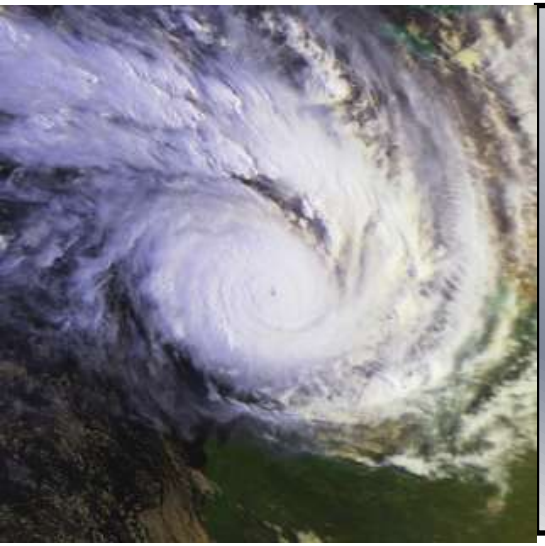
THE UNIVERSITY OF MELBOURNE

WCRP Extremes Data Workshop

26 February 2015



Tropical cyclone data for extreme event analysis

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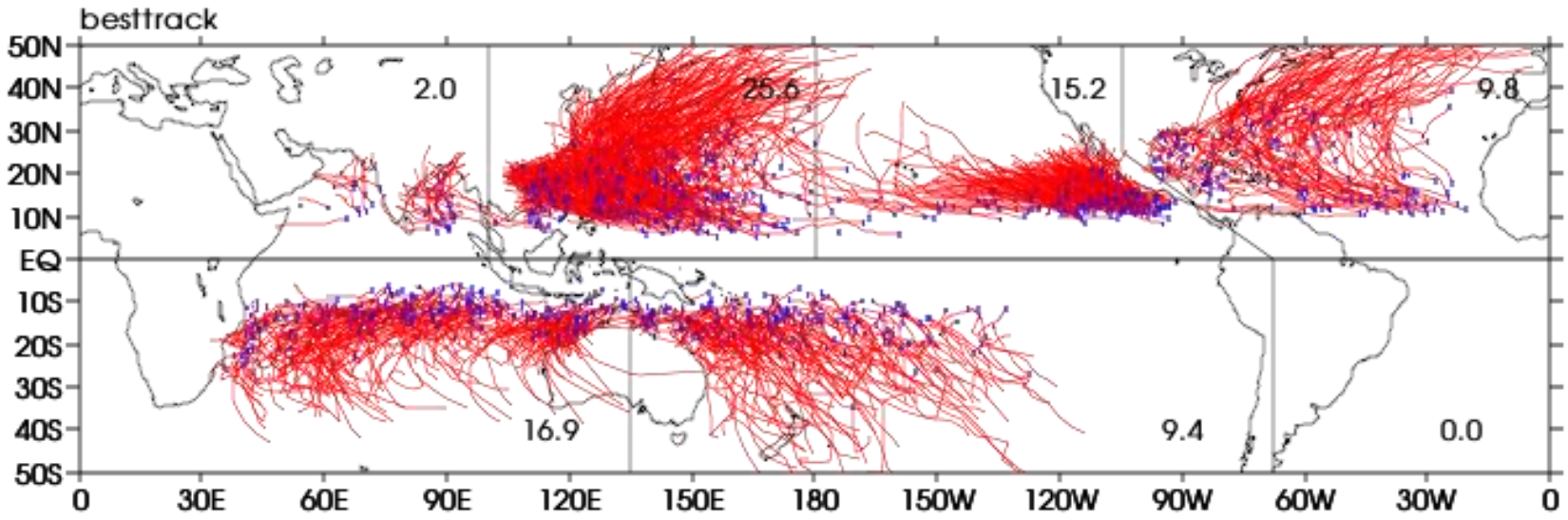
Tropical cyclone extreme events

- High winds
- High rainfall
- In coastal regions, storm surge (the most damaging aspect)
- [Snowstorms! e.g. Hurricane Sandy]

Tropical cyclone wind data

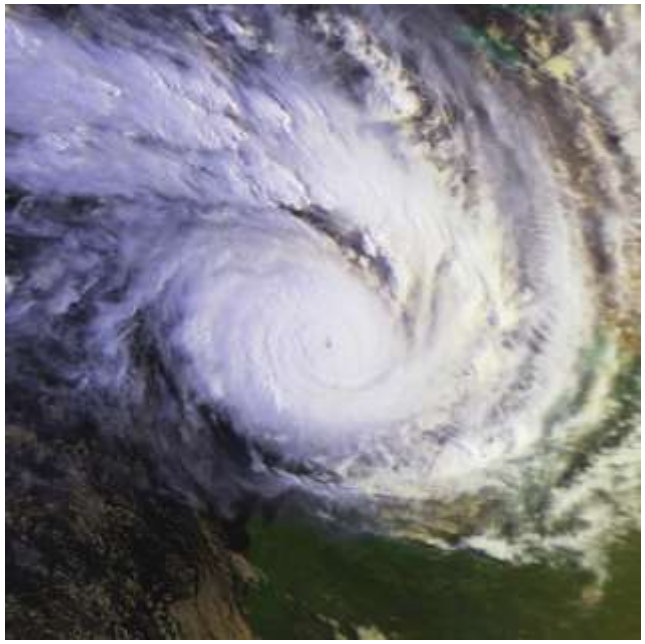
- "Best track" tropical cyclone data e.g. IBTrACS



IbTRACS, 1980-1999 (Knapp et al. 2010)

Compilation of best track data

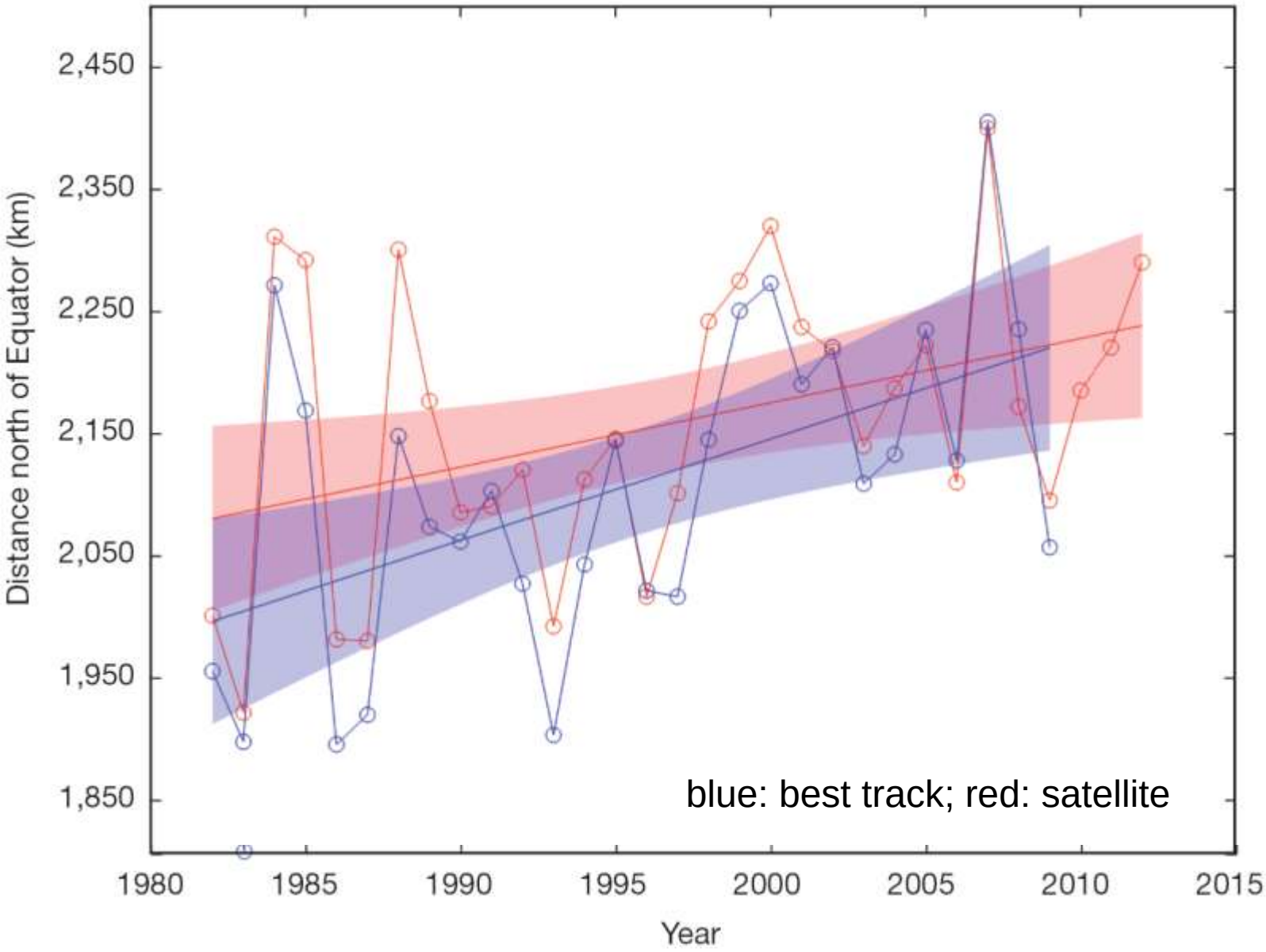
- Wind speed estimates over open ocean derived from “Dvorak” technique, a pattern recognition method based on satellite images (observer and automated)
- In the Atlantic (and sometimes the western north Pacific), aircraft reconnaissance
- Anemometers, where available on land
- *These techniques have changed with time*



“Homogenised” data sets

- Reanalysed best track data e.g. Landsea, Chenoweth and collaborators
  - Very useful but still may miss storms or strongest intensities
- Satellite based methods: Kossin et al. (2013) J. Climate
  - Analysis of past satellite images using consistent intensity estimation via a statistical technique using IR imagery (1980 onwards)
  - Not entirely free from homogeneity issues, for instance, satellite viewing angle issues in some regions may affect intensity estimates

Global trend in latitude of maximum tropical cyclone intensity



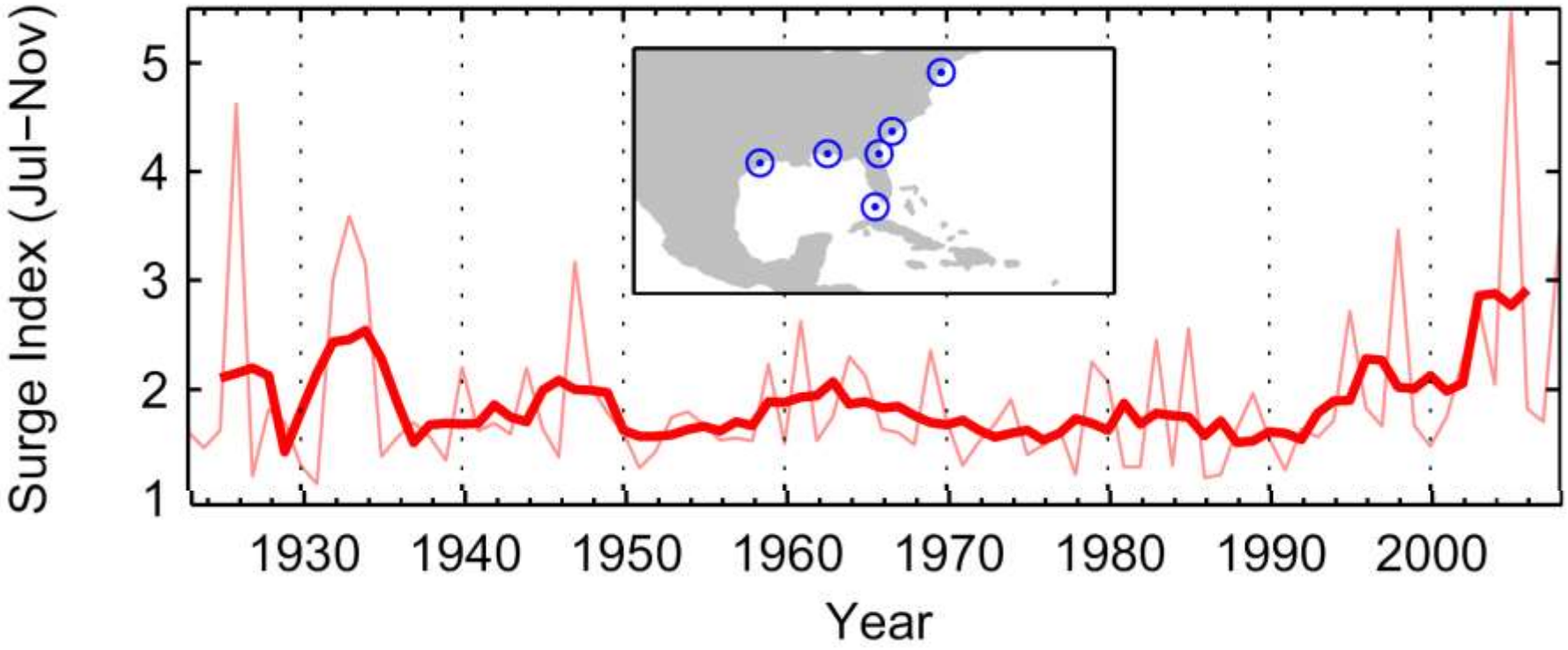
Kossin et al. (2014) Nature

Tropical cyclone rainfall

- Rain gauges over land
  - Clearly suffer from undercatch during tropical cyclone winds; data records are long but patchy geographically and in some locations have consistency problems
  - No detected climate trends to date in TC rainfall (Peterson et al. 2014)
- Satellite-based rainfall estimates
  - TRMM (1998-2014)
  - GPM (the successor to TRMM; 2014-)
  - Good record but not long enough for trend analysis
  - Underestimates TC rainfall in orographic regions (e.g. Chen et al. 2013 JGR)

TC storm surge

- Tide gauges
  - Long records, but subject to artificial trends: subsidence etc. Can be calibrated, with considerable effort (e.g. Grinsted et al. 2012 PNAS)
- Sea level gauges
  - Very accurate, no artificial trends, relatively short record (decades)
- Satellite sea level: can be used to calibrate tide gauges (~1993 onwards)
  - Blended with tide gauges (eSurge)



Grinsted et al 2012

The future

- Some satellite-based records now long enough for trend analysis
- For longer data records, focus on land-based records in regions with good data for TC trend analysis
- In addition to better data, better extreme value analysis/statistical techniques and more awareness of what those are