Quantifying the Impact of Natural Disasters

The case of Typhoon Damrey 2005 in Vietnam

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Background

- Natural disasters hit with increasing frequency, especially in costal areas

- We wish to calculate the costs of the disasters…
  - For insurance schemes and policies
  - For cost-benefit analyses and socio-economic planning
  - To learn more about the welfare implications of climate change

Two simple measurements of disaster costs

- We mainly obtain cost figures by asking people in surveys
  - Either just after an event has occurred
  - Or as part of regular household surveys

- Both types of information have potential problems:
  - Who is asking just after the event?
    An aid-worker, a government official, a researcher…
    The answer may well depend on the enumerator

  - What influences a recall survey answer:
    - Ex ante perceptions and preparations
    - Ex post disaster responses
      (which are functions of ex ante perceptions and preparations)

Requirements for "objective" cost calculations

To calculate costs of a disaster we need:

1. A precise mapping of the disaster area
2. A measure of welfare indicators in the disaster area after the disaster
3. A measure of welfare indicators in the disaster area after the disaster – but without the disaster!

This is a typical evaluation problem in the social sciences

The Impact evaluation

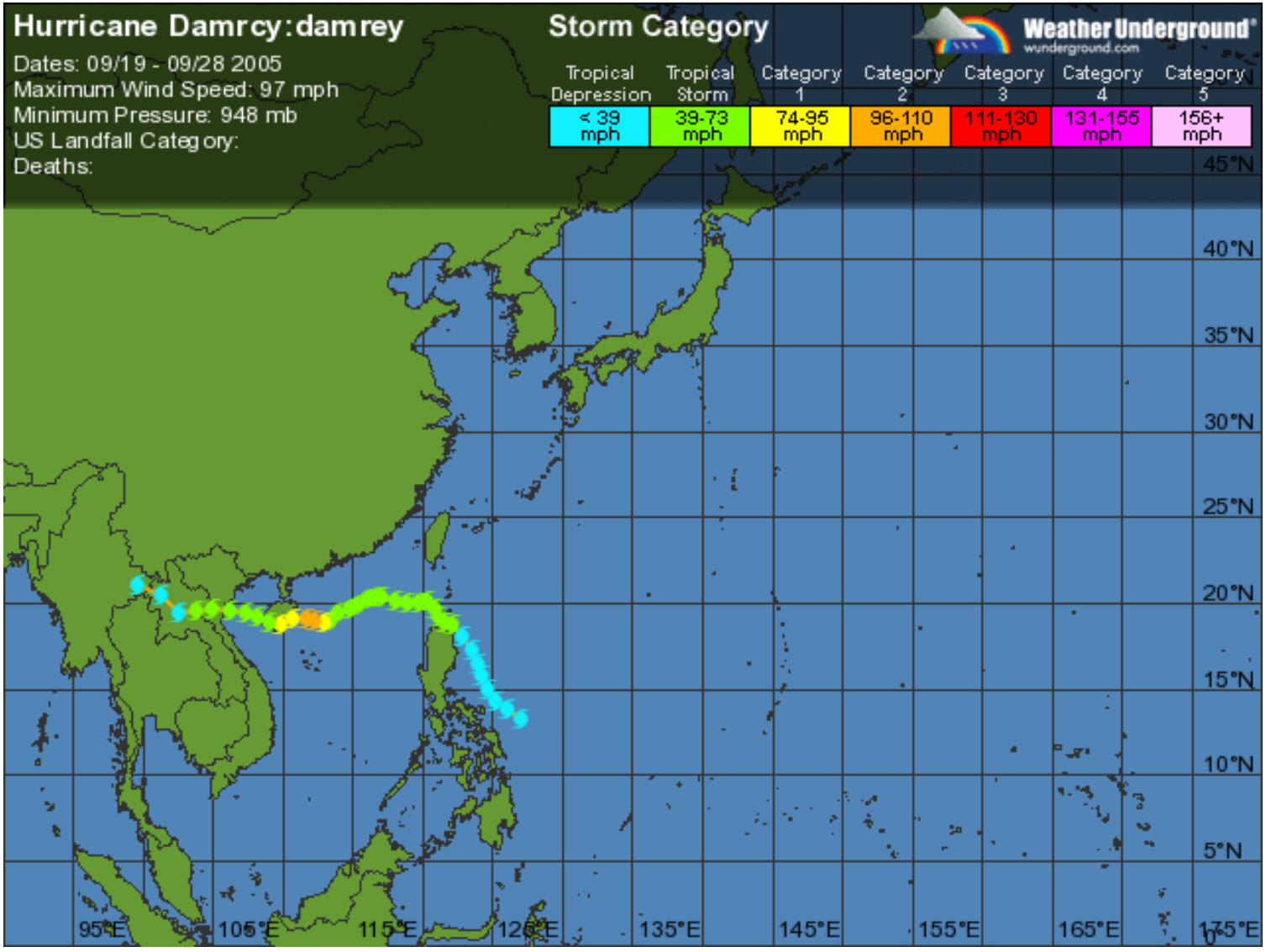
This talk shows a feasible way of computing objective costs using:

1. Detailed storm data,
2. A wind speed model,
3. Household survey data, and
4. Statistical analysis

We try to answer the questions:

1. Who are affected by Typhoon Damrey?
2. What are short-term impacts?
3. Are the impacts persistent?
4. What are the coping strategies, households rely on?

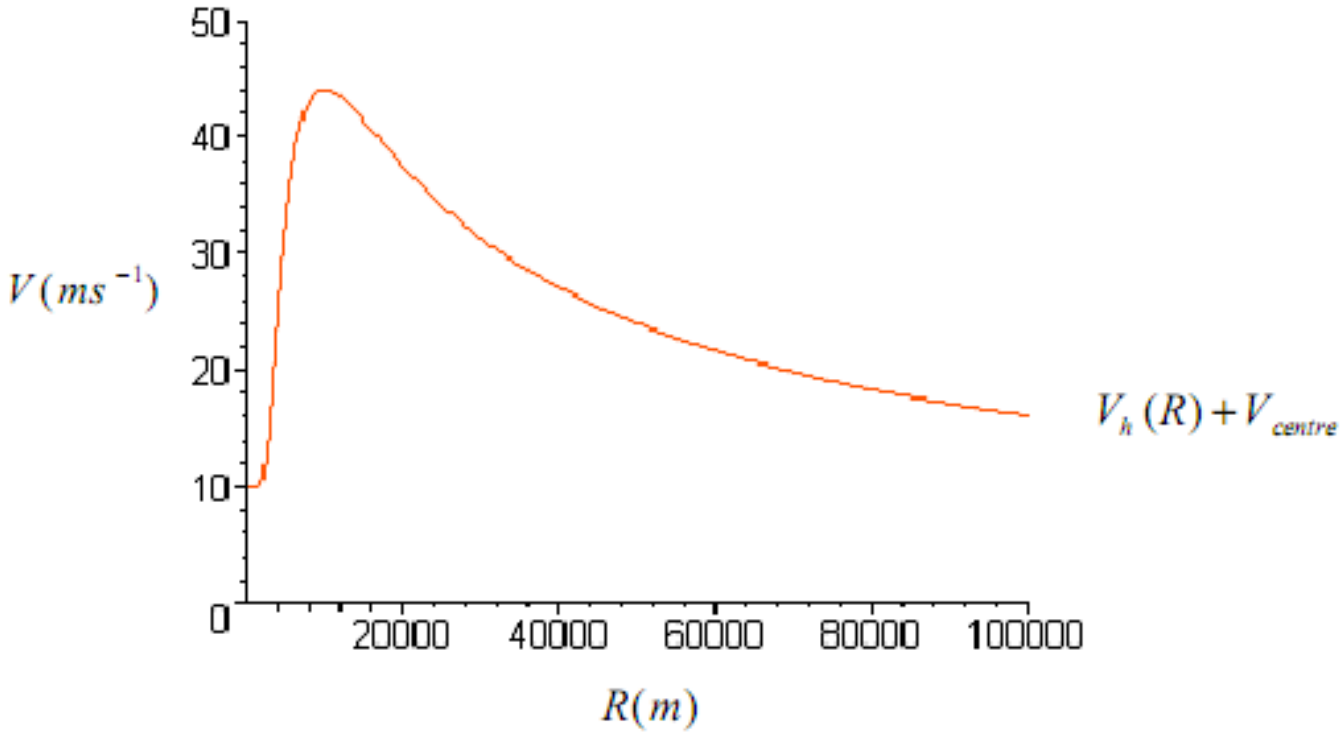
We look at a specific event: Hurricane Damrey



Some visible impacts of Damrey

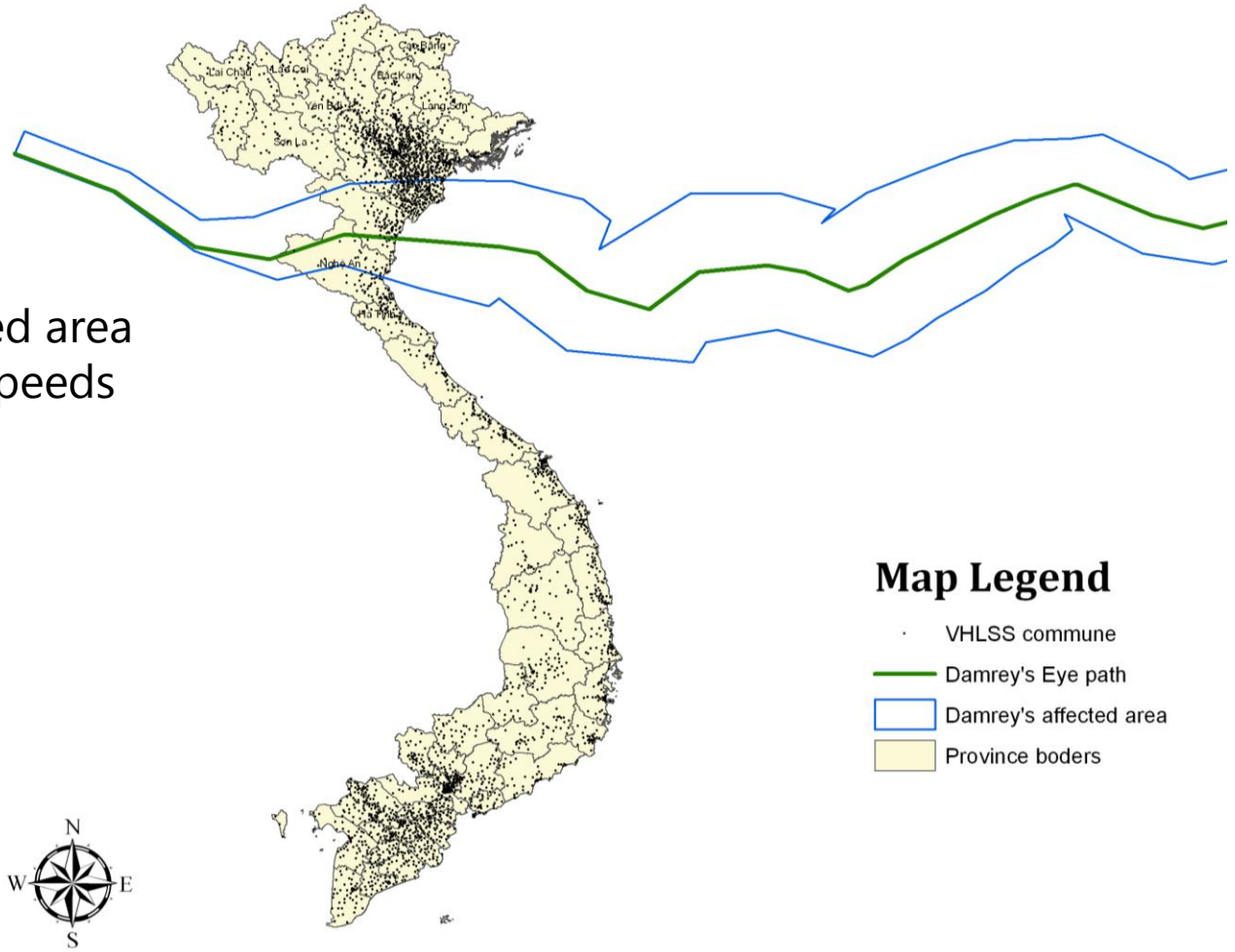
Identification of the affected area: A wind speed model by Holland (1980)

$$V(R) = \sqrt{\frac{b}{\rho} \cdot \left(\frac{R_{max}}{R}\right)^{b} \cdot (P_{env} - P_{centre}) \cdot e^{-\left(\frac{R_{max}}{R}\right)^{b}} + \frac{R^2 f^2}{4}} - \frac{Rf}{2}$$

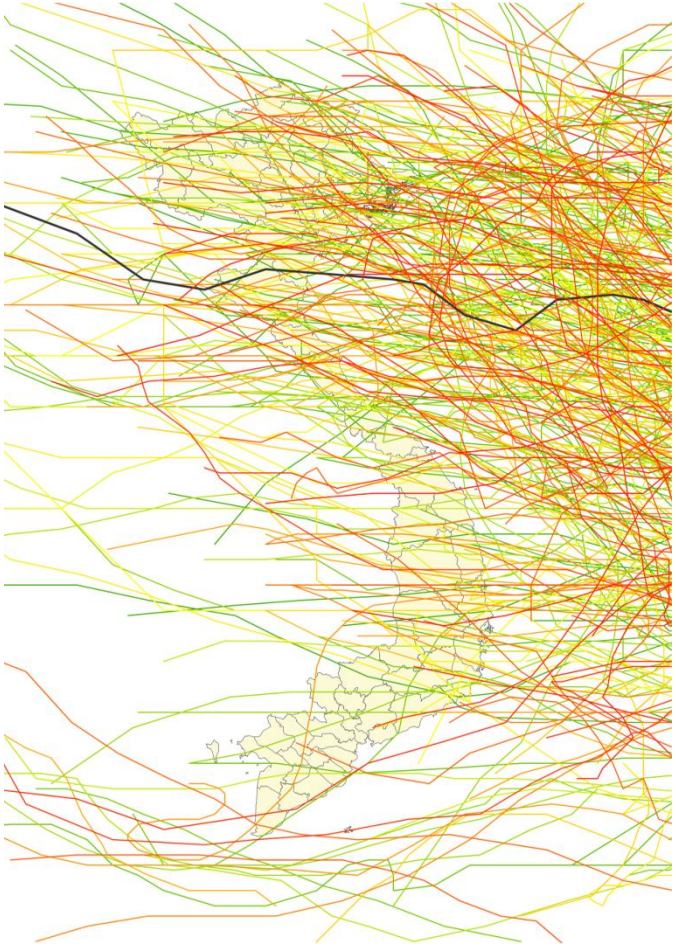


The affected area of Typhoon Damrey and spots where we have information about well-being

The affected area has wind speeds above
35 knots
~ 65 km/h
~ 40 mph



Establishing a comparison group: Storms in Vietnam 1951-2008



- We select comparison areas using multivariate matched sampling (Propensity Score Matching)
- The most important variable is the long-term probability of being hit by storms
- Other control variables include: distance to the coast, commune area and population size

The survey data

We have the data from the Vietnam Household Living Standard Surveys

Before Damrey: 2004 (pre-storm situation)

After Damrey: 2006 (short-term post data)

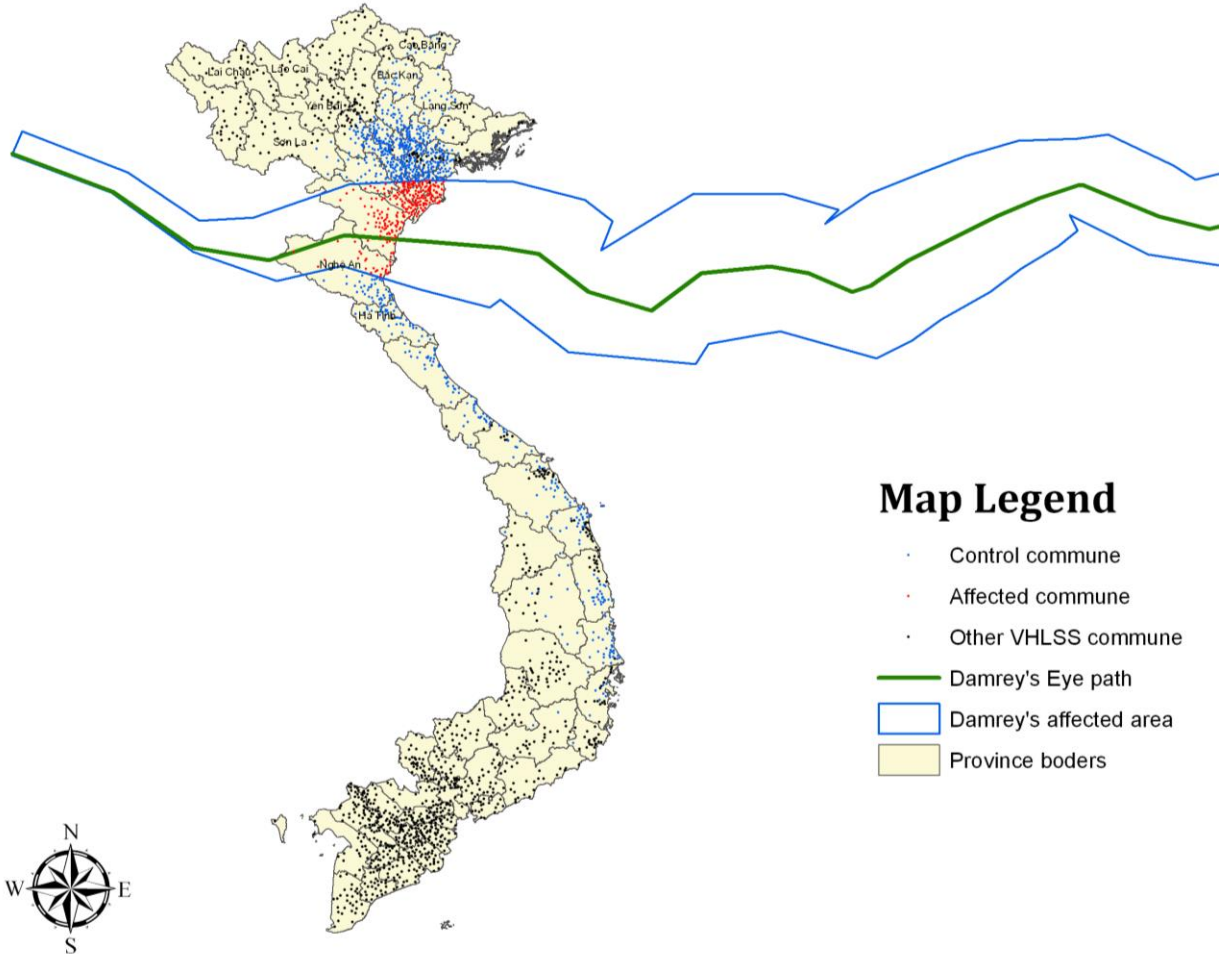
After Damrey: 2008 (long-term post data)

Total Sample: 6939 households in rural communes

Damrey hit 792 households in 264 rural communes of the VHLSS

We select 801 households in 1909 unaffected communes to form the comparison group

The affected area of Typhoon Damrey and comparison areas



Outcomes to examine the Impact

- Paddy production

- Crop income
- Sidelines income
- Total income

- Food expenditure (self-consumed and bought)

- House repairs

Estimates of the Short-term Impact (2006-2004)

- Paddy production (yield): loss = 0.1 kg/m^2 ~ 20 % of 2004 yield

- Crop income: 30% lower, but not significant
- Sidelines income: no significant loss
- Total income: no significant loss

- Food self-consumed: somewhat increase
- Food bought: significant decrease (14%)
- Total food consumption: significant decrease

- House repair probability: increase by 20%
- House repair expenses: increase by 25% of poverty line

Estimates of the Long-term Impact (2008-2004)

- Paddy production (yield): No impact

- Crop income: No impact
- Sidelines income: No impact
- Total income: No impact

- Food self-consumed: significant decrease
- Food bought: increase (but insignificant)
- Total food consumption: No impact

- House repair probability: increase by 10% (but insignificant)
- House repair expenses: increase by 50% of short-term impact

Coping strategies

- Households invest more in subsequent paddy production

- Households rely on remittances ($100)
- Households increase borrowing:
  - formal loans ($1300)
  - informal loans ($1000)

- Disaster aid: not significant

Summary

We have tried to develop

- An objective method to identify storm-affected areas,
- providing data for estimation of the storm impact, which
- allows for impact assessment based upon existing data

- This could be a foundation for
  - index-based insurance products,
  - cost-benefit analyses, and
  - wider impact assessments of climate changes