Scientific Modeling Solutions for the Life & Health Insurance Industry

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http://www.portlandactuarialclub.org/docs/201002_Slides.pdf
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RMS®

Growing Concerns

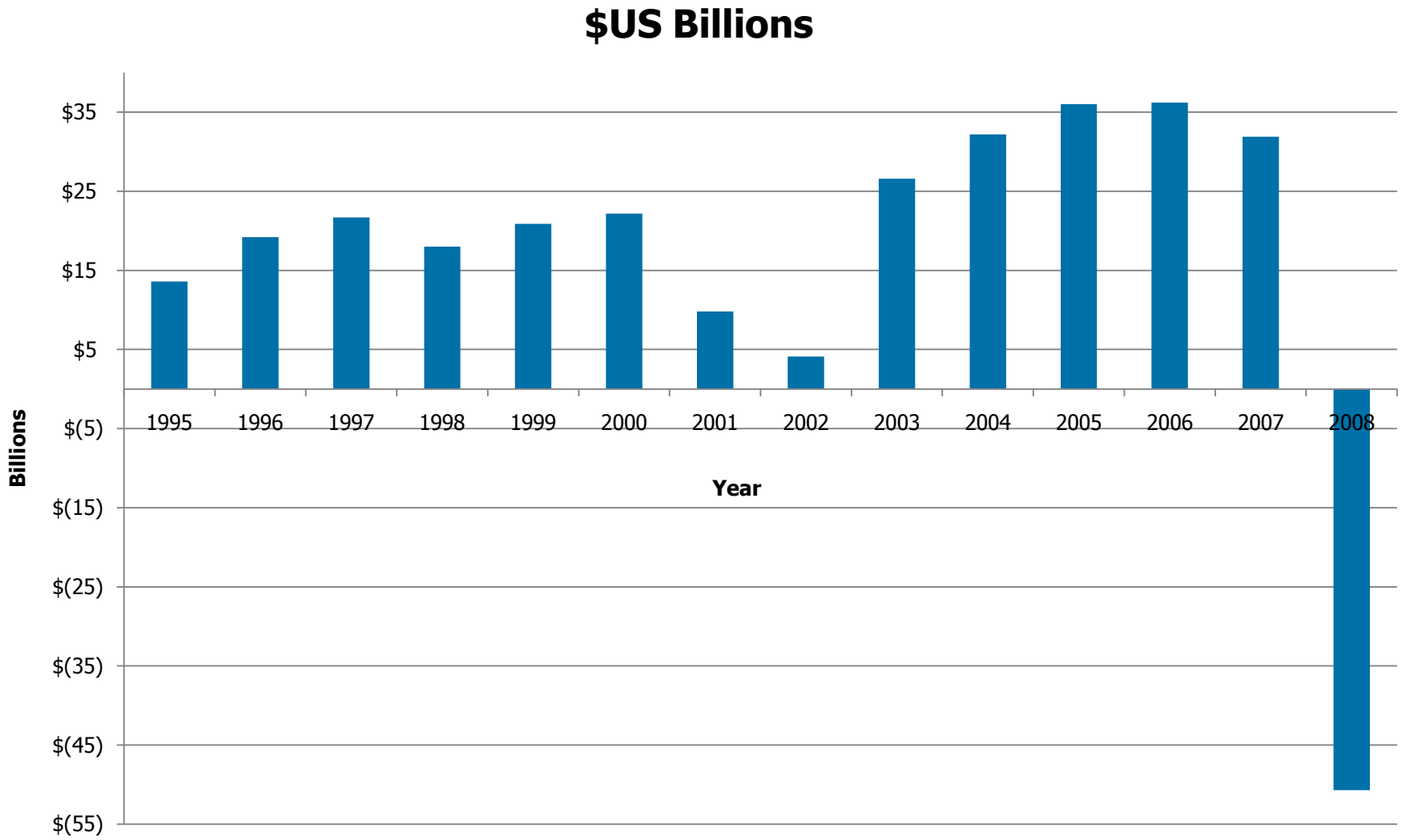
A moderate flu pandemic would cost life insurers nearly $15 billion in additional claims; and a severe flu pandemic along the lines of the 1918 event would cost up to $155 billion.

Insurance Information Institute (III); 2006

An increase of one year in longevity from current expectations could cause a three percent increase in [pension] liabilities, translating into a financial risk of around $600 billion in the U.S. and $90 billion in the UK.

International Financial Services London (IFSL); Feb 2010

L&H Industry Net Income, 1995-2008



Source: National Association of Insurance Commissioners Annual Statement Database

Agenda

- A brief history of catastrophe modeling
- Excess Mortality
- Influenza Pandemic
- Mortality Improvement
- Modeling challenges
  - Data
  - Validation
  - Probability Assessment
- Q & A

Catastrophe Modeling

- 1980s – Scenario models; natural hazards; property risks
- Early 90s – Introduction of probabilistic models; hurricane Andrew, Northridge EQ; property risks; workers compensation
- Late 90s – Widespread adoption in P&C segment
- Early 00s – 9/11, Terrorism; accumulation and exposure management
- Late 00s – Expansion to L&H segment; pandemic
- 2010 – New frontiers: longevity and mortality risk; Solvency II

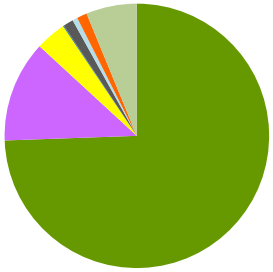
Excess Mortality

A Holistic View of Excess Mortality

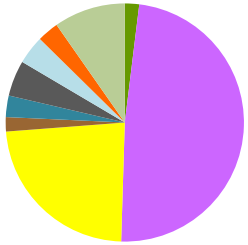
500 Year Return Period Loss (0.2% probability per year)

Group Life mortality rate Commercial Portfolios in the Central Business Districts of Major Cities

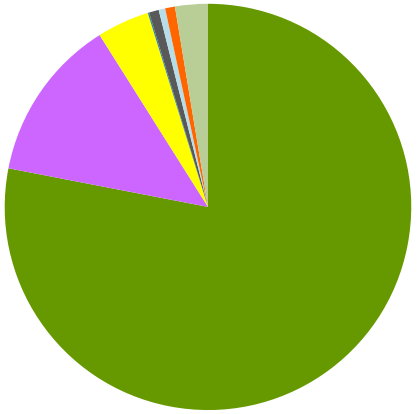
New York



Tokyo

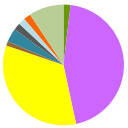


London

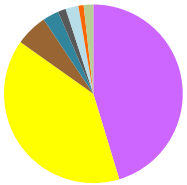


Individual Life mortality rate National/Regional Portfolios

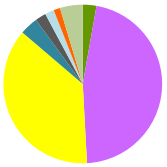
US



Japan



UK



Mortality Bonds issued by the Capital Markets

Publicly Rated Transactions

	Vita I	Vita II	Tartan	Osiris	Vita III	Nathan	Vita IV
Sponsor	Swiss Re	Swiss Re	Scottish Re	AXA	Swiss Re	Munich Re	Swiss Re
Tranches	$250m	$362m B 62m C 200m D 100m	A $75m B $80m	B $150m C $75m D $100m	A $400m (4 classes) B $300m (5 classes)	D $100m	E $75m
Term	3 Year 2003-2006	5 Year 2005-2009	3 Year 2006-2009	4 Year 2007-2010	4 - 5 Year 2007-2011	5 Year 2008-2012	5 Year 2009-2013
Measurement Period	Annual	2 Year	2 Year	2 Year	2 Year	2 Year	2 Year
Trigger	130% combined Mortality Index	A 125% B 120% C 115% D 110%	A 115% B 110%	B 114% C 110% D 106%	A 125% B 120%	A- Rating	US 105% UK 112% Separate Triggers
Territories	US, UK, France, Switzerland, Italy	US, UK, Germany, Canada, Japan	US only	France, Japan, US	US, UK, Germany, Japan, Canada	US, UK, Germany, Canada	US, UK

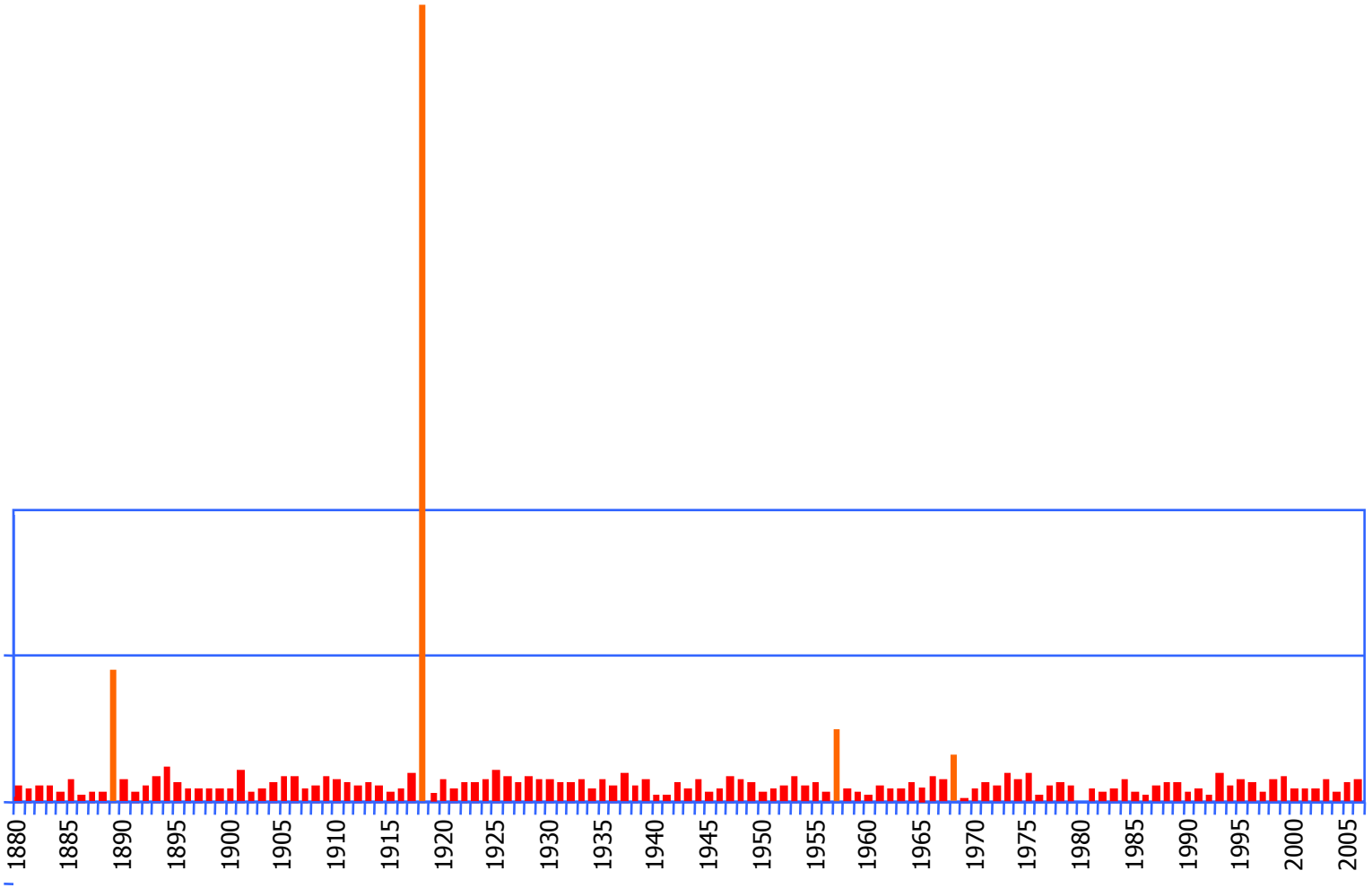
Influenza Pandemic

Industry inspired model development

- 2005/6 Emergence of H5N1 "avian flu"
- No quantitative metric to understand potential pandemic losses
- Board level fears that infectious disease was a significant unquantified threat
- Mandate was to quantify the potential infectious disease threat to life insurance portfolios (individual, group, credit)
- Resurgence in interest with 2009 novel A/H1N1 variant

Pandemic Severity Can Vary Drastically

Flu Deaths in United States Normalized by Population



1918 Influenza Pandemic

- Over 50 million deaths reported in over 60 countries worldwide
- ~700,000 people died in US
- Over 30% of US population infected
- >2% of all infected people died (a Death per Case rate of almost 20 times that of normal flu)
- High prevalence of secondary bacteriological infections
- Mortality was high among young men – 'cytokine storms'

Emergency treatment clinic for 1918 Influenza Pandemic, New York

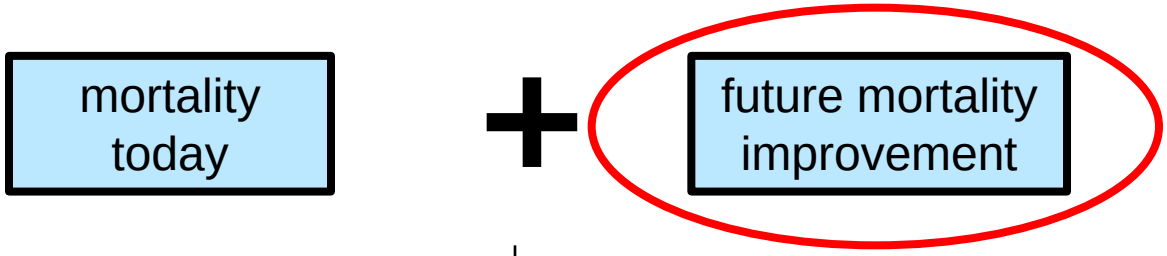
Mortality Improvement

Synthesizing Mortality and Longevity

- Insurers diversified between life insurance and annuities are supposed to benefit from a "***natural hedge***" of mortality / longevity risk
- There is argument over the extent of this hedging because "***the correlation is there but not in the tails***"
  - Annuities exposure mainly age 65+
  - Life exposure mainly age <65
  - Age specific excess mortality events could trigger large life insurance losses without counter balancing annuity gains
- Probabilistic event based model key for optimizing portfolio allocation to exploit the "***natural hedge***"

Actuaries and mortality modeling

- actuaries express mortality assumptions in two parts:



I. Age
II. Gender
III. Pension size
IV. Retirement type
V. Industry type
VI. Postcode

based on pooled industry data or client specific data

derived from proprietary industry data, or client data

RMS aims to provide alternative mortality improvements

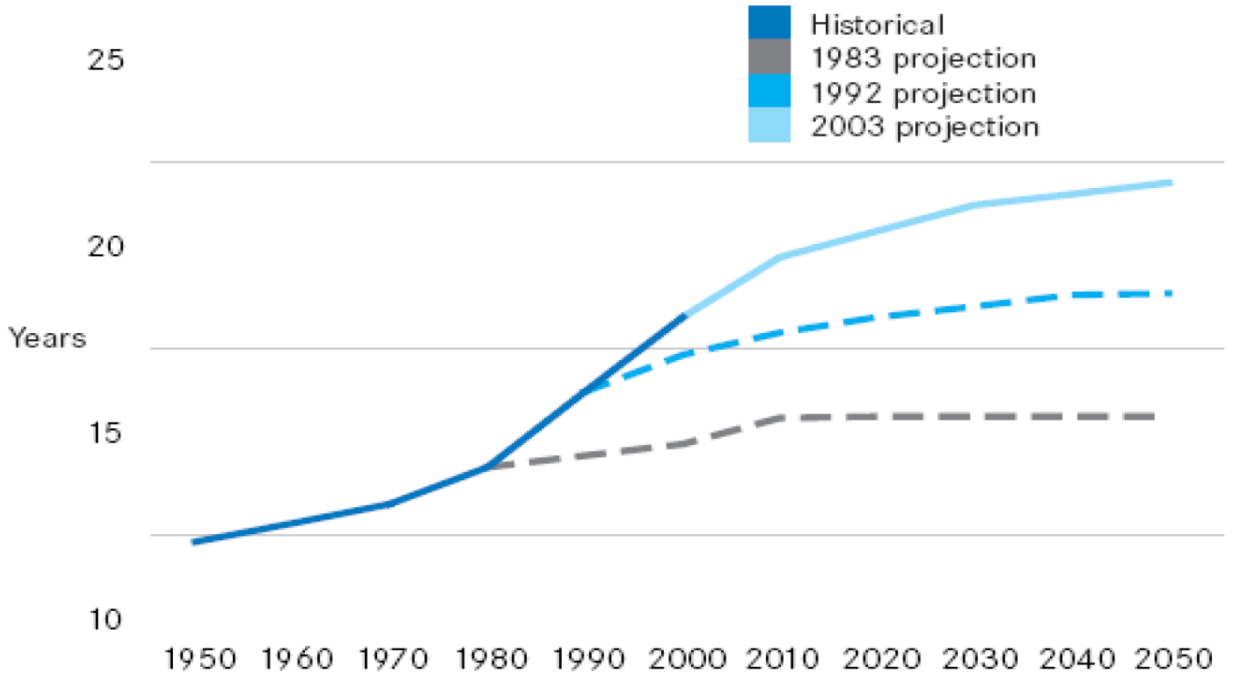
I. Age
II. Gender

derived from:
general population mortality data (publically available) or
pooled industry data

Actuaries and mortality modeling

- systematic underestimation of mortality improvement:

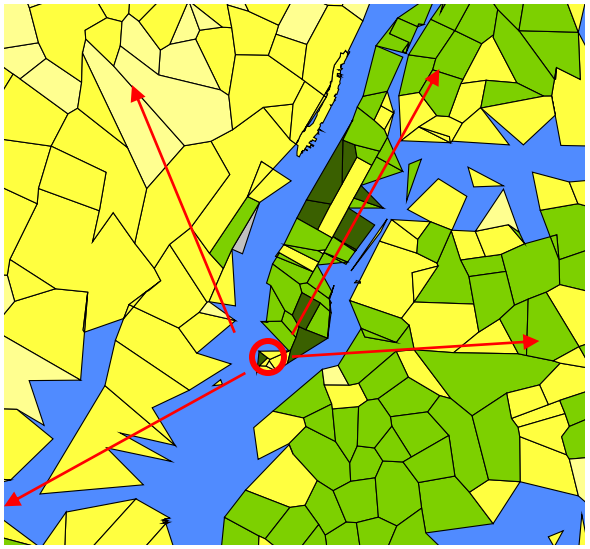
Figure 2 – projected life expectancy for 65 year old male



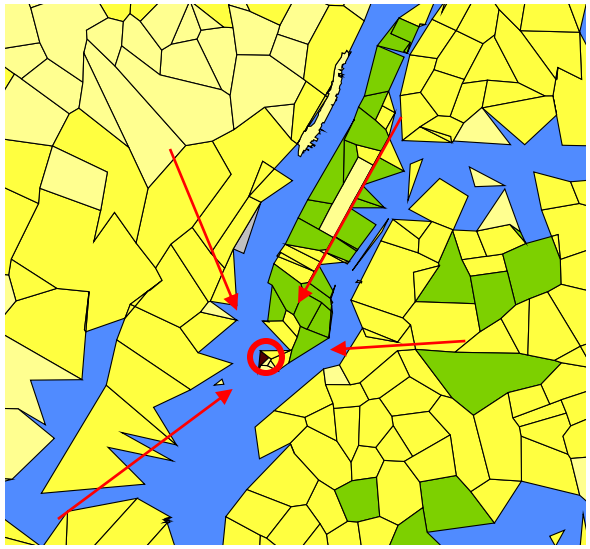
Source: GAD, UK

Modeling Challenges

Who's Where, When

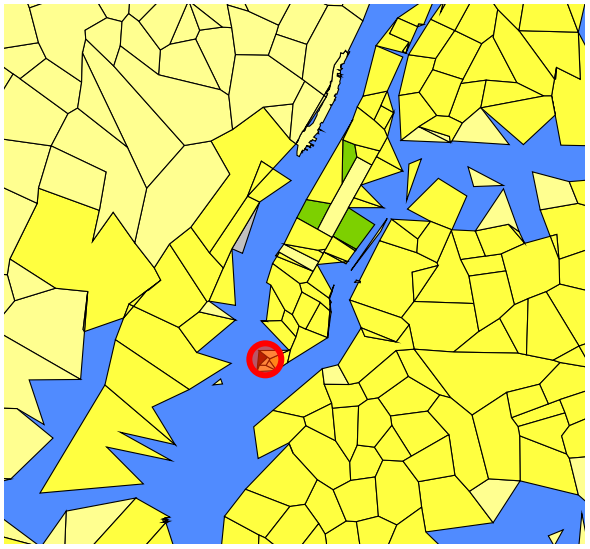


2 am
Night
Dispersed at Home

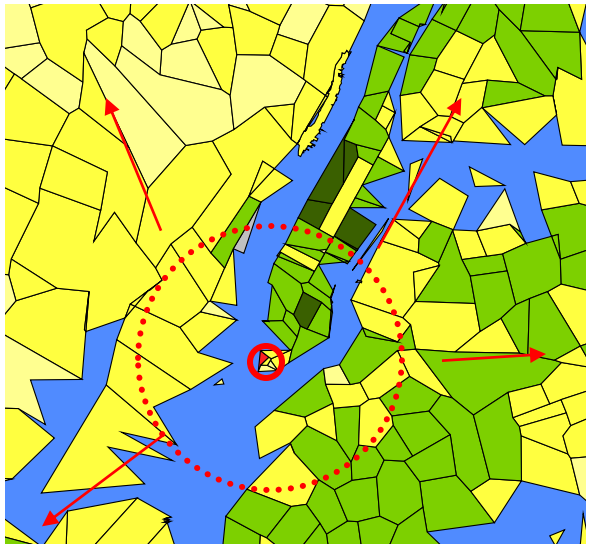


Location of people with a **work address in lower Manhattan** at different times of day

8 am
Morning
Commuting in to work



2 pm
Afternoon
Concentrated in their workplaces



8 pm
Evening
Distributed evening activities

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Data challenges: client data

What will we get from clients? Who are we missing?

- ***Individual life insurers***
  - Size of policy
  - Underwriting class
- ***Group life***
  - Number of people
  - Occupation
- ***Reinsurers***
  - Whole portfolios?
- ***Risk transfer market***
  - Individual data?
  - Portfolio-specific data

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