# Global Tropical Cyclone Climatology using IBTrACS

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# Gray (1968)



- First Global Climatology of Tropical Cyclones
  - Combined data from numerous sources
- Today, we have more complete coverage with satellite data
- But the literature hasn't revisited the global climatology

TABLE 1.—Areas where tropical storms develop 4

Area no.	Area location	Average per- centage of global total <sup>5</sup>	Average number of tropical storms per year
т	NE Pacific	16 (2)	10 (2)
π	NW Pacific	36	22
III	Bay of Bengal	10	6
IV	Arabian Sea	3	2
v	South Indian Ocean	10	6
VI	Off NW Australian coast	3	2
VII	South Pacific	11	7
VIII	NW Atlantic (including W. Caribbean and Gulf		
	of Mexico)	11	7
	Total	100	62

### IBTrACS: The International Best Track Archive for Climate Stewardship

- 14 sources
- 31,002 total tracks
- 500,000+ observations



~11,774 storms 6757 TCs with MSW>30



Number of sources for each storm (Kruk et al. 2010)

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## How can we get ONE answer?

- NHC + JTWC
- Average all available sources
  IBTrACS stopped doing this after v.2

- "IBTrACS-MAX"
  - Use the strongest intensity from any available source
- WMO Subset of IBTrACS



### WMO Subset of IBTrACS





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# Methodology

- Focus on period 1981-2010
  - Roughly corresponds to satellite era
  - Better documentation
  - Matches NCDC's new climate normals
- Annual and Monthly Normals
  - Tropical Storms (10-min wind ≥ 30 kts)
  - Hurricanes/Typhoons/Cyclones (10-min wind ≥ 60 kts)
  - Major Tropical Cyclones (10-min wind ≥ 90 kts)
  - Accumulated Cyclone Energy (ACE)

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Others?



# Methodology

- Convert 1-min to 10-min winds using a 0.88 factor
  - Based on modifications to Dvorak from other agencies
  - No adjustments to 2-min (CMA) or 3-min (IMD) winds
- Omit:
  - Subtropical or Extratropical
  - Non-synoptic times
  - No Wind Data
  - Tracks other than "Main"



### How many storms is this?





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#### Global

- Medians:
  - 81 90 for ≥ 30 kts
  - 42 47 for ≥ 60 kts
  - 17 22 for ≥ 90 kts
  - 515 686 × 10<sup>4</sup> kts for ACE
- Distributions for each dataset overlap



#### Western Pacific

- JTWC has more storms ≥ 90 kts
  - Esp. 1997-2004

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### **South Indian**

• Large differences in

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■ ≥ 90 kts

ACE



### Australia

- BoM did not have wind data until 1984/1985
- All variables are much lower in BoM than JTWC for 1996-2002





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### WMO Genesis Locations (>30 kts)





FIGURE 9.--Frequency of initial location of disturbances which later became tropical storms per 5° lat.-long. area per 25 yr. The lack of any initial disturbance genesis in the South China Sea may not be representative.

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## **Annual Mean Tropical Storm Counts**

	Gray (1968)	WMO	NHC+JTWC	MAX
Atlantic	7	12	12	12
Eastern Pacific	10 (?)	17	17	18
Western Pacific	22	25	26	29
North Indian	8	6	5	6
South Indian	6	10	11	13
Australia	2*	8	12	13
South Pacific	7*	8	8	10
Total	62	79	85	91

\*Gray's Australian region only included the Indian Ocean side



### Annual Cycle of WMO Genesis Locations





## Summary

- Median global number of tropical storms is 80–90 annually
- JTWC and the WMO dataset diverge in the 1990s
  - See upcoming talk by Knapp/Knaff/Sampson

- Not just in Western Pacific!
- Adjustments to Gray (1968)
  - More storms in Eastern Pacific, South China Sea, and South Pacific
  - Fewer in Bay of Bengal



# **Extra Slides**





## Genesis Locations (30 kts)











#### Atlantic

 2005 was an outlier for named storms and hurricanes





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### **Eastern Pacific**

 All years in the upper quartile for were before 1995 (except for >90 kt storms)

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### **North Indian**

IMD data in IBTrACS ulletstarts in 1990





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### **South Pacific**

 Planning to include SPEArTC dataset (Diamond et al. 2012)







### Goals

- Update the Gray (1968) Global climatology using IBTrACS
- Provide a baseline climatology for future studies
- Identify differences between sources





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