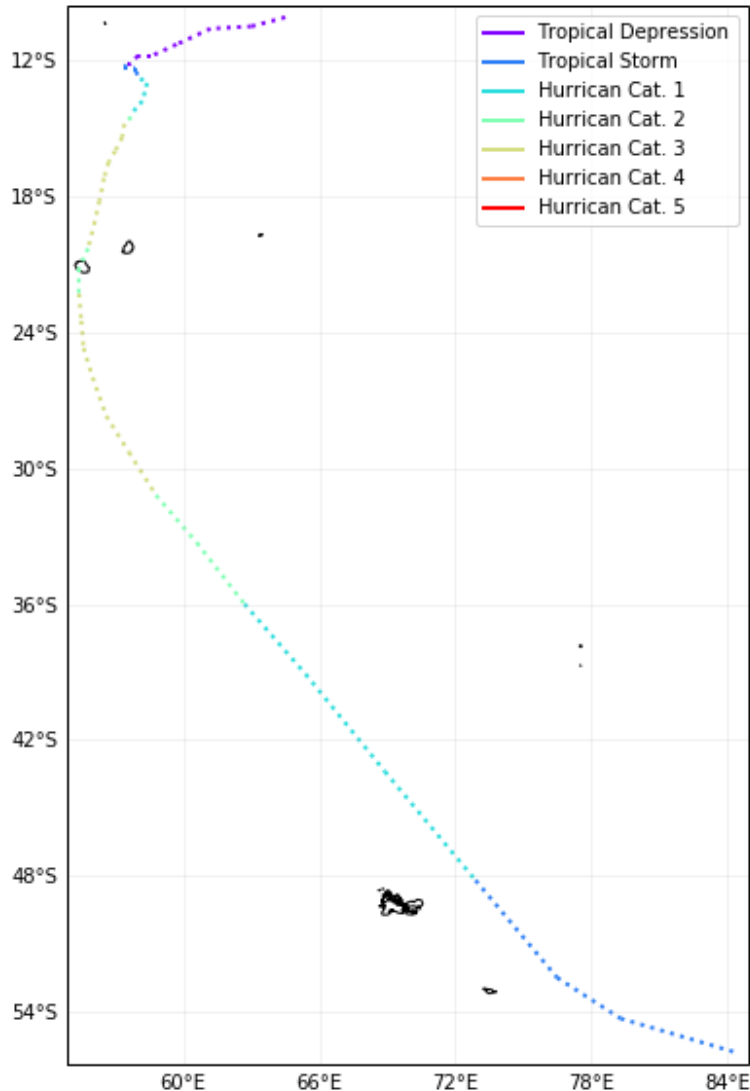
# Few Examples of Critical Counterfactuals: Berguitta 2018



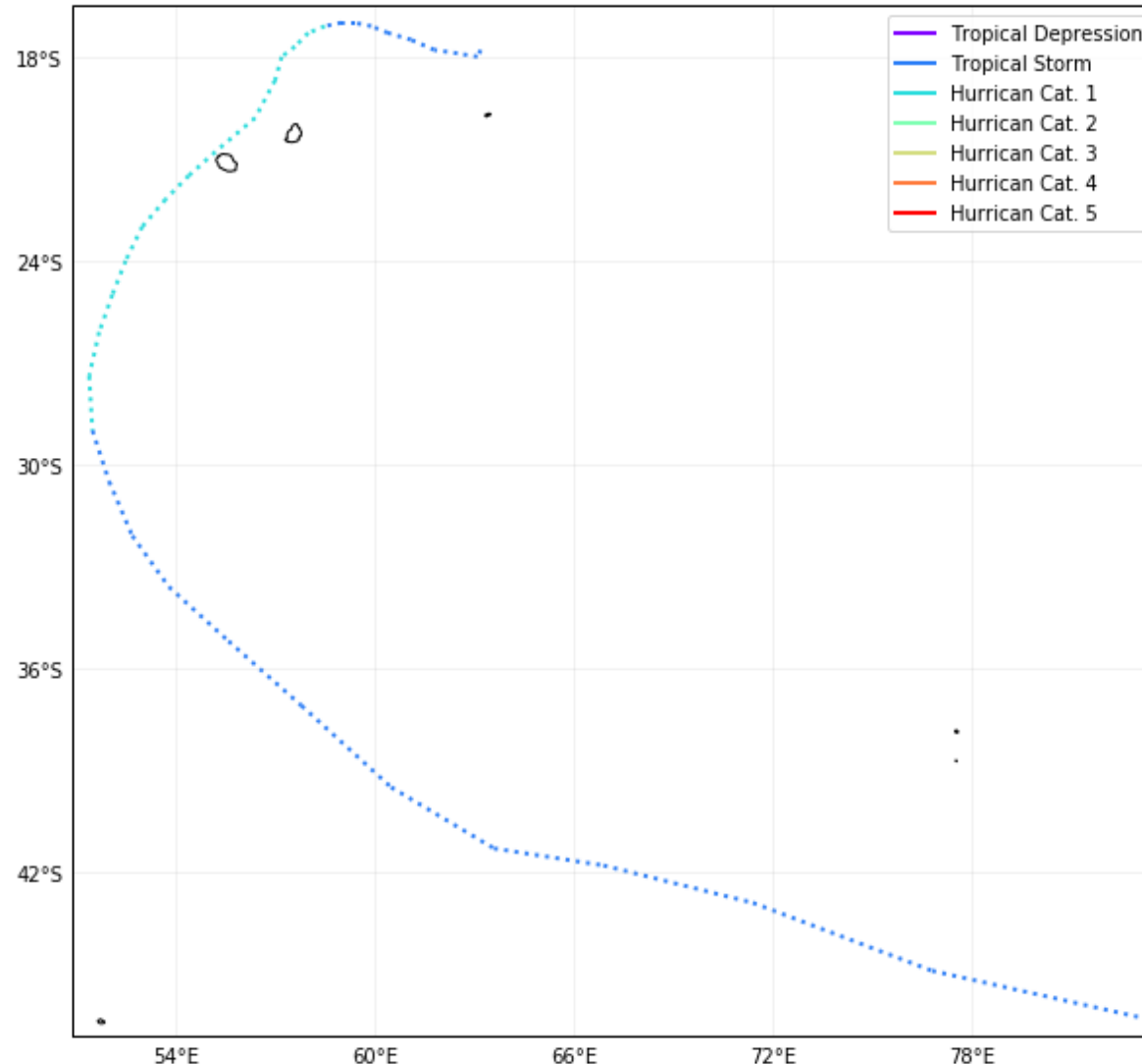
- Continues line is actual track, dotted line is critical counterfactual
- Berguitta has higher magnitude when close to Reunion

# From Counterfactuals to Storylines: Exceeding the 200-year payout

2017



2018



**Two major events affecting Reunion in 2017 and 2018.**

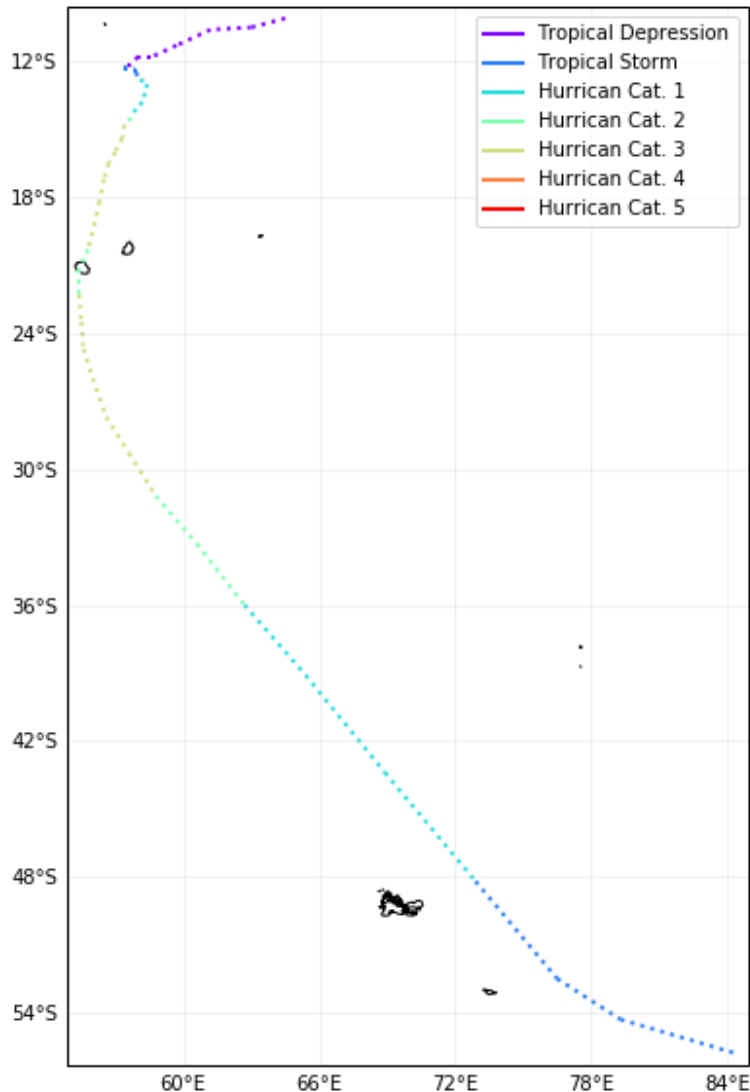
The 2017 is the counterfactual of an event which was in fact of no relevance.

The 2018 event is counterfactual Berguitta.

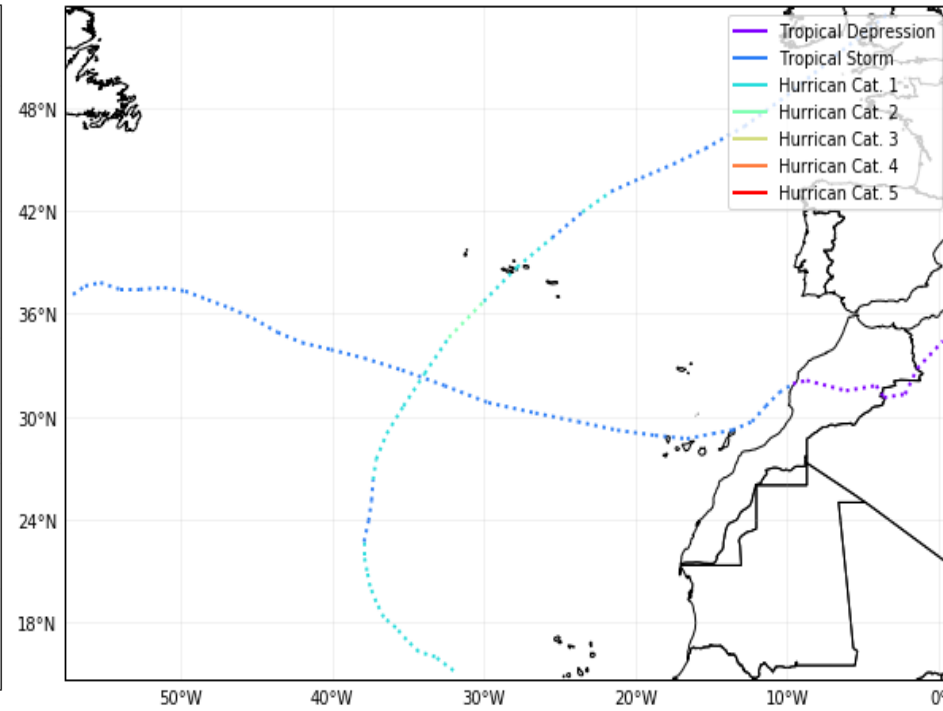
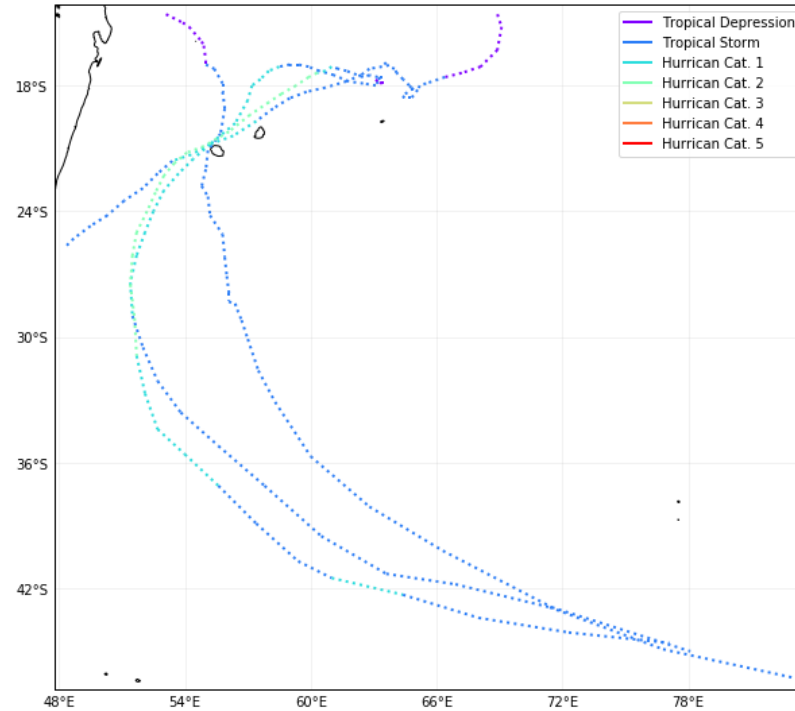


# From Counterfactuals to Storylines: Exceeding the 1000-year payout

2017



2018



**One major event affecting Reunion in 2017 and a series of events affecting Reunion as well as the Azores and Canary Islands in 2018.**

The 2017 event is the same as in previous storyline. The series of 2018 events in the Azores and Canary Islands include counterfactual Leslie and Helene.

The 2018 series of events in Reunion include counterfactual Berguitta and counterfactuals of others which were in fact of no relevance.

## Future Steps and Final Remarks

- Are these counterfactuals likely to exacerbate under climate change?
- What about storylines of future socio-economic conditions?
- Can the two above lead to a point where current regulation of the ESF does no longer suffice?

The goal is to work on the methodology and apply it to address different policy problems. The work is ongoing and started recently.

Suggestions, feedbacks, criticisms are all welcome.

Thank you.

# References

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