Society of Actuaries in Ireland

R For Actuaries: What, Why and Where?

26th October 2017

Disclaimer

The views expressed in this presentation are those of the presenters and not necessarily of the Society of Actuaries in Ireland

What is this and who are these people?

- What is this?
  - Recent Qualifiers suggestion.
  - Wider Fields organised a working group.
  - The first of many talks!
    - Visualisations, data handling, GLMs, Chain Ladder…
- Who are these people?
  - Kieran Walsh is a member of the R working group.
  - Pedro Écija Serrano is a member of the Wider Fields Committee and leads the R working group.

Title

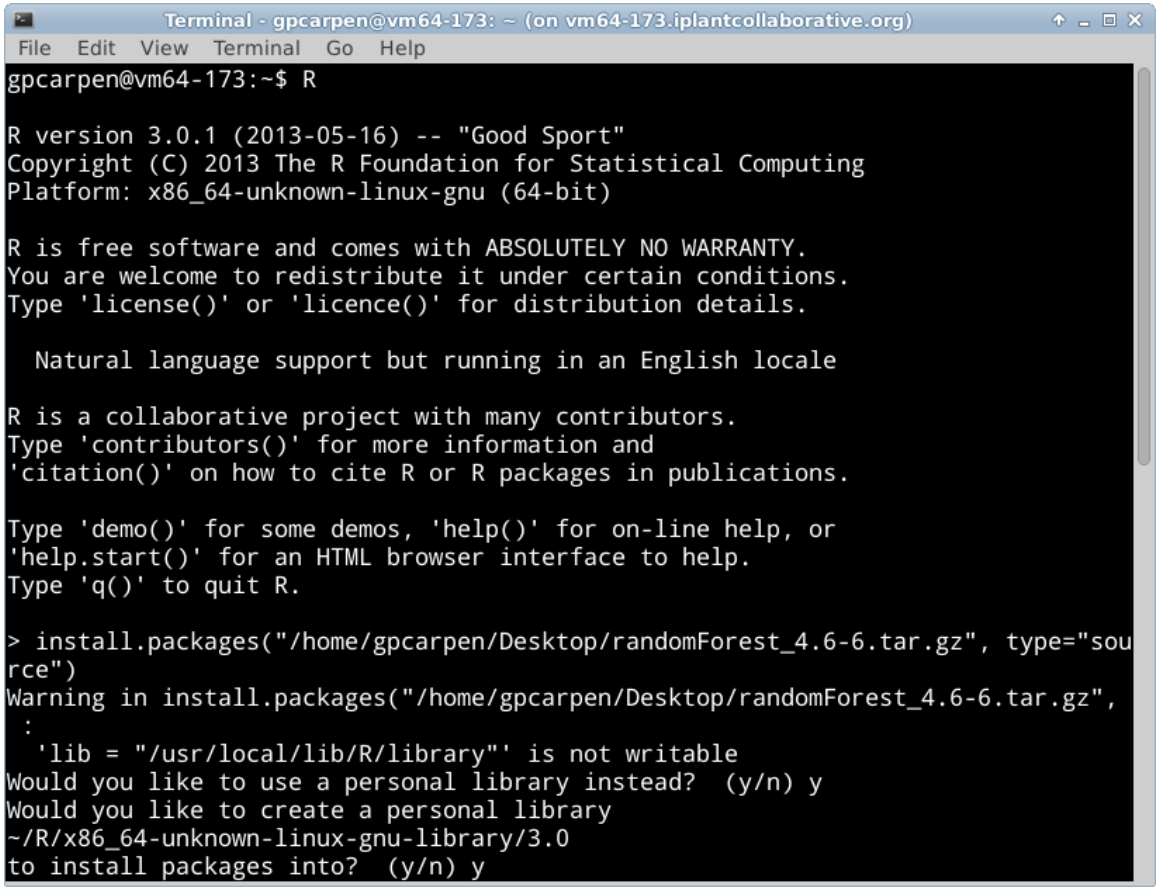
- What is R?
- Why bother?
- Where can I find more?

What is R?

- R is a free, portable, open source language for statistical programming.
  - Free: no fees for the base product and the vast majority of packages.
  - Portable: it runs on any OS (Windows, Linux, Mac OS…)
  - Open Source: anyone can contribute to its development.
  - Programming Language: set of instructions to implement algorithms.
  - Statistical: designed for statistical computing (linear and non-linear modelling, time series analysis, classification, clustering, etc.)

What is R?

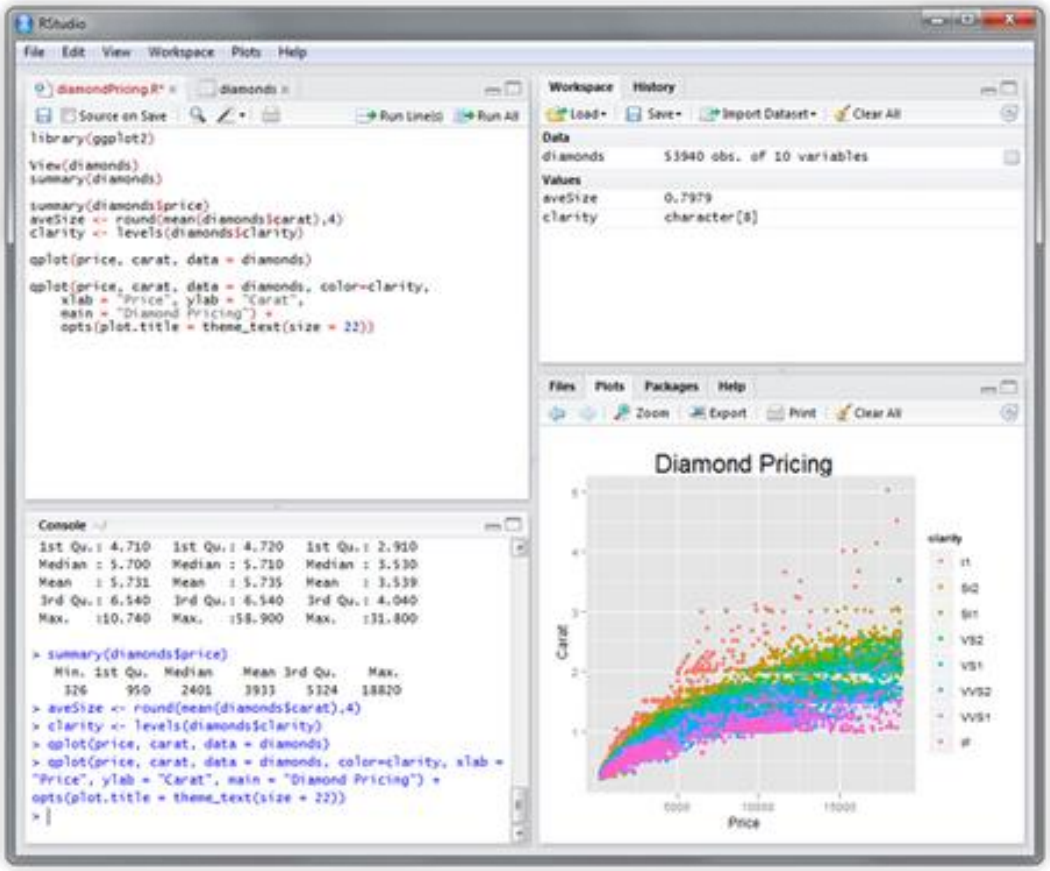
R on its own can be ugly.



https://pods.iplantcollaborative.org/wiki/pages/viewpage.action?pageId=11445211

What is R?

But it is easy to make it look better.

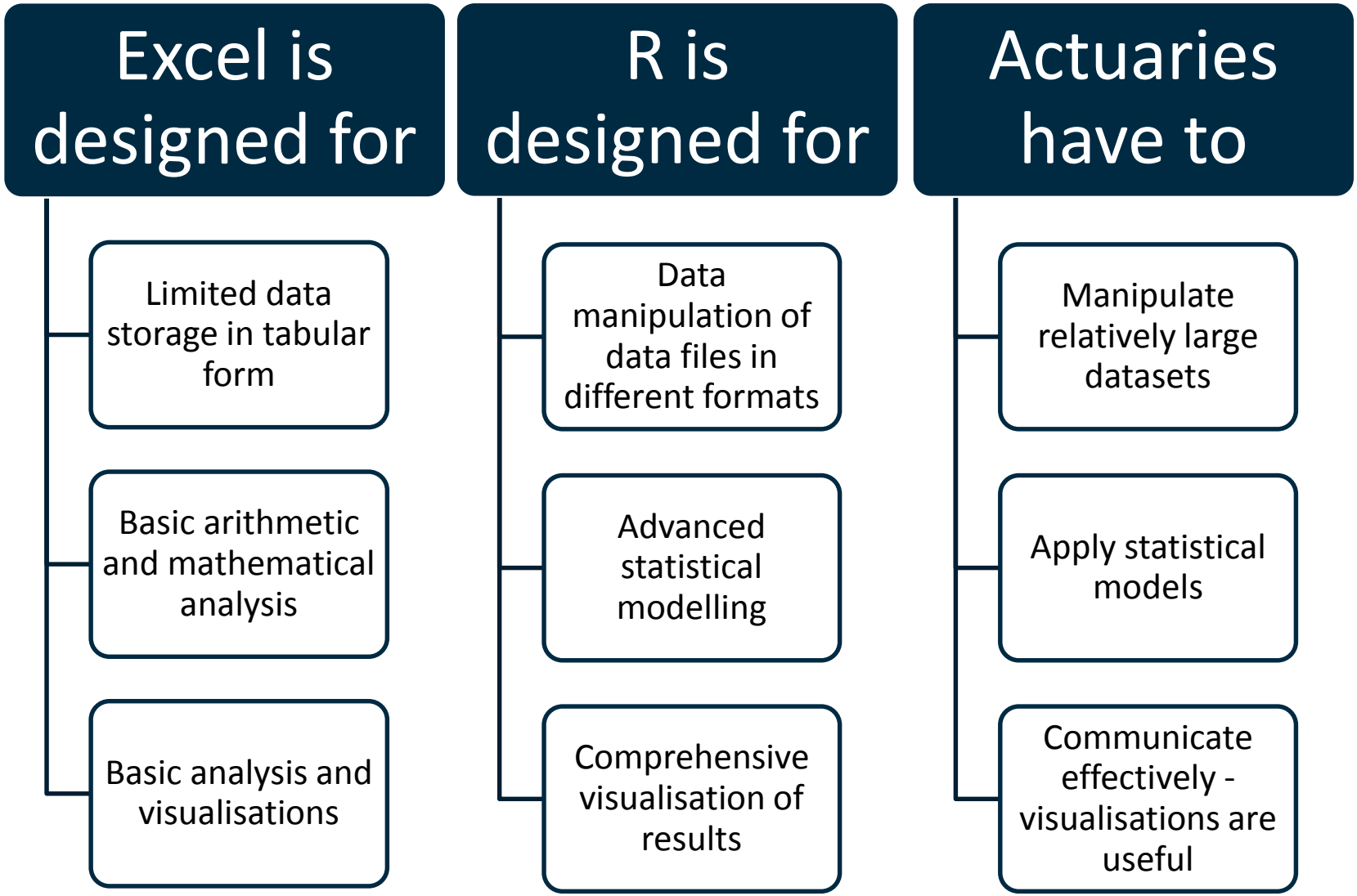


https://www.r-bloggers.com/rstudio-new-open-source-ide-for-r/

Why BotheR? – Summary

- Fit for Purpose
- Project Organisation
- Community
- Data Management
- Reproducibility and Expandability
- Graphics
- Missing Values and Cleaning
- Packages Relevant to Actuaries

Fit for Purpose



Project Organisation – Excel

- If you've ever come across the following:

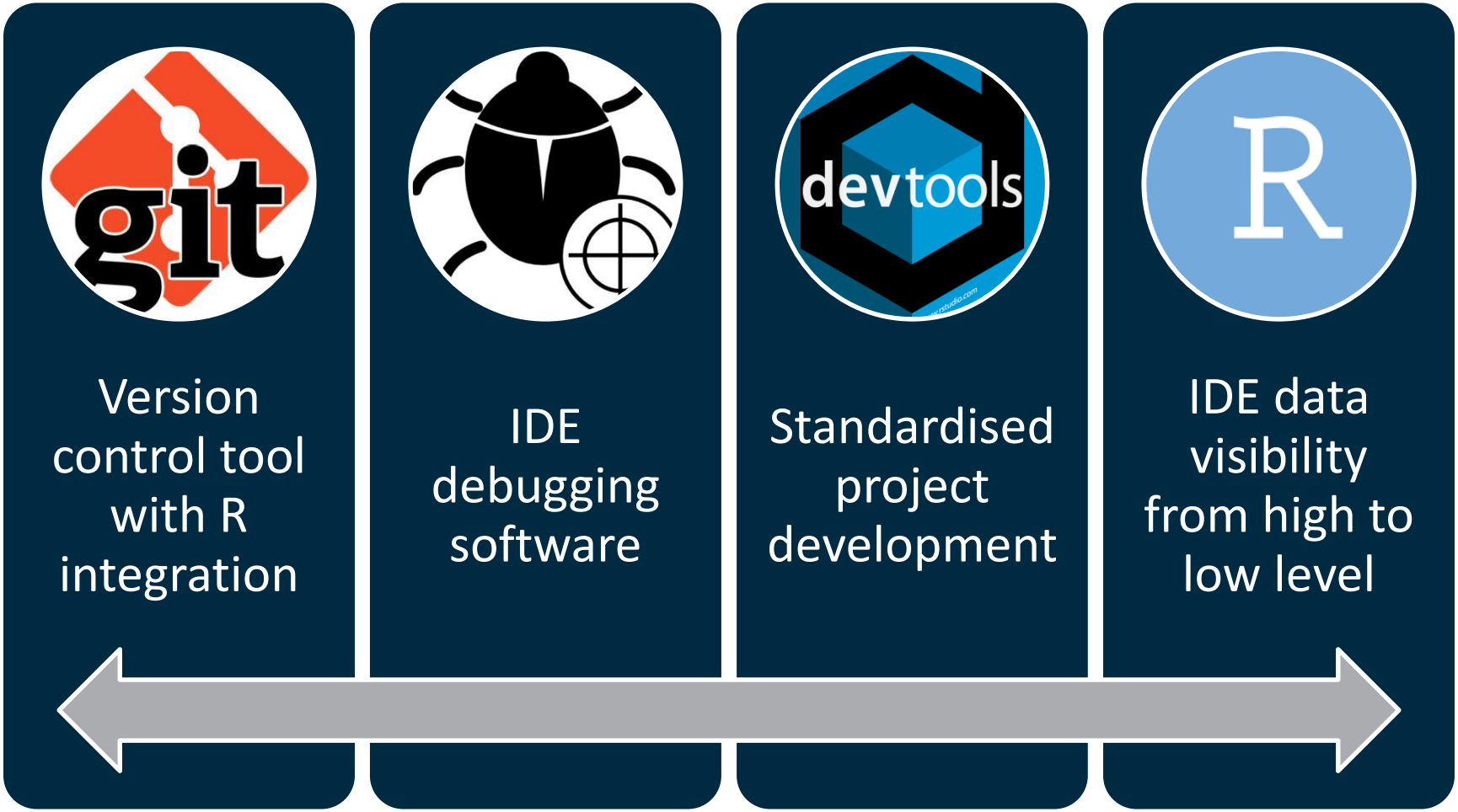
Pricing report v3.5 - final (2) - TM updates - correct 20170812 - to be pdf v7 13/09/2017 11:38 Microsoft Excel W... 1,773 KB

- You'll know it's sometimes hard to maintain consistent file naming conventions in Excel

Organisational Tools Lacking in Excel

- Version control
- Debugging software
- Compact data objects

Project Organisation – R



Community

Learning

Vast range of free, good quality books and courses

Packages

Huge quantity of community packages

Support

Widespread online support

- If you're ever stuck, someone has already solved the problem online (much like Excel/VBA)

Data Management – Excel Issues

- Virtually anything beyond simple operations on a small dataset
- Let's take an example…

Inconsistent Dates	• Multiple text to columns • Multiple "IF(LEFT…)" etc.
Join Tables	• Vlookup for each column you want to add it
Run Pareto Distribution	• Available add-in • Define manually
Varying Assumptions	• Link to new parameters • VBA loop

- In summary, a messy nightmare!

Data Management – R Solutions

- Handle vast complications on vast data in multiple dimensions

Inconsistent Dates	• Single line regex • Lubridate package
Join Tables	• SQL join functionality
Run Pareto Distribution	• Built-in functions
Varying Assumptions	• Vector operations • Grouped in single object

- Ahh… that's much better

Reproducibility and Expandability

- Take initial example of applying Pareto distribution to messy data
- What if we were to receive another set of files with 10x as many rows?

Excel

- Copy new data in
- Ensure formulae look over correct range
- Extend each assumption run
- Ad-hoc documenting in separate location
- Occasionally difficult to peer review

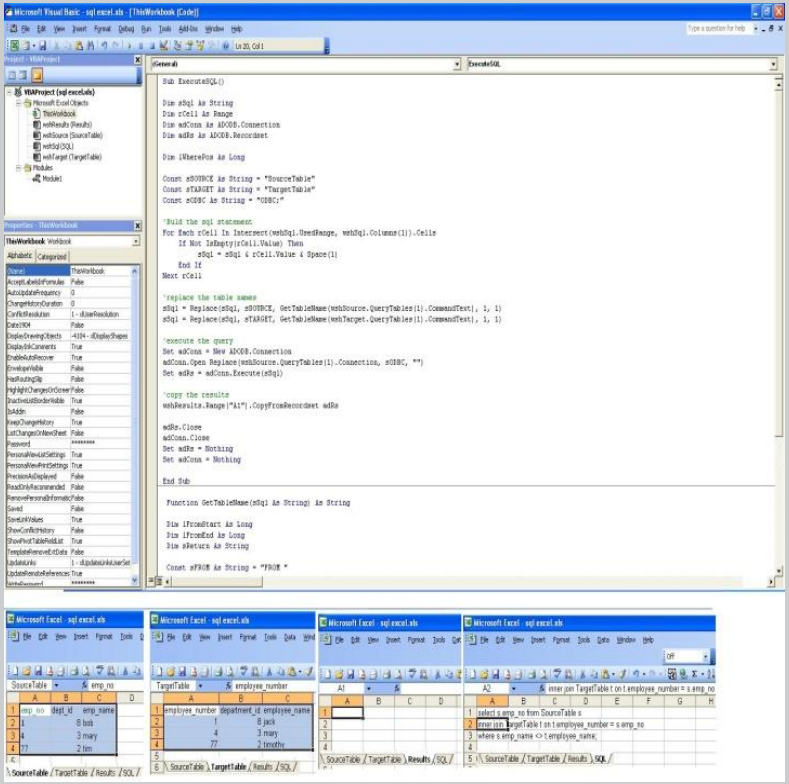
R

- Replace input files
- Documentation and code in single location (RMarkdown)
- It has been used for statistical analysis under regulatory peer review for many years

Reproducibility and Expandability

- Documentation and peer review: Excel vs. R Markdown

Excel

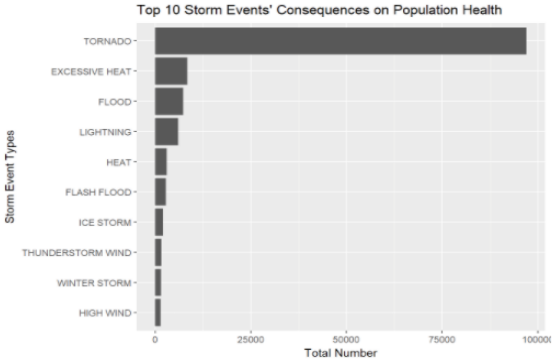


R

3. Results

3.1 Across the United States, which types of events (as indicated in the EVTYPE variable) are most harmful with respect to population health?

```
ggplot(head(storm_health, 10), aes(reorder(EVTYPE, TOTAL_HARM), TOTAL_HARM)) +
       geom_col() +
       coord_flip() +
       labs(title = "Top 10 Storm Events' Consequences on Population Health",
            y = "Total Number",
            x = "Storm Event Types")
```



The graph's y-axis contains the 48 different storm events types while its x-asix displays the total count for each types.

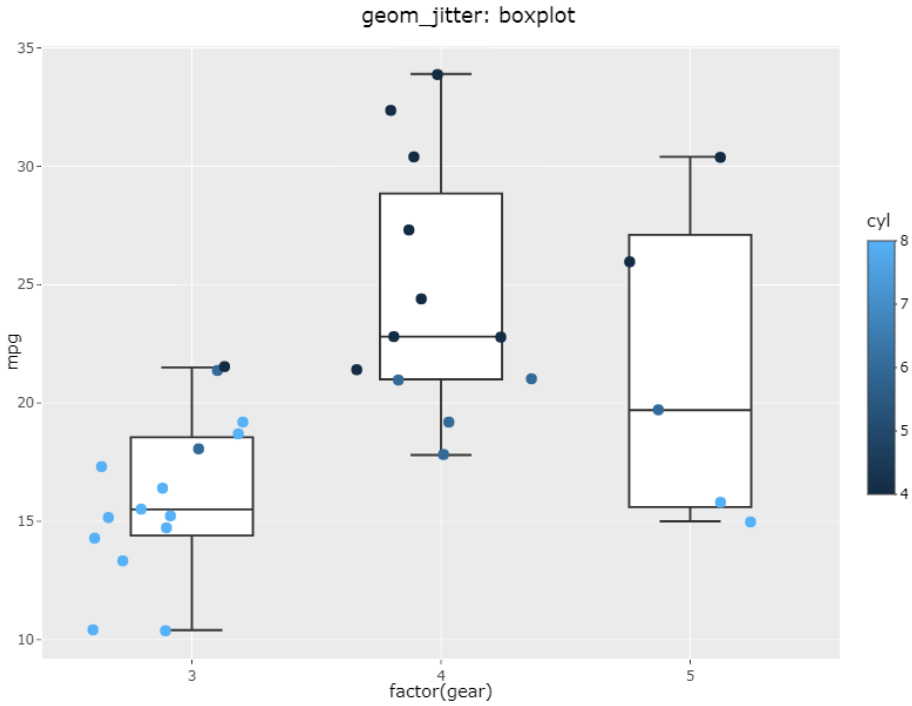
According to the graph, tornado, excessive heat, flood and lightning are most harmful with respect to population health, with tornado having the most harmful effects.

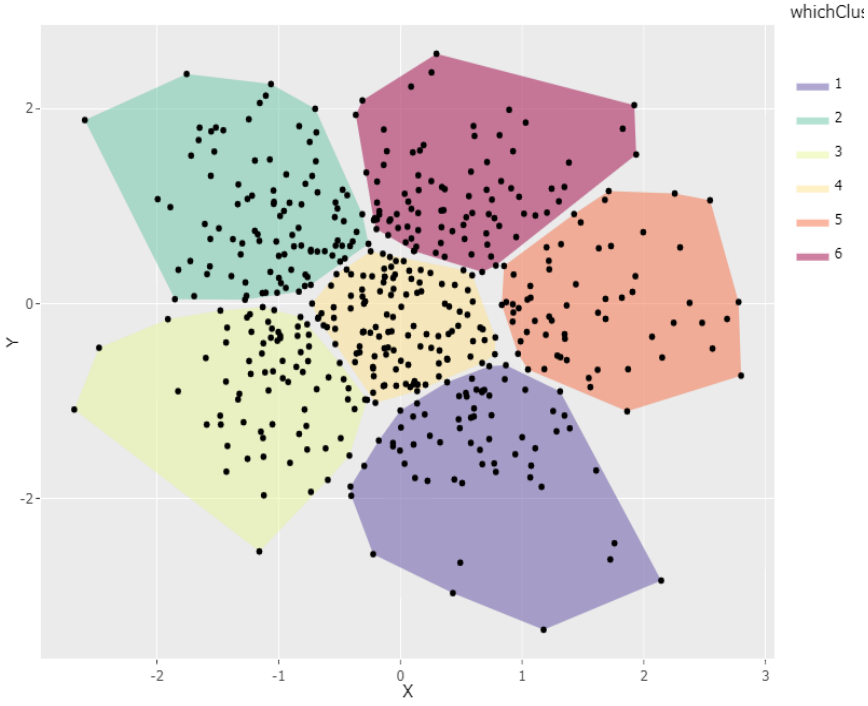
3.2 Across the United States, which types of events have the greatest economic consequences?

```
ggplot(head(storm_econ, 10), aes(reorder(EVTYPE, TOTAL), TOTAL)) +
       geom_col() +
       coord_flip() +
       labs(title = "Top 10 Economic Damage Caused by Storm Events",
            y = "Damage Amount($)",
            x = "Storm Event Types")
```

Graphics

- Let the graphs speak for themselves…





Graphics

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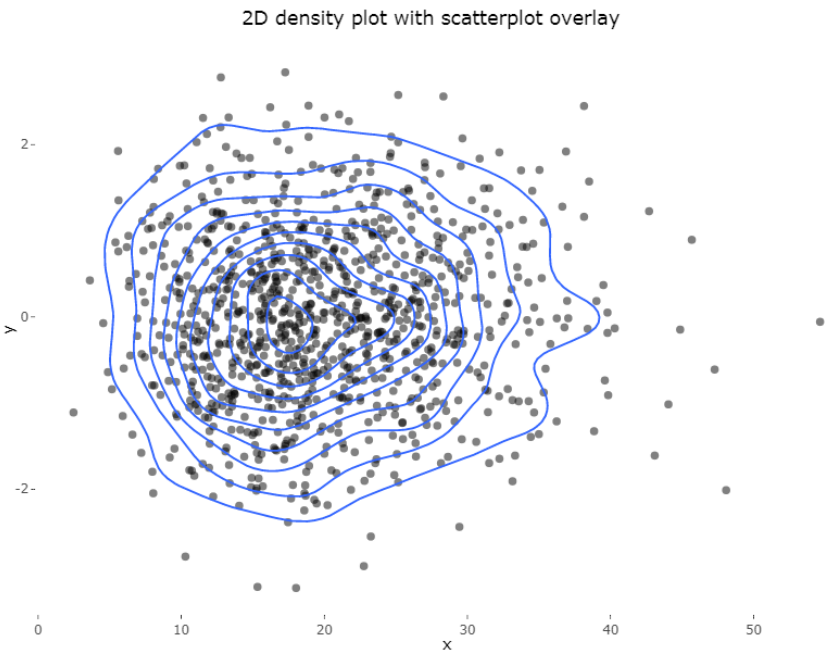

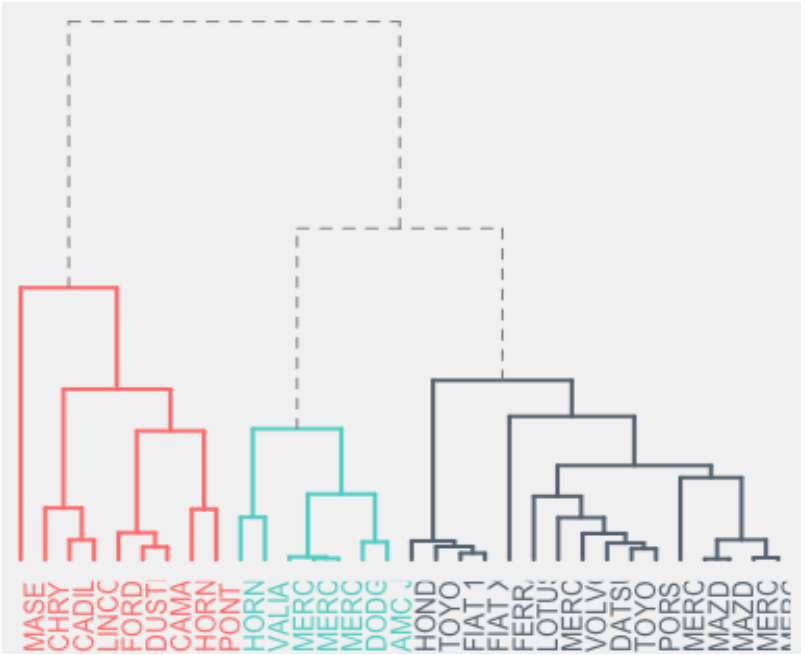

Graphics

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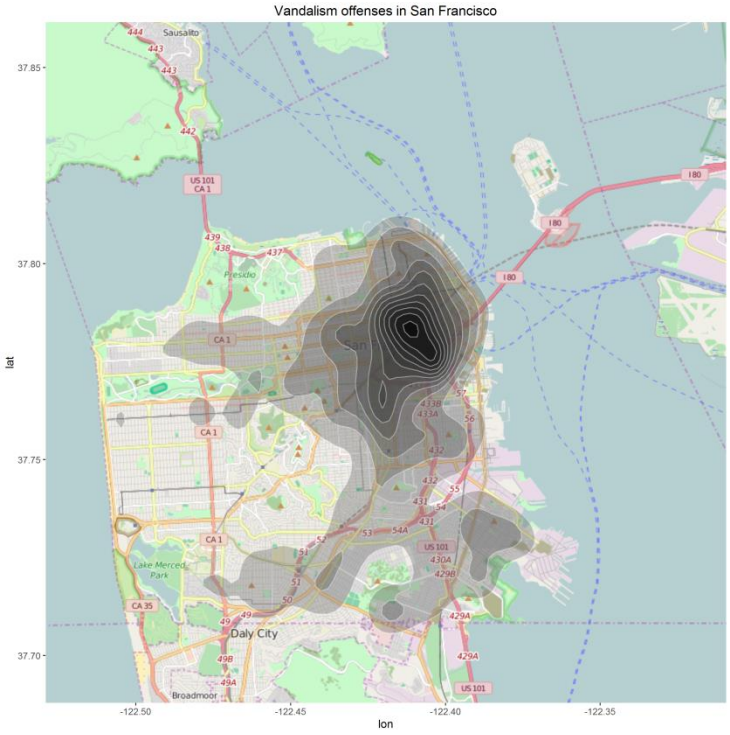
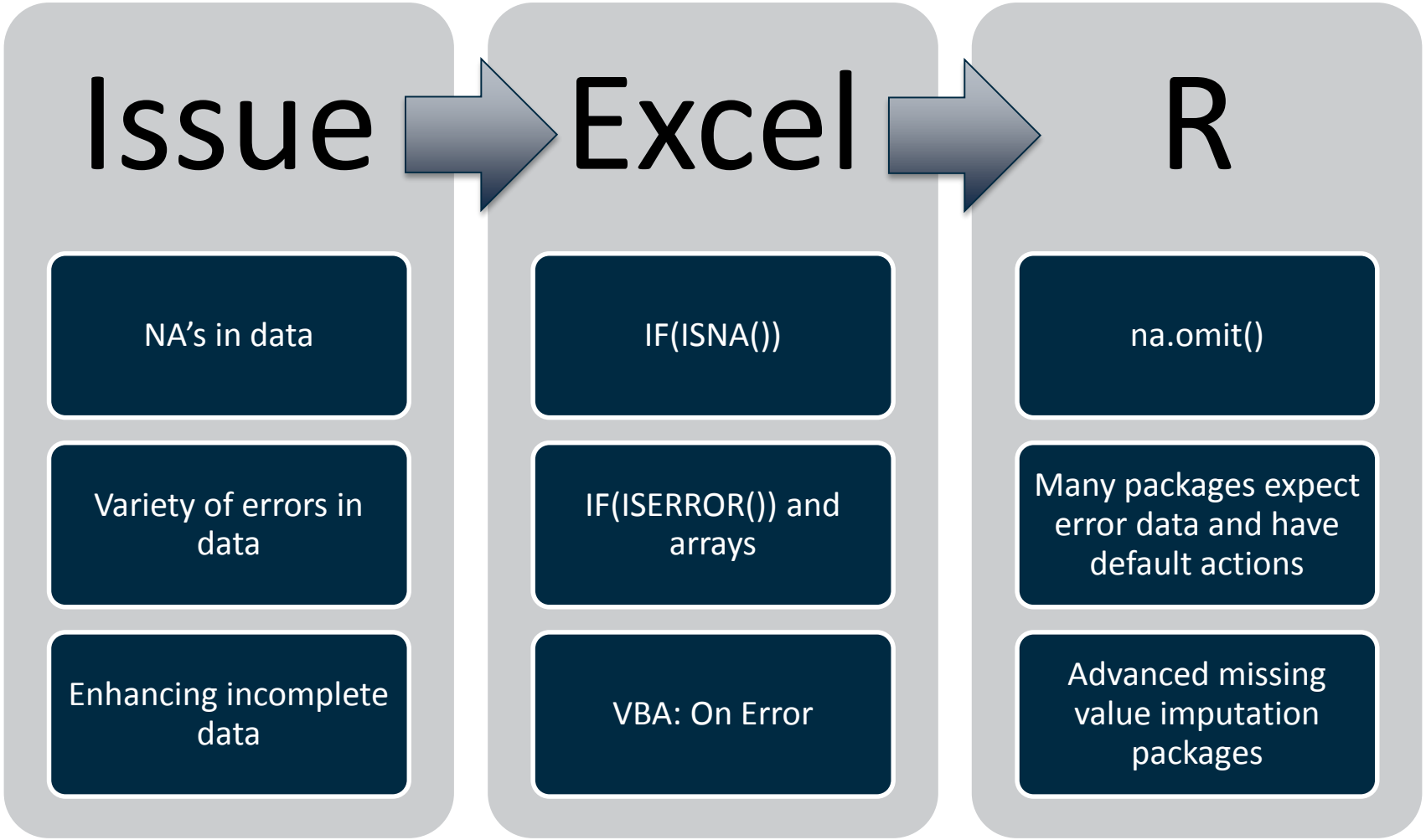


Missing Values and Cleaning

- Missing or error values can sometimes be difficult to handle in Excel



Packages Relevant to Actuaries

No package required

- GLMs

Actuar

- Loss modelling, risk and ruin theory, credibility theory and hierarchical models

Lifecontingencies

- Life tables, functions for demographic, financial and actuarial mathematics of life insurance

ChainLadder

- Claims reserving in general insurance

ELT

- To build experience life tables

DCL

- Claims reserving in general insurance using the double chain ladder framework

MRMR

- Multiplicative chain ladder and additive model for loss reserving in general insurance

RQuantLib

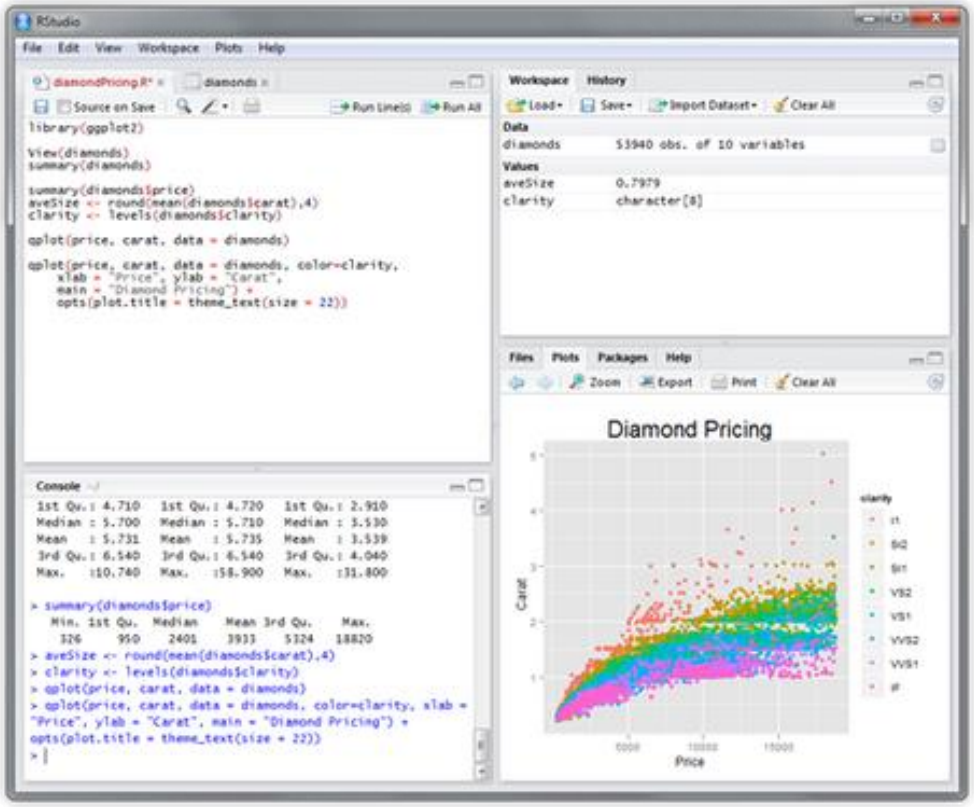
- Quantitative finance, modelling, trading and risk management of financial assets

Tweedie

- Tweedie distribution

Where can I find more?

- You need R to start: https://www.r-project.org/
- We recommend using an IDE
  - RStudio
  - Jupyter Notebook
  - Emacs
  - Atom
  - Others…



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Where can I find more?

- Learn R:
  - Google “introduction to R” and choose among the many free online courses available.
  - Find a book: https://www.r-project.org/doc/bib/R-books.html
  - The power of R comes mostly from its packages: Explore freely and replace base R with packages that provide an easier, more flexible way to do things.
- Some personal suggestions:
  - “Computational Actuarial Science with R”, Arthur Charpentier
  - Anything by Hadley Wickham, even if you are not into data science.
  - Hadley Wickham’s “tidyverse” set of packages.
    - Dplyr for easy and powerful data manipulation
    - Ggplot2 for great and flexible visualisations
  - Suscribe to R-Bloggers: https://www.r-bloggers.com/
  - Consider joining a relevant MeetUp group.
  - “R in Insurance” annual conference.

Questions?