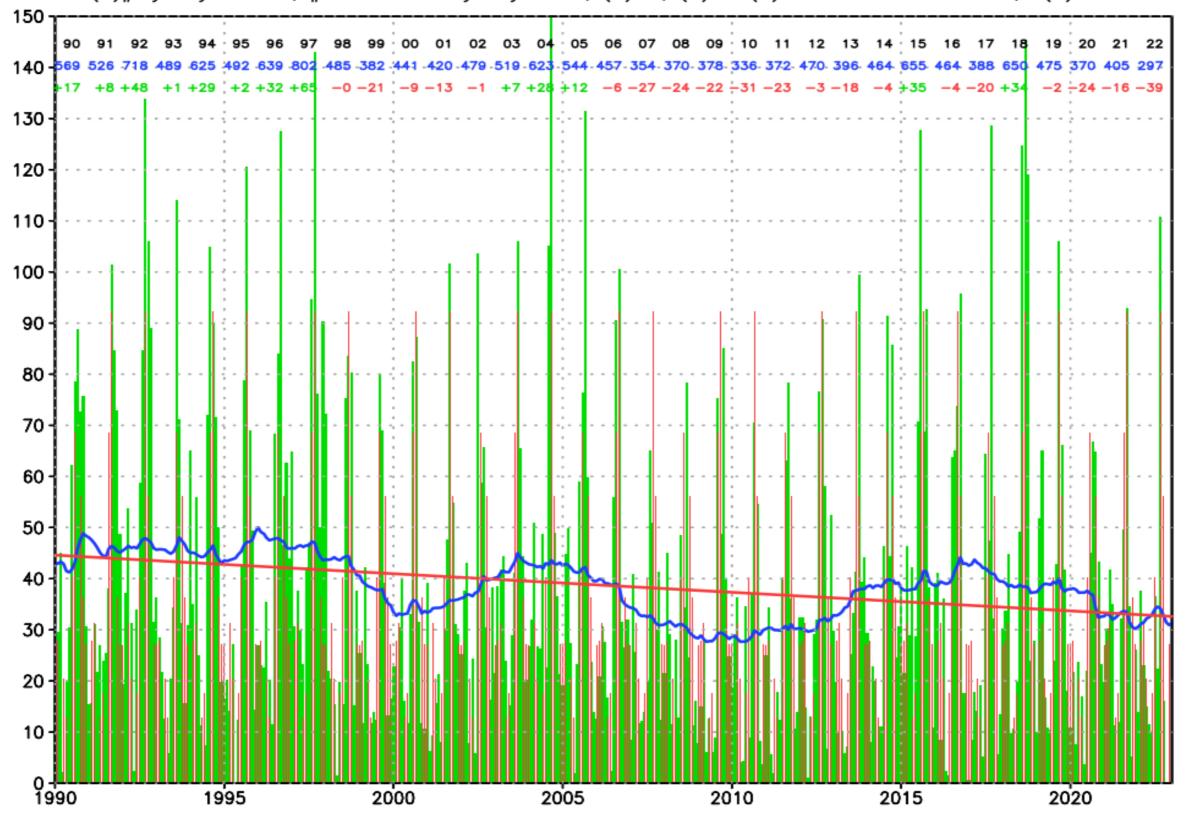
THE クラメトチェンジの質問ですか?

1

GLOBAL TC Activity sACEd units: days for: 19900101-20230101

sACEd=ACE scaled by 1/(4(6h/1d)*65kt*65kt); ACE=sum Vmax*Vmax every 6h if Vmax>=35k Climo: 1981 - 2010
 (B)#: yearly sACEd ; # below: % of yearly climo, (G)>0, (R)<0 (B)line: 48-mo run mean; (R) trend</pre>



Dr. Mike Fiorino (mike@wxmap2.com) WxMAP2 Ave Maria, FL

- Why is global Tropical Cyclone (TC) activity decreasing over the last 30+ years?
- How can we answer this question without a super Best Track (superBT)?
- My guess: decreasing mid- to upper-level moisture in the tropics, particularly in WPAC





A 'superBT' for TC Studies ...on climate time scales

Mike Fiorino

Commander, United States Navy (retired) B.S. ('75 PSU), M.S. ('78 PSU), Ph.D. ('87 NPS) all in Meteorology mfiorino@gmu.edu

George Mason University VA

University of Colorado Boulder CO Earth System Research Laboratory, Boulder CO National Hurricane Center, Miami FL Joint Typhoon Warning Center, Pearl Harbor HI

PCMDI Lawrence Livermore National Laboratory, Livermore CA

European Centre for Medium-Range Weather Forecasts, Shinfield Park, Berskshire, UK

Meteorological Research Institute – Japan Meteorological Agency, Tsukuba JAPAN Space and Naval Warfare Systems Command, Arlington VA

NASA Goddard Space Flight Center, Greenbelt MD

National Centers for Environmental Prediction, Camp Springs MD

Naval Postgraduate School, Monterey CA Fleet Numerical Meteorology and Oceanography Center, Monterey CA Naval Research Laboratory, Monterey CA Atlantic Oceanographic and Meteorological Laboratory, Miami FL Pennsylvania State University, University Park PA







...personal notes...

- officially retired from US Navy and NOAA and Univ of CA (PCMDI).
- affiliated with George Mason University for access to library and computing (similar to emeritus status, i.e., pro bono – no pay, courtesy of Jim Kinter COLA)
- 14th visit to Japan and turned 69, i.e., I'm an old guy living a 55+ community (Ave Maria FL largely unaffected by hurricane IAN)
- my Alzheimer's (dementia) prevention strategy:
 - maintain real-time NWP/TC data flows from NCEP/ECMWF/JMA/CMC/CSU/JTWC/NHC... and webs at wxmap2.com
 - 私は毎日日本語をべんきょうしっています





BLUF Bottom Line Up Front

- entire NWP/TC/reanalysis s/w & data installed & working at climateb.aori.u-tokyo.ac.jp
- superBT = Best Track of TCs +
 - BT of pTCs (potential/preTCs)
 - diagnostic file with storm and environment variables from ERA5
 - storm structure R34 & ROCI/POCI (TC size) multiple sources
 - TC precipitation CMORPH & GSMaP
- climate time scales BT of TC & pTCs of primary importance, especially pTCs for TC genesis
- ERA5 TC forecasts are very good with consistent quality over the 43-y period 1979-2021 → ERA5 analyses are very good





... at the outset...

A 'super' Tropical Cyclone (TC) Best Track (BT) for climate time-scale studies is only as 'super' (good) as the BT itself...made by humans

SHEM 1990-2022 (~30 y) NHEM: 1980-2022 (~40 y)





BT part of the superBT

BT data comes from JTWC & NHC

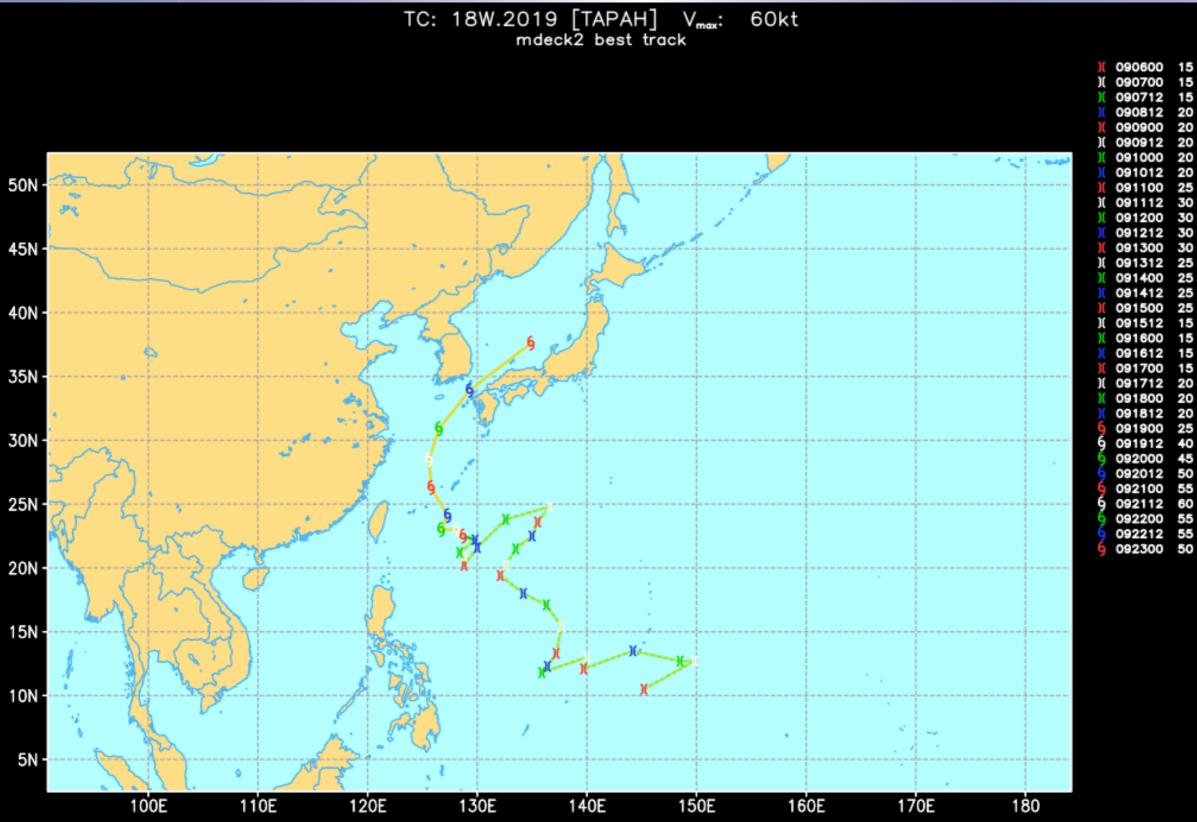
- ▶ global
- consistent operations for best tracking and forecasting
- consistent metrics knots, nautical miles, *I-minute average* surface (10-m) wind
- common data format (ATCF)
- ► consistent initiation of INVESTS or pre-potential TC (pTC) disturbances → specialized-localized satellite reconnaissance and tracking/model diagnostics
- JTWC has not issued a warning without starting an INVEST since 2005...only one case...
- only in recent years has JTWC/NHC properly maintained the INVEST or pTC data set...I have maintained since 2007 and in some basins back to 1999...





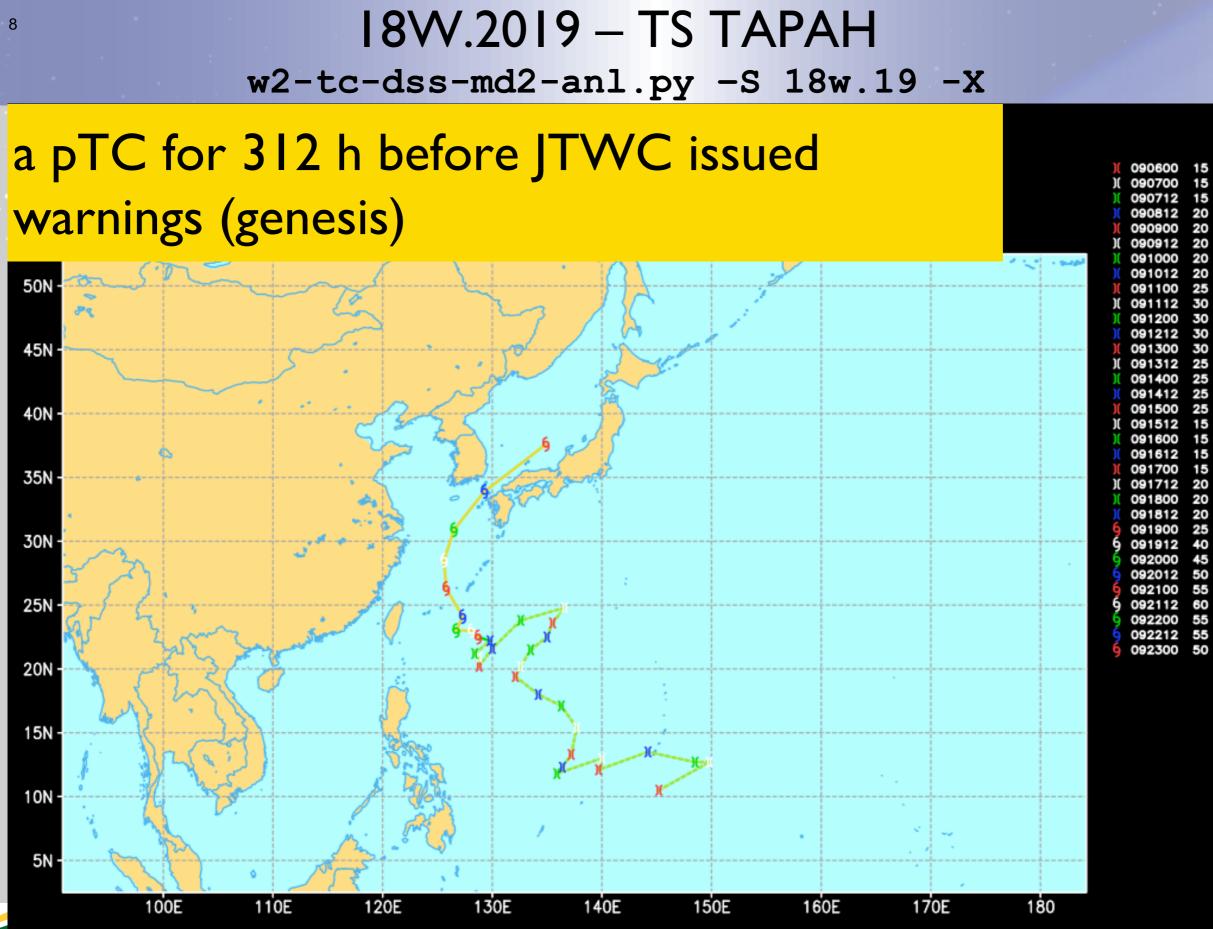
18W.2019 – TS TAPAH

w2-tc-dss-md2-anl.py -S 18w.19 -X



MA





MA



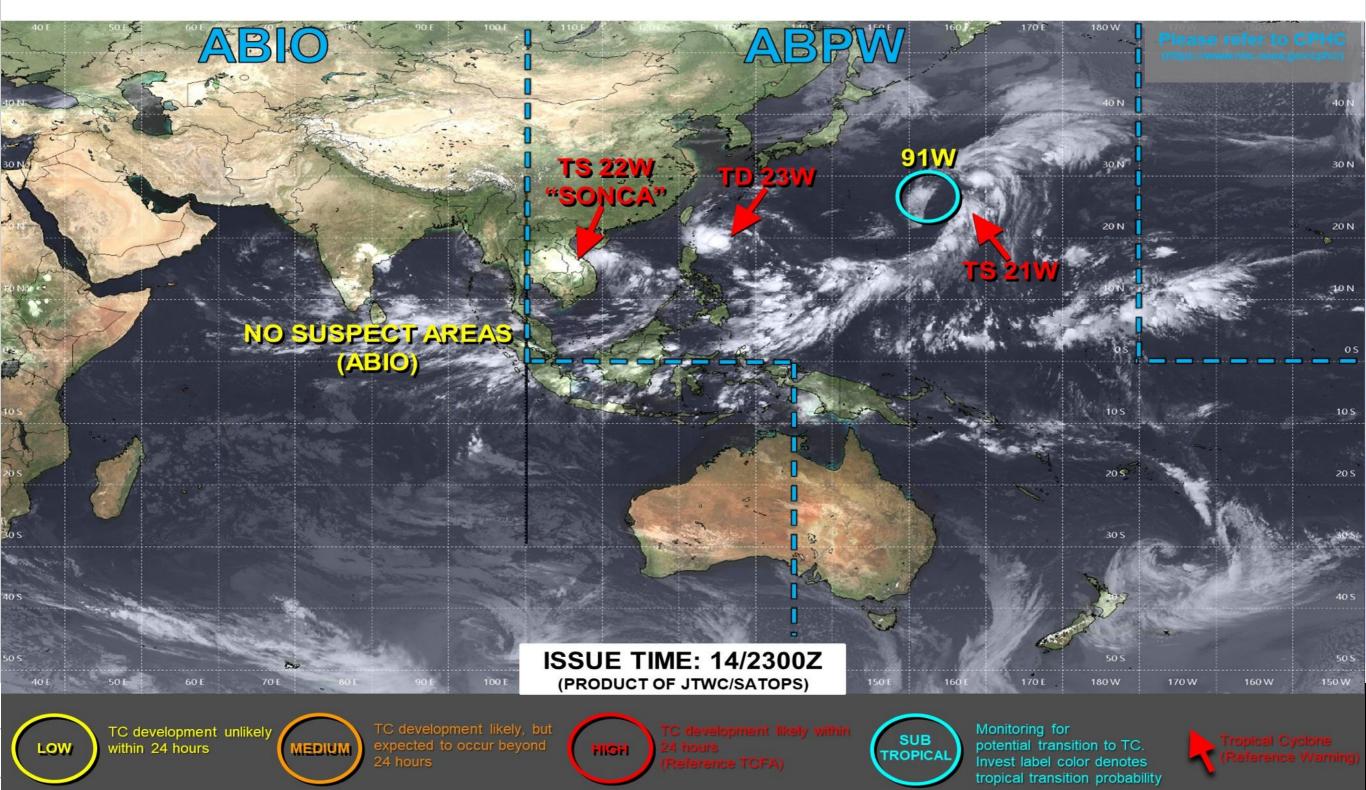
BT part of the superBT

- the *superBT converts all* the operational *TC data* into *python objects* that drive all applications.
 - ► **I947-2022**
 - < 1900 in the atLANTic</p>
- for climate applications will look at:
 - TC activity
 - TC genesis or TC formation from a pTC

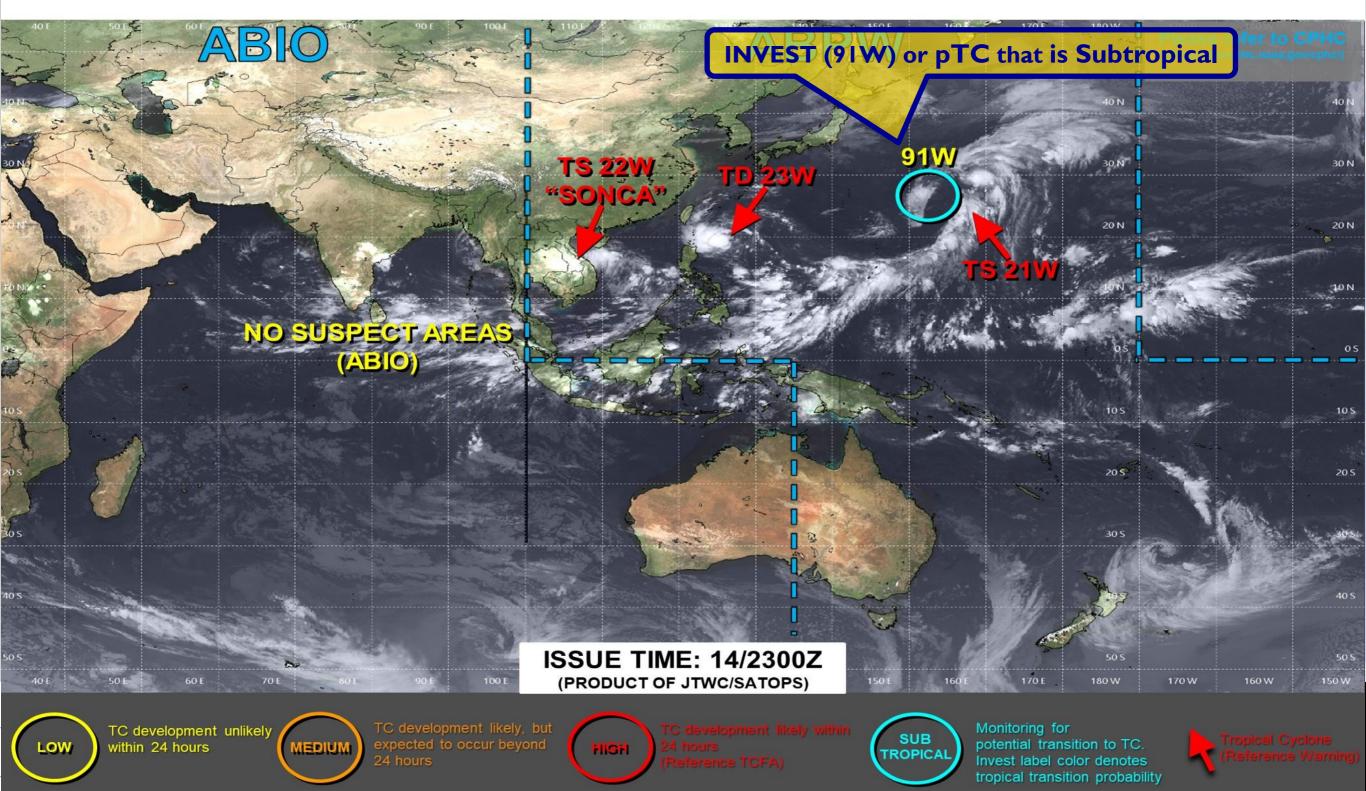




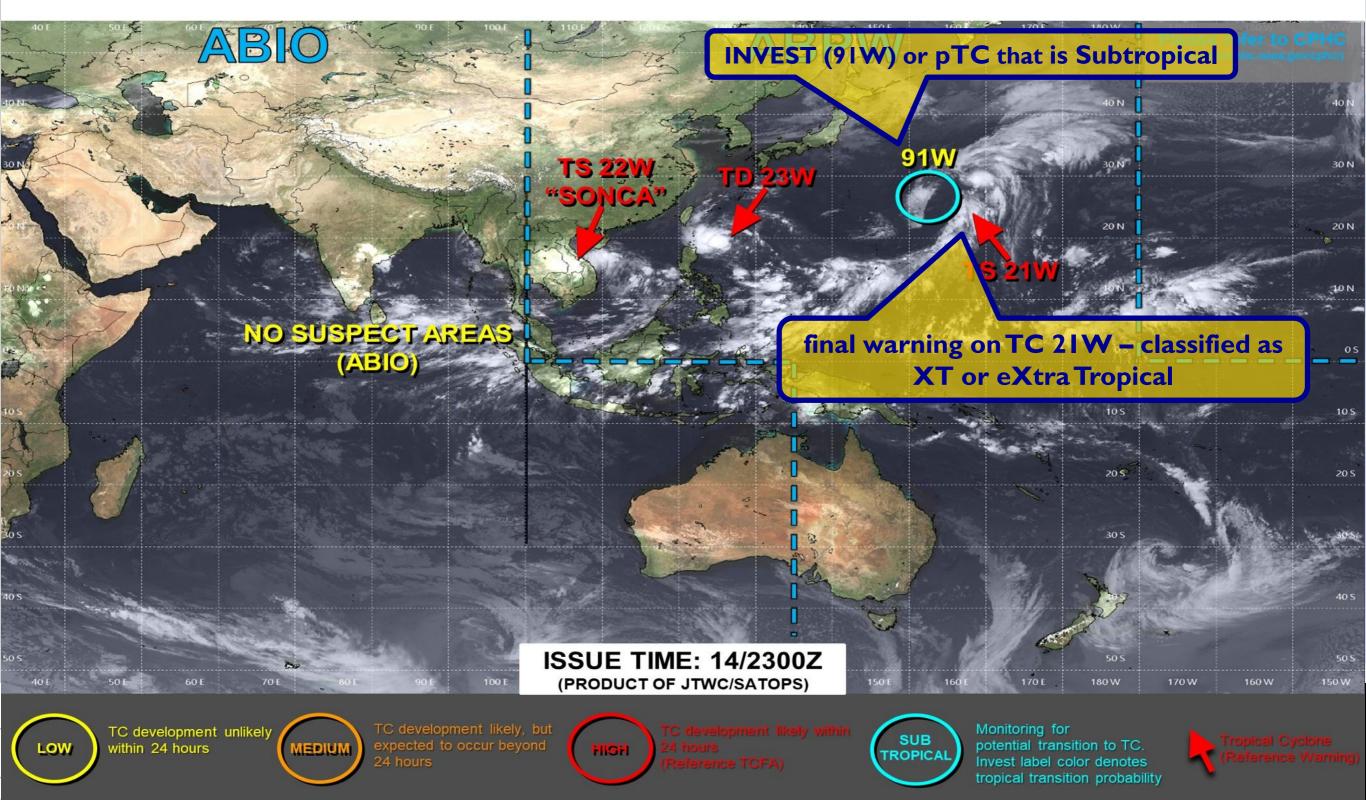






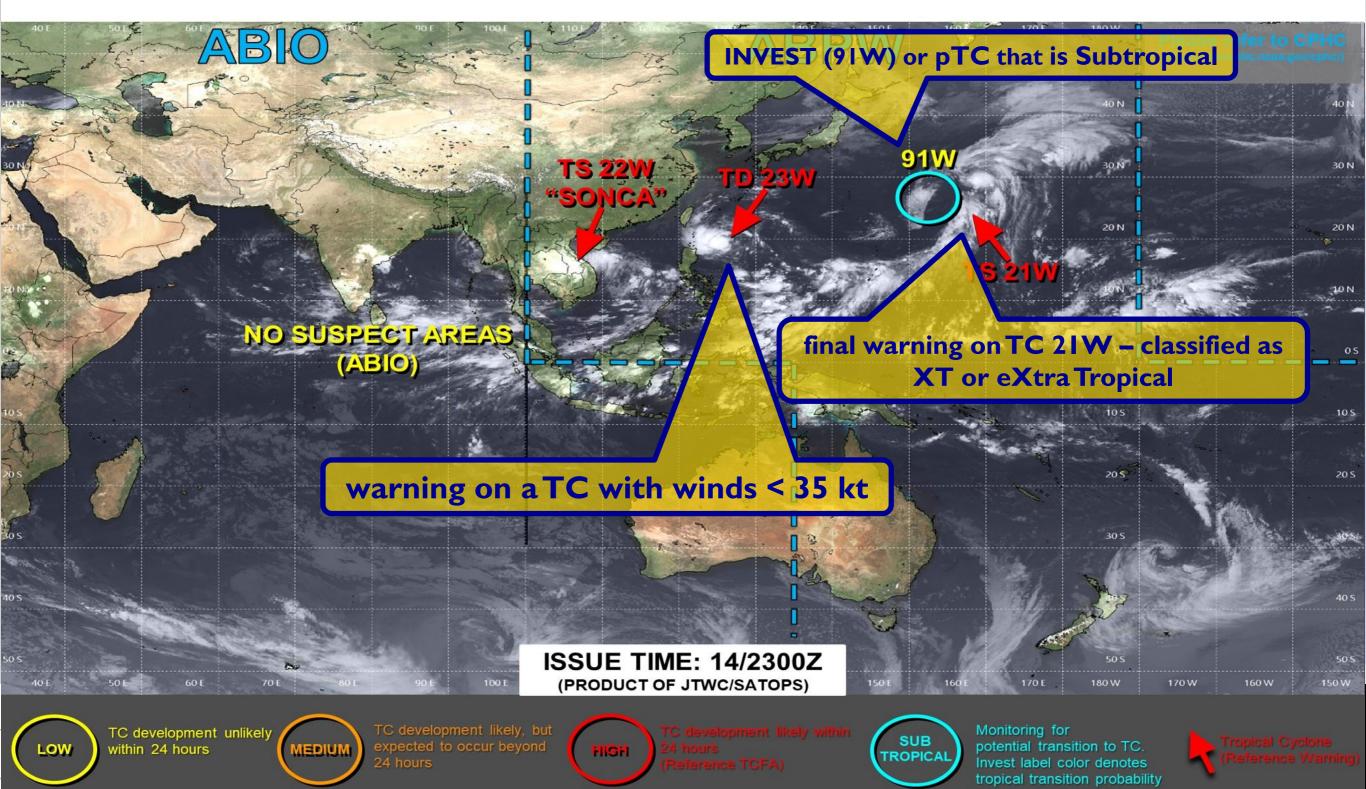








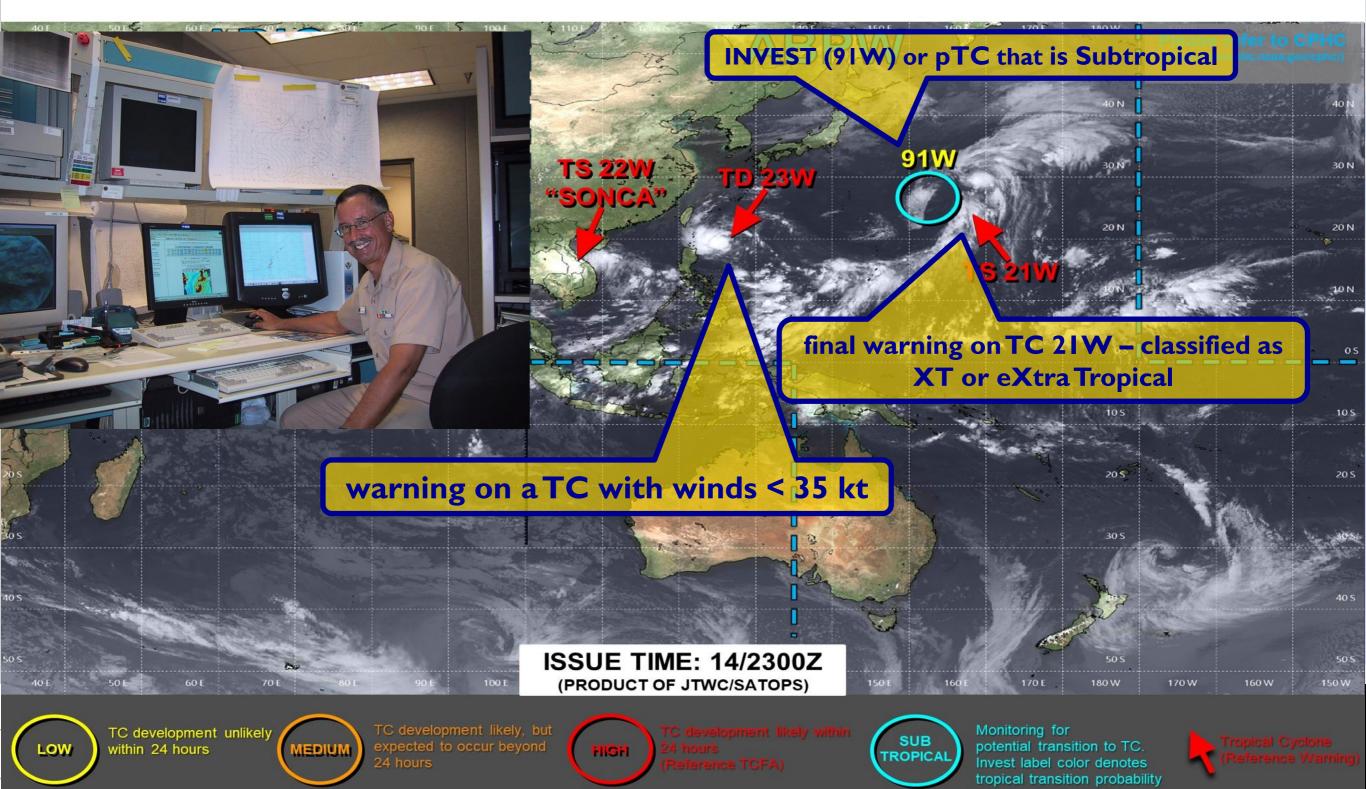






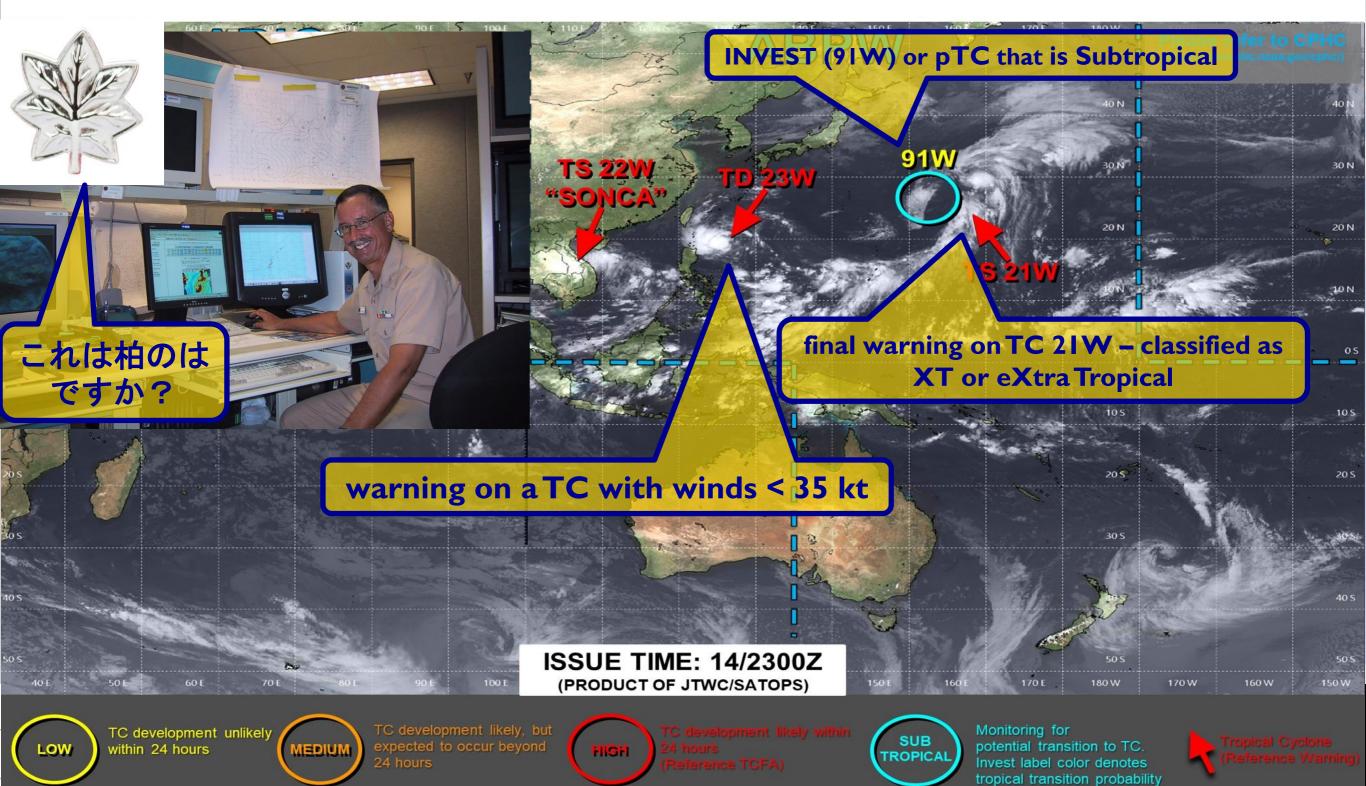
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I6W.2022 NANMODAL 'bdeck' text file /braid1/mfiorino/w22/dat/tc/bdeck/jtwc/bwp162022.dat

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V	VP, 1	6.	2022091412,	, BEST,	Θ.	229N.	1403E,	45,	991,	TS.	34,	NEQ,	110,	130,	100,	35,	1005,	300,	20,	Θ,	Θ,	W,	Θ.		Θ,	Θ,	NANMADOL, M,
			2022091418,	, BEST,	0,	231N.	1398E,	50,	989,	TS.		NEQ,	120,	100,	95,	120.	1003,	300,	20,	Θ,	Θ,	W,	Θ,		Θ,	Θ,	NANMADOL, M,
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			2022091500,	, BEST,			1389E,	55,				NEQ,	40,	30,	Θ,		1002,	300,	25,	Θ,	Θ,	W,	0,		0,	Θ,	NANMADOL, M,
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l l	VP, 1	6,	2022091518,	, BEST,	Θ,	234N,	1364E,	85,	962,	TY,	64,	NEQ,	50,	35,	30,	50,	1003,	345,	25,	Θ,	40,	W,	Θ,		Θ,	Θ,	NANMADOL, D,
V	VP, 1	6,	2022091600,	, BEST,	Θ,	238N,	1358E,	110,	950,	TY,	34,	NEQ,	180,	130,	120,	180,	1003,	345,	20,	Θ,	30,	W,	Θ,		Θ,	Θ,	NANMADOL, D,
N			2022091600,	, BEST,	Θ.	238N.	1358E,	110.	950,	TY.	50,	NEO.	100,	80,	70,	100.	1003,	345,	20,	Θ,	30,	W,	Θ,		0,	Θ,	NANMADOL, D,
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V			2022091612,	, BEST,	Θ,	248N,	1347E,	130,	920,	ST,	34,	NEQ,	185,	175,	150,	185,	1004,	380,	20,	Θ,	30,	W,	Θ,		Θ,	Θ,	NANMADOL, D,
V	VP, 1	6,	2022091612,	, BEST,	Θ,	248N,	1347E,	130,	920,	ST,	50,	NEQ,	105,	100,	85,	105,	1004,	380,	20,	Θ,	30,	W,	Θ,		Θ,	Θ,	NANMADOL, D,
V	VP, 1	6,	2022091612,	, BEST,	Θ,	248N,	1347E,	130,	920,	ST,	64,	NEQ,	55,	55,	45,	55,	1004,	380,	20,	Θ,	30,	W,	Θ,		0,	Θ,	NANMADOL, D,
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V	VP, 1	6,	2022091706,	, BEST,	Θ,	267N,	1325E,	130,	919,	ST,	34,	NEQ,	240,	215,	210,	225,	1004,	400,	15,	Θ,	20,	W,	Θ,		Θ,	Θ,	NANMADOL, D,
			2022091706,	, BEST,	Θ.	267N.	1325E,	130.			50,		130,	110,	105,		1004,	400,	15,	Θ,	20,	W,	0,	36	Θ,	Θ,	NANMADOL, D,
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			2022091712,	, BEST,			1320E,						135,	125,	120,		1005,	400,	15,	0,	15,	W,	Θ,		0,	0,	NANMADOL, D,
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I6W.2022 NANMODAL 'bdeck' text file /braid1/mfiorino/w22/dat/tc/bdeck/jtwc/bwp162022.dat

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	WP,	16,	2022091318,	, BEST,	0,	225N,	1402E,	35,	995,	TS,	34,	NEQ,	0,	100,	0,	Θ,	1003,	190,	30,	Θ,	Θ,	W,	Θ,		Θ,	Θ,	SIXTEEN, S,
	WP,	16,	2022091400,	, BEST,	Θ,	227N,	1404E,	40,	996,	TS,	34,	NEQ,	40,	85,	65,	0,	1004,	190,	30,	Θ,	Θ,	W,	Θ,		Θ,	Θ,	NANMADOL, M,
	11 C		2022091406,	, BEST,	0,	229N,	1406E,	45,	993,	TS,	34,	NEQ,	40,	85,	65,	5.	1004,	300,	30,	Θ,	Θ,	W.	Θ,	10	0,	Θ,	NANMADOL, M,
			2022091412,	BEST,			1403E,	45.	991.		34.	NEQ,	110,	130.	100.		1005.	300.	20.	Θ,	Θ.	W.	Θ.		0,	Θ.	NANMADOL, M,
			2022091418,	BEST.			1398E.	50.	989.	TS.	34.	NEQ.	120,	100.	95,	120.	1003.	300.	20.	Θ,	Θ,	W.	Θ.		0,	Θ,	NANMADOL, M,
	and the second second		2022091418,	BEST.	0.	231N.	1398E,	50,	989,	TS.	50,	NEQ,	50,	Θ.	Θ.	70.	1003.	300,	20,	Θ.	Θ.	W.	Θ.		0,	Θ.	NANMADOL, M,
			2022091500,	BEST.			1389E,	55,			34.	NEQ.	155.	70,	Θ.		1002.	300.	25,	Θ,	Θ,	W.	Θ.		0,	0,	NANMADOL, M,
			2022091500,	BEST,			1389E.	55,	980,	TS,	50,	NEQ.	40,	30,	Θ,	45.	1002,	300,	25,	Θ,	Θ,	W.	Θ.		0,	Θ.	NANMADOL, M,
	Here a second		2022091506,	BEST.	0.	233N.	1381E,	65,			34,	NEQ.	170,	75,	40,	180.		345,	40,	Θ,	Θ,	W.	Θ.		0,	0,	NANMADOL, D,
			2022091506,	BEST.			1381E.	65,				NEQ.	45,	35,	Θ,	40,		345,	40.	Θ,	Θ,	W,	Θ.		0.	0.	NANMADOL, D,
			2022091506,	BEST.				65,				NEQ,	20,	Θ,	Θ,		1003,	345.	40,	Θ,	Θ,	W,	Θ.		0,	0,	NANMADOL, D,
	1.00		2022091512,	. BEST.			1372E,	75.	969,			NEQ,	160,	145,	130.		1003.	345.	25.	85.	Θ,	W.	Θ.		0,	0,	NANMADOL, D,
			2022091512,	BEST,			1372E.	75,		TY,		NEQ.	85,	75,	70.		1003.	345.	25.	85.	Θ.	W,	Θ.		0,	0.	NANMADOL, D,
	1.00		2022091512,	. BEST.				75,					45,	40.	35,		1003,	345.	25.	85,	0,	W.	Θ.		Θ,	0.	NANMADOL, D,
			2022091518,	, BEST,			1364E,	85,		TY,			175,		120,		1003,	345,		0,	40,	W,	Θ,		0,	0.	NANMADOL, D,
	Luito		2022001510	DECT	~	2241	10045	05	000	-	50	NIE O	05	70			1000	245	25	~			~		~	~	

ATCF format – .csv 29 columns (~WMO standard)

- storm id, date-time,
- position: lat, lon,
- intensity: Vmax, pmin,
- classification: SD/SS/LO/DB/TD/MD/TS/TY/STY
- 34/50/65 kt wind radii
- POCI, ROCI (Pressure and Radius of Outermost Closed Isobar)
- eye diameter, Rmax, name
- depth code: S/M/D

16W.2022 NANMODAL 'adeck'

/braid1/mfiorino/w22/dat/tc/bdeck/jtwc/awp162022.dat

				<u> </u>	_ /					•		_ /		/			<u> </u>						Ξ.					
W	P, 1	16,	2022091918,	01,	CARQ,	-24,	332N,	1304E,	70,	0,	TS,	34,	AAA,	0,	Θ,	0,	0,	Θ,	0,	Θ,	Θ,	Θ,	W,	0,	Х,	Θ,	0,	NANMADOL, ,
			2022091918,						60,		TS,		AAA,	Θ,	0,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	W,	0,	Х,	Θ,	Θ,	NANMADOL, ,
			2022091918,						55,		TS,		AAA,	Θ,	0,	Θ,	Θ,	Θ,	0,	0,	Θ,	Θ,	W,	0,	Х,	52,	16,	NAMMADOL
107			2022091918,					1343E,			TS,		AAA,												Х,	Θ,		NANMADOL, ,
1.1									50,					0,	0,	0,	0,	0,	0,	0,	Θ,	0,	W,	0,			0,	NANMADOL, M,
			2022091918,					1371E,	45,				NEQ,	260,	80,	130,		1000,	280,	60,	Θ,	Θ,	W,	0,	х,	55,	20,	
			2022091918,					1371E,	45,				NEQ,	0,	0,	0,		1000,	280,	60,	Θ,	Θ,	W,	0,	Х,	55,	20,	NANMADOL, M,
W			2022091918,					1371E,	45,			64,	NEQ,	0,	Θ,	0,		1000,	280,	60,	Θ,	Θ,	W,	0,	Х,		20,	NANMADOL, M,
W			2022091918,						70,	Θ,		Θ,		Θ,	Θ,	Θ,	Θ,	Θ,	0,	Θ,	Θ,	Θ,		Θ,	SJB,	60,	26,	
W	P, 1	16,	2022091918,	02,	WRNG,	-18,	341N,	1311E,	60,	0,		Θ,		0,	Θ,	Θ,	0,	Θ,	0,	Θ,	Θ,	0,		Θ,	SJB,	60,	26,	
W	Ρ, 1	16,	2022091918,	02,	WRNG,	-12,	350N,	1325E,	55,	Θ,		Θ,		Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,		0,	SJB,	60,	26,	
W	P, 1	16,	2022091918,	02,	WRNG,	-6,	361N,	1343E,	50,	Θ,		0,		Θ,	Θ,	Θ,	0,	Θ,	0,	Θ,	Θ,	Θ,		Θ,	SJB,	60,	26,	
W	P, 1	16,	2022091918,	02.	WRNG,	Θ,	374N.	1371E,	45,	Θ,		0,		Θ,	Θ,	Θ,	0,	Θ,	Θ,	Θ,	Θ,	Θ,			SJB,		26,	
W			2022091918,					1368E,	49,		XX.		NEQ,	232,	230,	217,	287,											
			2022091918,					1402E,	32,				NEQ,	0,	0,	0,	0,											
			2022091918,						29,				NEQ,	Θ,	0,	Θ,	0,											
			2022091918,					1371E,	45,	0,			NEQ,	260,	80,	130,	290,											
			2022091918,					1467E,	34,	Θ,			NEQ,	189,	0,	0,	94,											
			2022091918,					1371E,	45,	Θ,			NEQ,	Θ,	Θ,	0,	0,											
W			2022091918,					1408E,	31,	0,			NEQ,	0,	Θ,	0,	0,											
W			2022091918,					1367E,	52,			34,	NEQ,	0,	Θ,	0,	Θ,											
W	Ρ, Ι	16,	2022091918,	03,	AEMN,	6,	375N,	1396E,	35,	994,	XX,	34,	NEQ,	Θ,	Θ,	Θ,	Θ,											
W	Ρ, 1	16,	2022091918,	03,	AEMN,	12,	391N,	1427E,	33,	998,	XX,	34,	NEQ,	Θ,	0,	Θ,	Θ,											
W	P, 1	16,	2022091918,	03,	AEMN,	18,	408N,	1459E,	30,	1004,	XX,	34,	NEQ,	Θ,	Θ,	0,	Θ,											
W	P, 1	16,	2022091918,	03,	AEMN,	24,	430N,	1491E,		1006,		34,	NEQ,	Θ,	Θ,	0,	Θ,											
W			2022091918,					1371E,	45,	Θ,			NEQ,	260,	80,	130,	290,											
			2022091918,					1412E,	35,	Θ,			NEQ,	221,	0,	0,	138,											
1			2022091918,					1462E,	29,	Θ,			NEQ,	Θ,	0,	Θ,	0,											
			2022091918,					1512E,	24,	0,	1		NEQ,	Θ,	Θ,	Θ,	Θ,											
			2022091918,					1541E,	23,	0,			NEQ,	Θ,	Θ,	Θ,	Θ,											
			2022091918,					1558E,					NEQ,															
									22,	0,				0,	0,	0,	0,											
			2022091918,						21,	0,			NEQ,	0,	Θ,	0,	Θ,											
			2022091918,						19,	0,			NEQ,	0,	Θ,	Θ,	Θ,											
			2022091918,						18,	0,			NEQ,	0,	Θ,	0,	0,											
			2022091918,					1371E,	45,	Θ,			NEQ,	260,	80,	130,	290,											
W			2022091918,					1444E,	35,	0,			NEQ,	151,	12,	0,	97,											
W			2022091918,						27,	Θ,			NEQ,	0,	Θ,	0,	0,											
			2022091918,						19,	Θ,			NEQ,		0,	0,	0,											
			2022091918,					1371E,					NEQ,		80,		290,											
W			2022091918,						34,				NEQ,	130,	14,	Θ,	96,											
W			2022091918,						28,	Θ,			NEQ,	0,	Θ,	Θ,	Θ,											
W			2022091918,						26,	Θ,			NEQ,	0,	Θ,	0,	0,											
W			2022091918,						24,	Θ,			NEQ,	Θ,	Θ,	Θ,	Θ,											
W	P, 1	16,	2022091918,	03,	AGDI,				26,	0,			NEQ,	0,	Θ,	Θ,	Θ,											
W	Ρ, 1	16,	2022091918,	03,	AGDM,	Θ,	360N,	1365E,	44,	992,	XX,	34,	NEQ,	303,	Θ,	79,	240,											
W	P, 1	16,	2022091918,	03,	AGDM,	6,	355N,	1387E,	33,	997,	XX,	34,	NEQ,	Θ,	Θ,	212,	Θ,											
W	P, 1	16,	2022091918,	03,	AGDM,	12,	350N,	1389E,	30,	998,	XX,	34,	NEQ,	Θ,	Θ,	224,	Θ,											
W	P, 1	16,	2022091918,	03,	AGDM,	18,	358N,	1408E,	35,	1004,	XX,	34,	NEQ,	Θ,	Θ,	73,	Θ,											
W			2022091918,											Θ,	Θ,	Θ,	0,											
1000			2022091918,											0,	0,	Θ,	0,											
W			2022091918,											Θ,	Θ,	Θ,	Θ,											
			2022091918,											Θ,	0,	Θ,	Θ,											
			2022091918,											Θ,	Θ,	0,	Θ,											
W			2022091918,											Θ,	0 ,	0,	Θ,											
W			2022091918,											0.	0,	Θ,	Θ,											
	1	101	2022031310,		HODIT,	00,	11511	INZUL,	13,	1010,	int,	54,	HEQ.	91		.,												

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16W.2022 NANMODAL 'adeck'

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		-			-					-	-			•			-		-		-					
1			2022091918,						70,	0, TS,	34, AAA,	0,	Θ,	0,	Θ,	Θ,	0,	Θ,	Θ,	Θ,	W,	0,	Х,	0,	0,	NANMADOL, ,
			2022091918,						60,	0, TS,	34, AAA,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	Θ,	W,	0,	Х,	Θ,	Θ,	NANMADOL, ,
			2022091918,						55,		34, AAA,	Θ,	Θ,	Θ,	Θ,	Θ,	0,	Θ,	Θ,	Θ,	W,	0,	Х,	52,	16,	NANMADOL, ,
	WP,	16,	2022091918,	01,	CARQ,			1343E,	50,	0, TS,	34, AAA,	0,	Θ,	0,	Θ,	Θ,	0,	Θ,	Θ,	Ο,	W,	Θ,	Х,	Θ,	0,	NANMADOL, ,
1	WP,	16,	2022091918,	01,	CARQ,	Θ,	374N,	1371E,	45,	978, TS,	34, NEQ,	260,	80,	130,	290,	1000,	280,	60,	Θ,	Θ,	W,	0,	Х,	55,	20,	NANMADOL, M,
	WP,	16,	2022091918,	01,	CARQ,	Θ,	374N,	1371E,	45,	978, TS,	50, NEQ,	Θ,	Θ,	0,	Θ,	1000,	280,	60,	Θ,	Θ,	W,	0,	Х,	55,	20,	NANMADOL, M,
1	WP,	16,	2022091918,	01,	CARQ,	Θ,	374N,	1371E,	45,	978, TS,	64, NEQ,	0,	Θ,	0,	Θ,	1000,	280,	60,	Θ,	Θ,	W,	0,	Х,	55,	20,	NANMADOL, M,
			2022091918,						70,	Θ, ,	Θ, ,	Θ,	Θ,	Θ,	Θ,	Θ,	0,	Θ,	Θ,	Θ,		0,	SJB,	60,	26,	
			2022091918,						60,	Θ, ,	Θ, ,	0,	Θ,	0,	0,	Θ,	0,	Θ,	Θ,	0,		0,	SJB,	60,	26,	
	WP,	16,	2022091918,	02,	WRNG,	-12,	350N,	1325E,	55,	Θ, ,	Θ, ,	Θ,	Θ,	0,	Θ,	Θ,	0,	Θ,	Θ,	Θ,		0,	SJB,	60,	26,	
1	WP,	16,	2022091918,	02,	WRNG,	-6,	361N,	1343E,	50,	Θ, ,	Θ, ,	Θ,	Θ,	Ο,	Θ,	Θ,	0,	Θ,	Θ,	Θ,		Θ,	SJB,	60,	26,	
	WP,	16,	2022091918,	02,	WRNG,	Θ,	374N,	1371E,	45,	Θ, ,	Θ, ,	Θ,	0,	Θ,	Θ,	Θ,	0,	Θ,	Θ,	Θ,		0,	SJB,	60,	26,	
	WP,	16,	2022091918,	03,	AC00,	Θ,	368N,	1368E,	49,	989, XX,	34, NEQ,	232,	230,	217,	287,											
	WP,	16,	2022091918,	03,	AC00,	6,	384N,	1402E,	32,	995, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AC00,	12,	411N,	1447E,	29,	999, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	ACEI,	Θ,	374N,	1371E,	45,	Θ, ,	34, NEQ,	260,	80,	130,	290,											
	WP,	16,	2022091918,	03,	ACEI,	12,	420N,	1467E,	34,	Θ, ,	34, NEQ,	189,	Θ,	Θ,	94,											
	WP,	16,	2022091918,	03,	AEMI,	Θ,	374N,	1371E,	45,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AEMI,	12,	378N,	1408E,	31,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
1	WP,	16,	2022091918,	03,	AEMN,	Θ,	367N,	1367E,	52,	989, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
1	WP,	16,	2022091918,	03,	AEMN,	б,	375N,	1396E,	35,	994, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
1	WP,	16,	2022091918,	03,	AEMN,	12,	391N,	1427E,	33,	998, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
1	WP,	16,	2022091918,	03,	AEMN,	18,	408N,	1459E,	30,	1004, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
- 1	WP,	16,	2022091918,	03,	AEMN,	24,	430N,	1491E,	28,	1006, XX,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AFUI,	Θ,	374N,	1371E,	45,	Θ, ,	34, NEQ,	260,	80,	130,	290,											
	WP,	16,	2022091918,	03,	AFUI,	12,	381N,	1412E,	35,	Θ, ,	34, NEQ,	221,	Θ,	Θ,	138,											
	WP,	16,	2022091918,	03,	AFUI,	24,	410N,	1462E,	29,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AFUI,	36,	435N,	1512E,	24,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AFUI,	48,	440N,	1541E,	23,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AFUI,	60,	437N,	1558E,	22,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
- 1	WP,	16,	2022091918,	03,	AFUI,	72,	439N,	1549E,	21,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
- 1	WP,	16,	2022091918,	03,	AFUI,	84,	452N,	1519E,	19,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
N			2022091918,					1490E,	18,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
N	WP,	16,	2022091918,	03,	AGD2,	0,	374N,	1371E,	45,	Θ, ,	34, NEQ,	260,	80,	130,	290,											
	WP,	16,	2022091918,	03,	AGD2,	12,	405N,	1444E,	35,	Θ, ,	34, NEQ,	151,	12,	Θ,	97,											
			2022091918,					1529E,	27,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											
	WP,	16,	2022091918,	03,	AGD2,	36,	487N,	1614E,	19,	Θ, ,	34, NEQ,	Θ,	Θ,	Θ,	Θ,											

ATCF format – .csv 29 columns

- operational information including forecaster initial (SJB = Steve Barlow)
- previous I2, 24 h positions
- converted into standard WMO format and sent to operational NWP centers for 'bogussing' or TC vortex analysis/initialization...

bdeck & adeck converted to 'mdeck' or merged deck

- mdeck has all storm information from both data files
- turned into a .py object with 'variables' and 'methods' for easy access in .py
- more significantly ... mdecks for each pTC maintained
 - pTCs are coded as 9XB (X → 0,1,...,10 B → basin ID W-Western North Pacific (0-90N, 100E-180E)
 - in one year there will be multiple 90W
 - each instance is coded with letter. first \rightarrow A, second \rightarrow B
 - 91W from JTWC above is actually H1W or the 8th 91W

actively maintained in .zip files from both centers since
 2007 – the only properly maintained pTC data set

essential for TC genesis studies





222209566 FW. 2022 013 1869 20.00 142.6								٩							
2222000518 F2W, 2022 015 1005 20.7M 141.8E		2022090506	F2W.2022 015 10	05 20.0N	142.6E		313.0	5.1 b	DB NW		1/30	lf: 0.00	INVEST		
2222006060 F2W.2022 015 1085 21.0W 141.9E		2022090512	F2W.2022 015 10	05 20.3N							2/30	lf: 0.00	INVEST		1000
2222090660 FW. 3022 015 1005 20.7H 42.3E		2022090518	F2W.2022 015 10	05 20.7N	141.8E		313.0	5.1 c	DB NW		3/30	lf: 0.00			
2022990612 F2W.2022 015 1065 21.NN 142.22		2022090600	F2W.2022 015 10	05 21.0N	141.9E		345.0	3.6 C	DB NW		4/30	lf: 0.00			
202299018 F2W.2022 053 1066 21.8W 142.3E		2022090606	F2W.2022 015 10	05 20.7N	142.3E		51.3	2.4 c	DB NW		5/30	lf: 0.00			
2022090706 F2m.2022 015 1066 21.9m 142.1E	•	2022090612	F2W.2022 015 10	05 21.2N	142.2E		360.0	3.5 c	DB NW		6/30	lf: 0.00			
2022090760 FPM.2022 015 1006 22.5 N 142.0 E		2022090618	F2W.2022 015 10	06 21.8N	142.3E		338.3	3.8 C	DB NW		7/30	lf: 0.00			
2022000712 F2N.2022 015 1006 22.8 N 11.7 E		2022090700	F2W.2022 015 10	06 21.9N	142.1E		308.9	2.4 c	DB NW		8/30	lf: 0.00			
2222090710 F.W. 2022 015 1008 22.4.N 141.5E		2022090706	F2W.2022 015 10	06 22.2N	142.0E		325.2	2.4 c	DB NW		9/30	lf: 0.00			
2022000000 F.W. 2022 015 1000 24.2N 142.9E	3	2022090712	F2W.2022 015 10	06 22.5N	141.7E		328.3	3.5 c	DB NW		10/30	lf: 0.00			1.5.1
2022090000 F.W. 2022 015 1009 24.7 N 143.0 E		2022090718	F2W.2022 015 10	08 22.8N	141.5E		322.4	3.8 c	DB NW		11/30	lf: 0.00			1000
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2022091910 10W.2022 003 902 25.4W 150.4E 149 00 275.0 0.0 C 11 WN LPC 40/57 C1: 0.00 WAWMADUL														
2022091600 16W.2022 110 950 23.8N 135.8E 152 88 285.0 7.0 C TY WN CRM 41/57 lf: 0.00 NANMADOL		Contraction and an international states of the												
2022091612 16W.2022 130 920 24.8N 134.7E 174 99 310.0 7.0 C ST WN RCB 43/57 lf: 0.00 NANMADOL														
2022091618 16W.2022 135 917 25.5N 133.8E 166 95 315.0 8.0 C ST WN CRM 44/57 lf: 0.00 NANMADOL														
2022091700 16W.2022 130 917 26.0N 133.1E 222 125 310.0 9.0 C ST WN BCH 45/57 lf: 0.00 NANMADOL														
2022091706 16W.2022 130 919 26.7N 132.4E 199 114 315.0 9.0 C ST WN SMB 46/57 lf: 0.00 NANMADOL														
2022091712 16W.2022 125 923 27.6N 132.0E 219 126 325.0 9.0 C TY WN SMB 47/57 lf: 0.00 NANMADOL	- Karana-													
GEORGE 2022091718 16W.2022 115 930 28.5N 131.4E 214 118 330.0 10.0 C TY WN BCH 48/57 lf: 0.00 NANMADOL	GEORGE													
2022091800 16W.2022 105 939 29.7N 131.0E 215 111 335.0 11.0 C TY WN BCH 49/57 lf: 0.00 NANMADOL	VIACONI	A CONTRACT OF A RECEIPTION OF A												
2022091806 16W.2022 095 947 30.7N 130.7E 211 121 340.0 11.0 C TY WN SMB 50/57 lf: 0.08 NANMADOL		the second se												
UNIVERSITY 2022091812 16W.2022 080 958 31.9N 130.6E 222 128 350.0 12.0 C TY WN SMB 51/57 lf: 0.72 NANMADOL	INIVERSITY	2022091812	16W.2022 080 958	31.9N	130.6E	222 128	350.0 1	2.0 C	TY WN	SMB	51/5/	LT: 0.7	2 NANMADOL	

2022090506	F2W.2022 015 1005	20.0N 142.6E	313.0 5.1 b DB NW		lf: 0.00 INVEST		
2022090512	F2W.2022 015 1005	20.3N 141.5E			lf: 0.00 INVEST	T	
2022090518	F2W.2022 015 1005	20.7N 141.8E		3/30	lf: 0.00		
2022090600	F2W.2022 015 1005	21.0N 141.9E			lf: 0.00		
2022090606	F2W.2022 015 1005	20.7N 142.3E		5/30	lf: 0.00		
2022090612 2022090618	F2W.2022 015 1005	21.2N 142.2E 21.8N 142.3E			lf: 0.00		
2022090018	F2W.2022 015 1006 F2W.2022 015 1006	21.8N 142.3E 21.9N 142.1E			lf: 0.00 lf: 0.00		
2022090700	F2W.2022 015 1000	22.2N 142.0E			lf: 0.00		
: 2022090712	F2W.2022 015 1000	22.5N 141.7E			lf: 0.00		
2022090718	F2W.2022 015 1008	22.8N 141.5E			lf: 0.00		
2022090800	F2W.2022 015 1008	24.2N 142.9E		12/30	lf: 0.00		
2022090806	F2W.2022 015 1009	24.7N 143.0E	32.6 5.9 c DB NW	13/30	lf: 0.00		
2022090812	F2W.2022 015 1010	25.2N 143.5E	45.3 6.4 c DB NW	14/30	lf: 0.00		
2022090818	F2W.2022 015 1010	25.2N 140.5E	284.3 6.1 c DB NW	15/30	lf: 0.00		
2022090900	F2W.2022 015 1010	26.4N 144.7E			lf: 0.00		
2022090906	F2W.2022 020 1007	27.1N 145.7E			lf: 0.00		
2022090912	F2W.2022 020 1007	27.4N 146.9E			lf: 0.00		
2022090918	F2W.2022 020 1007	27.3N 147.9E			lf: 0.00		
2022091000 2022091006	F2W.2022 020 1002 F2W.2022 020 1002	26.6N 147.5E 26.6N 147.3E		20/30 21/30	lf: 0.00 lf: 0.00		
2022091000	F2W.2022 020 1002				lf: 0.00		
	W. 2022 000	ADA 21'AM		2 128		12.0 C	
2022091818 16	W.2022 070	965 33.1N	130.5E 22	2 131	355.0	11.0 C	
2022091900 16	W.2022 060	975 34.1N	131.1E 21	6 120	5.0	11.0 C	
2022091906 16	W.2022 055	971 34.8N	132.4E 23	9 96	25.0	11.0 C	
2022091912 16	W.2022 050	971 36.1N	134.3E 25	0 00	45.0	14 0 0	
						14.0 C	
	W.2022 045	978 37.4N	137.1E 19			20.0 C	
2022092000 16	W.2022 040	993 38.5N	141.2E 19	1	66.4	29.9 C	
2022 16W STY NANM	IADOL :135	: 7.2;14.8	: 25.5 139.	3:09	90506<->	092000	
2022031410		73.1M 133.0E 103 00	303.0 2.0 C IS WIN	יכוסכ ויייו	LI: 0.00 NANHAL	DOL	
IT WIN SUR 21/2	/ LI: 0./Z	NANMADUL					
TY WN BCH 52/5	7 lf: 0.75	NANMADOL					
TS WN BCH 53/5	7 lf: 0.51	NANMADOL					
TS WN MEK 54/5	7 lf: 0.73	NANMADOL					
TS WN MEK 55/5							
TS WN SJB 56/5							
		IN AN ADOL					
EX NW 57/5	7 lf: 0.77						

: 20.0<->38.5 6:ddED :tG:180 9X: F2W 1st: 091218 :130.5<->147.9 : 8. 4: 5:

		wZ-u		-ani.py -	5 IUW.22		
	2022090506	F2W.2022 015 1	005 20.0N 142.6E	313.0 5.1 b DB NW	- 1/30 lf: 0.00 INVE	ST	
	2022090512	F2W.2022 015 1	005 20.3N 141.5E	313.0 5.1 b DB NW	- 2/30 lf: 0.00 INVE	ST	
	2022090518	F2W.2022 015 1	005 20.7N 141.8E	313.0 5.1 c DB NW			
	2022090600	F2W.2022 015 1					
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•	2022090612	F2W.2022 015 1					
	2022090618	F2W.2022 015 1					
• • • •	2022090700 2022090706	F2W.2022 015 1 F2W.2022 015 1		308.9 2.4 c DB NW 325.2 2.4 c DB NW			
	2022090712	F2W.2022 015 1		328.3 3.5 c DB NW			
	2022090718	F2W.2022 015 1		322.4 3.8 c DB NW			and the second second
	2022090800	F2W.2022 015 1			- 12/30 lf: 0.00		
	2022090806	F2W.2022 015 1			- 13/30 lf: 0.00		
	2022090812	F2W.2022 015 1	010 25.2N 143.5E	45.3 6.4 c DB NW	- 14/30 lf: 0.00		
	2022090818	F2W.2022 015 1		284.3 6.1 c DB NW			and the state
	2022090900	F2W.2022 015 1					
	2022090906	F2W.2022 020 1					
	2022090912 2022090918	F2W.2022 020 1	007 27.4N 146.9E 007 27.3N 147.9E				
	2022091000	F2W.2022 020 1		153.0 3.9 c DB NW			
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	2022091012		002 26.8N 146.6E				A TRANSPORT
21816022031812		ZUZZ UN				12.0 L	and the second second
							All stars and stars
2022091818	16W.	2022 07	0 965 33.1N	130.5E 222	131 355.0	11.0 C	
000000000							and the second second
2022091900	16W.	2022 06	0 975 34.1N	131.1E 216	120 5.0	11.0 C	CONCEPTS:
000000000	1.610	2022 05	5 071 34 ON	122 45 220	05 25 0	11 0 0	and the
2022091906	TOM.	2022 05	5 971 34.8N	132.4E 239	96 25.0	11.0 C	Carl Harden I.
000001010	1.600	2022 05	0 071 26 1N	124 25 250	00 45 0	14 0 6	Martin Martin
2022091912	TOM.	2022 05	0 971 36.1N	134.3E 250	88 45.0	14.0 C	Contraction of the
022091918	1.6W	2022 04	5 978 37.4N	137.1E 190	55.0	20.0 C	Second A L'I'''
022091910	TOM.	2022 04	5 576 57.4N	137.16 190	35.0	20.0 C	
2022092000	16W	2022 04	993 38.5N	141 2F 191	66 4	29.9 c	
					00.4	20.0 0	
2022 16W ST	Y NANMAD)OL :1	35 : 7.2;14.8	: 25.5 139.3	: 090506<->	>092000	
					summary	stats	
IT WIN SHIB	2022021410		Z NANMADUL		an a		
			The second se	ED – Explos	sive Deenii	hσ >= 50	kt / 24 h
TY WN BCH	52/57	lf: 0.7	5 NANMADOL	$\mathbf{LP} = \mathbf{L}\mathbf{v}\mathbf{p}\mathbf{r}\mathbf{v}$		18 - 30	
TS WN BCH	53/5/	LT: 0.5	1 NANMADOL				
TO WAL MEN	54/57	14.07	2 MANMADOL				
TS WN MEK	54/5/	LI: U./	3 NANMADOL				
TS WN MEK	55/57	1f. 0 1	1 NANMADOL				
TS WN SJB	56/57	lf: 0.1	6 NANMADOL				
EX NW	57/57	lf: 0.7	1				
				5 4 6 4	dED .+C.190	OV. COM	1ct. 001010
: 20.0<->38	. J.	.)<->14/	.9 : 8.2 :11.6	: 5: 4: 0:0	UED : (0:190	9X: FZW	120: 031219

		W Z	LL U	55 IIIUZ	ant.F	y S	TOM. 22			
	2022090506	F2W.2022 015	1005 20.0N	142.6E	313.0 5.1 b	DB NW	1/30 lf: 0.00 INVE	ST	all of the second	
	2022090512			141.5E			2/30 lf: 0.00 INVE	ST		
	2022090518			141.8E			3/30 lf: 0.00			
•	2022090600			141.9E			4/30 lf: 0.00			
•	2022090606	F2W.2022 015			51.3 2.4 c		5/30 lf: 0.00			
	2022090612 2022090618			142.2E 142.3E			6/30 lf: 0.00 7/30 lf: 0.00			
	2022090700			142.1E			8/30 lf: 0.00		and the second	
• • •	2022090706			142.0E			9/30 lf: 0.00			
	2022090712			141.7E			0/30 lf: 0.00		and the second	
	2022090718	F2W.2022 015	1008 22.8N	141.5E	322.4 3.8 c	DB NW 1	1/30 lf: 0.00			
	2022090800			142.9E					and the second second	
	2022090806			143.0E					and the second	
	2022090812			143.5E						
	2022090818 2022090900			140.5E 144.7E					and the second	
	2022090906			145.7E					and the second of the	
	2022090912			146.9E			.8/30 lf: 0.00		States and the second	
	2022090918			147.9E			9/30 lf: 0.00			
	2022091000	F2W.2022 020	1002 26.6N	147.5E			0/30 lf: 0.00			
	2022091006			147.3E					1.100.001	
	2022091012			146.6E						
022091812	TOM.	2022 08	20 226	2 3T'AM	130.0E	222 1	.28 350.0	12.0 C	Call Str. E and	
022091818	16W.	2022 0	70 965	5 33.1N	130.5E	222 1	31 355.0	11.0 C	BOR STAN	
022091900	16W	2022 00	50 975	5 34.1N	131.1E	216 1	20 5.0	11.0 C	12.45	
022091906	16W.	2022 05	55 971	1 34.8N	132.4E	239	96 25.0	11.0 C	Call of the second	
022091912	16W	2022 0	50 971	36 1N	134.3E	250	88 45.0	14.0 C	Anter and the set	
	S	ummar	'y stats						Bernard Bernard	
022091918	16W.	.2022.04	12 978	3 37.4N	137.1E	190 -	55.0	20.0 C	EBB 1	
022092000	16W.	20 SAC	Ea 993	38.5N	141.2E	191 -	66.4	29.9 C		
	Y NANMAD	101 .	134 7	2 14 9	. 25 5 1	120 2 .	000506	002000	and the second second	
the second se				.2,14.0		199.9	summary	stats	11 11 118	
IT WIN SHIB	31/3/		Z NAM		303.0 2.0 0					
TY WN BCH		lf: 0.		IAE OL	ED – Ex	xplosiv	ve Deepi	ng >= 5() kt / 24 h	
								0		
TS WN BCH	53/57	lf: 0.	DI NAM	IALIOL						
TS WN MEK	54/57	lf: 0.	73 NA 📗	IA DOL						
TS WN MEK		lf: 0.	11 NAN	DOL						
TS WN SJB		lf: 0.								
				DOL						
EX NW	5//5/	lf: 0.	//	V						
: 20.0<->38.	5 :130	.5<->14	7.9:8	3.2 :11.6	: 5: 4:	6:ddE	D :tG:180	9X: F2W	1st: 091218	

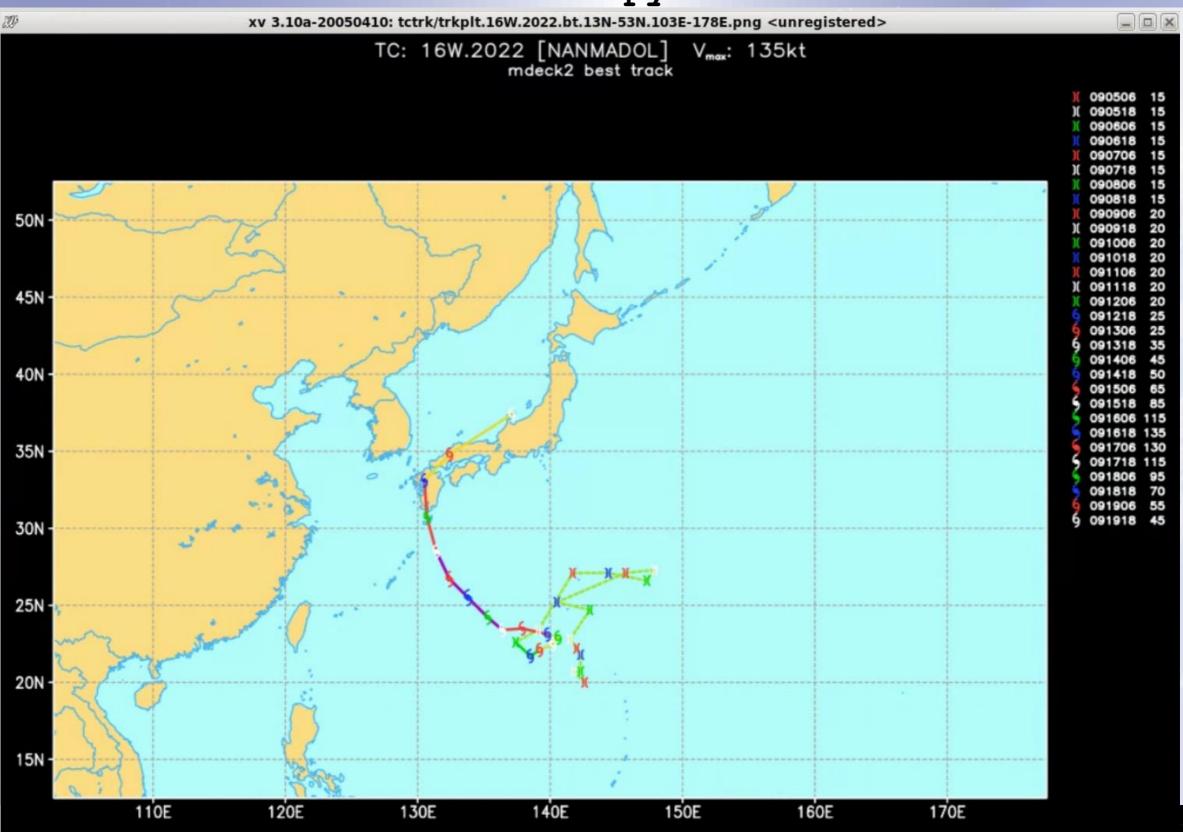
		wZ-	LC-us	55-muz	-ani . b	y -3	TOM.	22			
	2022090506	F2W.2022 015 1	005 20.0N	142.6E	313.0 5.1 b D	B NW	1/30 lf: 0.00	INVEST			
	2022090512	F2W.2022 015 1	005 20.3N	141.5E	313.0 5.1 b D	DB NW	2/30 lf: 0.00	INVEST			
	2022090518	F2W.2022 015 1			313.0 5.1 c D		3/30 lf: 0.00				
•	2022090600			141.9E			4/30 lf: 0.00				
•	2022090606				51.3 2.4 c [5/30 lf: 0.00				
	2022090612			142.2E			6/30 lf: 0.00				
	2022090618 2022090700			142.3E 142.1E			7/30 lf: 0.00 8/30 lf: 0.00			12.84	
• • • •	2022090706			142.0E			9/30 lf: 0.00				
	2022090712			141.7E						and the second second	
	2022090718			141.5E						and the	
	2022090800			142.9E			12/30 lf: 0.00			and the second second	
	2022090806			143.0E						and the second second	
	2022090812			143.5E						14 19	
	2022090818			140.5E							
	2022090900			144.7E						Contract of the second	
	2022090906 2022090912			145.7E 146.9E						Contraction (States Street	
	2022090918			147.9E						All and a set	
	2022091000			147.5E						Call Harrison 15	
	2022091006			147.3E						1.	
	2022091012	F2W.2022 020 1	002 26.8N	146.6E	284.0 4.1 c D	DB NW 2				des Repairs 1	
022091812	TOM.	2022 08	928	31.9N	130.0E	ZZZ I	128 300	.0 12.0	J L	all the c	
022091818	161	2022 07	0 965	33.1N	130.5E	222 1	121 255	.0 11.0	0.0	and the second	
022091010										The second second	M
022091900	16W.	2022 06	0 975	34.1N	131.1E	216 1	120 5	.0 11.0	9 C	The second second	
000000000	1.614	2022 05	5 071	24 ON	122 AE	220	06 25	0 11 (a c	and I	
022091906	TOM.	2022 05	5 971	34.8N	132.4E	239	96 25	.0 11.0	a c :	Same a Sta	
022091912	16W	2622 05	0	36.1N	134.3E	250	88 45	.0 14.0	0 C ·	SEC.	
	S	ummary	y stats	37 411						Section and the	
022091918	TOM.	2022 04	2 9/8	37.4N	137.1E	190 -	22	.0 20.0	a C .		
022092000	16W.	sAC	Ea 993	38.5N	141.2E	191 -	66	.4 29.9	9 с		
	and an and a second second second	Mariana an				20.2	000500		000		
022 10W SI	Y NANMAL	JOL :1) : /	.2,14.8	: 25.5 1	39.3	summa	ry state	100	199	
summ	nary stat	Sow.2022 000	70 7 23.1N	179. 16 TAA AA			3,9,11,11,10,0	W WINDOL		B 2 - 131	
	32/3/	LI. 0.7			$FD = F_{y}$	nlosi		$nin\sigma >$	= 50) kt / 24 h	
TY WIat/lo	n range	e lt: 0.7	5 NANM	AUOL		piosi		Ping -	_ 50		
TS WN BCH	55/57	11: 0.5	1 NANM	AT/OL							
TS WN MEK	54/57	lf: 0.7	3 NA M	A DOL							
TS WN MEK	55/57	lf: 0.1	1 NANM	DOL							
				and the second							
TS WN N	50/5/	lf: 0.1	O NAM	DOL							
EX NW	57/57	lf: 0.7	7								
				2 11 6		6.ddp	n .+c. 1	PA AV	E214	1ct. 0010	10
: 20.0<->38.	э :130	. 5<->14/	.9:8	.2 :11.0	D: 4:	0:00E	0 :00:10	50 9X:	FZW	120: 0915	10

		WZ U	.c us		ant.p	y ~	, т	0w.22				
	2022090506	F2W.2022 015 10	05 20.0N 1	L42.6E	313.0 5.1 b D	B NW	1/30	lf: 0.00 INVES	T			
	2022090512				313.0 5.1 b DI			lf: 0.00 INVES	ST			
	2022090518				313.0 5.1 c D			lf: 0.00				
•	2022090600 2022090606	F2W.2022 015 10 F2W.2022 015 10		141.9E	345.0 3.6 c DI 51.3 2.4 c DI			lf: 0.00 lf: 0.00				
·	2022090612				360.0 3.5 c DI			lf: 0.00				
	2022090618				338.3 3.8 c DI			lf: 0.00				
	2022090700				308.9 2.4 c DI		8/30	lf: 0.00				
	2022090706				325.2 2.4 c DI			lf: 0.00				
	2022090712				328.3 3.5 c DI							
	2022090718 2022090800				322.4 3.8 c Di 40.0 7.8 c Di						a series of	
	2022090806				32.6 5.9 c DI							
	2022090812	F2W.2022 015 10	10 25.2N 1	L43.5E	45.3 6.4 c DI	B NW	14/30	lf: 0.00			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	2022090818				284.3 6.1 c DI						and the stand	
	2022090900				59.5 8.9 c DI			lf: 0.00			and a state of the	
	2022090906 2022090912				63.1 11.0 c DE 74.3 11.1 c DE						Contraction Contraction	
	2022090918				86.4 8.0 c DI						Maria Charles	
	2022091000				153.0 3.9 c DI						1990 - 19 M	
	2022091006				209.1 4.6 c DI						A Part of the second	
	2022091012				284.0 4.1 c DE				10-26 - DE	THE ST	and the second second	
022091812		2022 080		31.9N	130.0E	222	120	320.0	12.0	C	Charles M. E. W.	
022091818	16W.	2022 070	965	33.1N	130.5E	222	131	355.0	11.0	C	1. Car . 18 3	
022091900	TOW	2022 060	975	34.1N	131.1E	216	120	5 0	11.0	C	- Barton	
022091906	16W.	2022 055	5 971	34.8N	132.4E	239	96	25.0	11.0	C	Carl 4 the	
022091912	16W.	ummary	state	36.1N	134.3E	250	88	45.0	14.0	C	320 Labor	
022091918	160	unnary	Stats	37 4N	137.1E	190		55 0	20.0	C	STER TO M	
	1011.	sACE	d									
022092000	16W.	2022 64	993	38.5N	141.2E	191		66.4	29.9	C		
022 16W ST	Y NANMAL	UL :1:	: 7	.2,14.8	: 25.5 1	39.3		10506<->	09200	00		
summ	nary stat	SUN. 2022 000 5	0, 73.TM T	133. NE 103 00			sur	nmary s	stats		12.00 110	
IT WIN SPID	51/5/	UL: 0.74	2 NANPI	ADUE		nloci	NO	Dooni		- 50	1/+ / 7/h	
TY WN lat/lo	on range	e lf: 0.7	5 NANM/	AL OL		hiosi	ve	Deepii	ig	- 50	kt / 24 h	
TS WN BCH	55/57	lf: 0.5	L NANM	IOL								
									sumr	nary	y stats	
TS WN MEK		lf: 0.7		DOL						•		
TS WN MEK	55/57	lf: 0.1	I NAN 🛛	DOL				time	to ge	nes	sis and pTC	
TS WN JE	56/57	lf: 0.10	5 NANN	DOL								
EX NW		lf: 0.7										
						a		+0.100	aw =	-	3	
: 20.0<->38.	5 :130	.5<->147	.9:8	.2 :11.6	: 5: 4:	0:0df	ED :	τG:180	9X: F	ZW	1st: 091218	

16

16W.2022 SuperTyphoon NANMODAL

w2-tc-dss-md2-anl.py -S 16w.22 -X



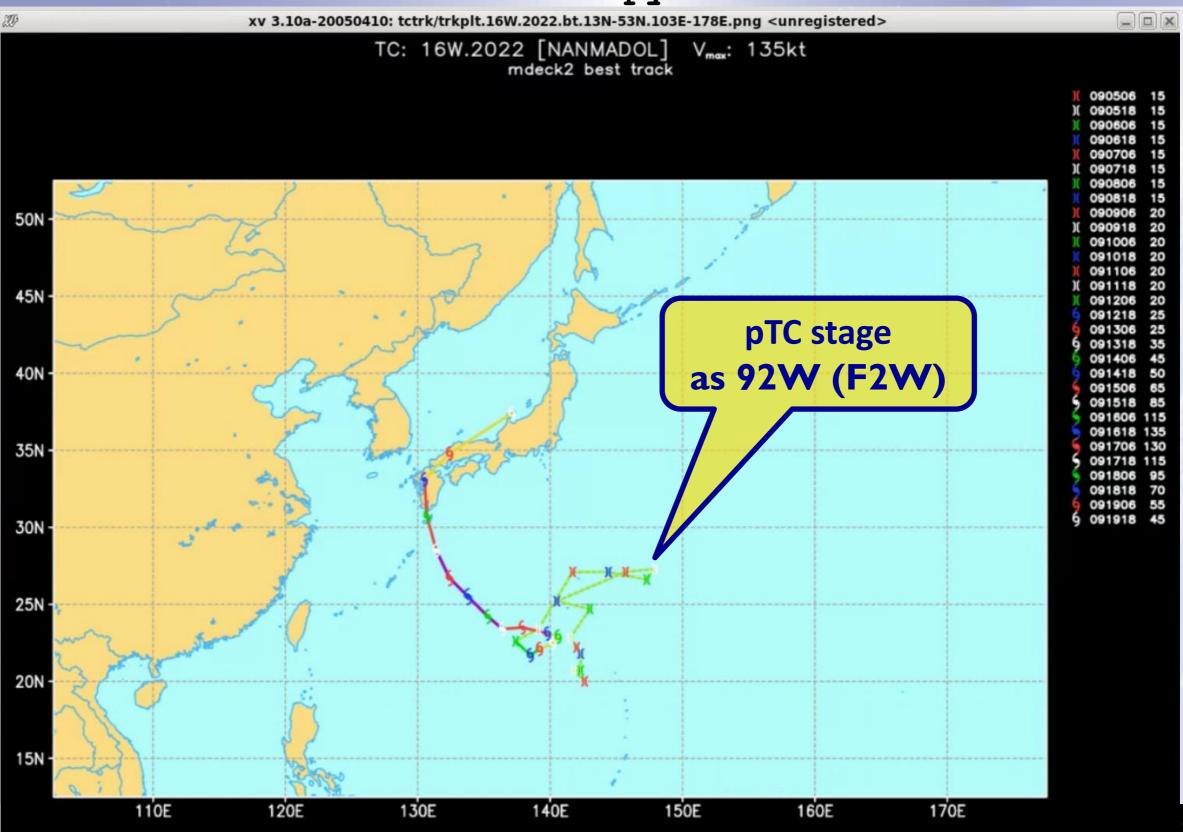




16

16W.2022 SuperTyphoon NANMODAL

w2-tc-dss-md2-anl.py -S 16w.22 -X







WPAC 2022 summary w2-tc-dss-md2-anl.py -S w.22 -s

		0.17 6.000		17 - 5	I data (-22 (d	the state of the	de al. (de la 10000 11							
								deck/jtwc/2022 10						بدائية مترافقت	
2022 01W		ONE								:105.0<->120.7 : 0.3					3W 1st: 033012
2022 02W	TY	MALAKAS	:115 :	8.8;13	3.8 :	11.3 1	145.2 :	040206<->041600	: 3.5<->34.4	:135.1<->161.9 : 8.9	9 :10.5 :	4: 0	: 4:ddRI	:tG:114 9X: A	5W 1st: 040700
2022 03W	TS	MEGI	: 40 :	2.8;14	4.0 :	9.3 1	133.5 :	033006<->041306	: 6.1<->11.5	:124.0<->155.5 : 0.9	9:0.2:	0: 0	: 0:	:tG:234 9X: A	4W 1st: 040900
2022 04W	TY	CHABA	: 75 :	4.2; 8	8.5 :	18.4 1	16.5 :	062518<->092800	: 13.7<->26.5	:110.5<->130.4 : 2.8	3:2.2:	0: 0	: 2:ddRW	:tG: 96 9X: E	7W 1st: 062918
2022 05W		AERE								:126.5<->146.2 : 3.					BW 1st: 063012
2022 06W		SONGDA								:122.8<->138.7 : 1.1					4W 1st: 072900
2022 07W		TRASES								:126.1<->130.8 : 0.1					5W 1st: 080100
2022 08W		EIGHT								:112.8<->119.6 : 0.					5W 1st: 080400
2022 09W		MEARI								:135.8<->149.2 : 1.0					OW 1st: 081106
2022 10W		MA-ON								:102.7<->160.8 : 3.0					
2022 11W		TOKAGE								:148.5<->165.7 : 4.0					
2022 12W		HINNAMNOR								:124.5<->155.6 :14.					
2022 13W	TD	THIRTEEN	: 30 :	1.5; 9	9.8 : 3	20.8 1	136.0 :	082300<->090118	: 18.2<->24.5	:123.3<->143.2 : 0.4	4 : 0.0 :	0:0	: 0:	:tG:186 9X: D	3W 1st: 083018
2022 14W	TY	MUIFA	:115 :	9.8;13	3.0 : 1	24.6 1	130.0 :	090312<->091612	: 17.0<->40.8	:120.2<->147.1 : 9.9	9 :11.7 :	3: 0	: 4:ddRI	:tG: 72 9X: G	IW 1st: 090612
2022 15W	TY	MERBOK	: 70 :	5.2; (5.8 : 1	26.9 1	161.9 :	090900<->091518	: 20.0<->48.3	:157.5<->170.0 : 3.9	9:3.2:	0: 0	: 0:	:tG: 42 9X: X	KW 1st: 091018
2022 16W	STY	NANMADOL	:135 :	7.2;14	4.8 :	25.5 1	139.3 :	090506<->092000	: 20.0<->38.5	:130.5<->147.9 : 8.2	2 :11.6 :	5: 4	: 6:ddED	:tG:180 9X: F	2W 1st: 091218
2022 17W	TD	TALAS								:134.8<->141.2 : 0.0					W 1st: 092118
2022 18W		NORU								:102.9<->134.7 : 7.					
2022 19W		KULAP								:141.6<->167.2 : 3.1					5W 1st: 092518
2022 20W		ROKE								:131.7<->163.8 : 5.1					
2022 21W*										:151.1<->158.5 : 1.0					OW 1st: 101212
2022 22W		SONCA								:107.5<->119.2 : 0.4					OW 1st: 101212
2022 22W															7W 1st: 101400
										:126.6<->147.2 : 0.					W 151: 101410
2022 A0W										:126.0<->132.0 : 0.0					
2022 A1W										:113.7<->132.4 : 0.0					
2022 A2W										:130.6<->135.4 : 0.0					
2022 A3W										:110.0<->120.7 : 0.0					LW.2022
2022 A4W										:126.6<->155.5 : 0.0					
2022 A5W								040206<->040618		:147.6<->161.9 : 0.0					
2022 A6W								040618<->041006		:113.5<->117.4 : 0.0					
2022 A7W								041612<->041706		:136.8<->138.4 : 1.4					
2022 A8W										:107.2<->122.2 : 0.0	0:0.0:	0:0	: 0:		
2022 A9W								042906<->043012		:141.4<->145.4 : 0.0					
2022 BOW	TD		: 20 :	0.0; (5.2 :	15.8 1	125.8 :	070806<->071412	: 9.4<->22.4	:119.6<->131.3 : 0.0	9:0.0:	0: 0	: 0:		
2022 B1W	TD		: 15 :	0.0; 2	2.0 :	6.5 1	130.4 :	051012<->051212	: 5.8<->8.3	:126.5<->136.2 : 0.0	0:0.0:	0: 0	: 0:		
2022 B2W	TD		: 15 :	0.0; 1	1.0 :	4.0 1	132.1 :	052406<->052506	: 3.7<->4.4	:131.3<->133.0 : 0.0	0:0.0:	0: 0	: 0:		
2022 B3W								052712<->053100		:125.8<->137.2 : 0.0	9:0.0:	0: 0	: 0:		
2022 B4W								060112<->060300		:163.4<->171.2 : 0.0					
2022 B5W								060612<->060712		:131.6<->136.3 : 0.0					
2022 B6W								060618<->060712							
2022 B7W										:115.8<->130.4 : 0.0					
2022 B8W										:129.1<->135.5 : 0.0					
2022 BOW										:106.0<->114.2 : 0.0					
and the second s										:136.6<->147.5 : 0.0					
2022 COW															
2022 C1W										:134.2<->145.1 : 0.0					
2022 C2W										:136.9<->143.2 : 0.0					
2022 C3W										:136.9<->146.8 : 0.0					
2022 C4W	TD		: 25 :	0.0:0	0.8 :	24.1 1	37.6 :	072800<->072818	: 21.6<->25.7	:136.8<->138.7 : 0.1	2 : 0.0 :	0:0	: 0:		







WPAC 2022 summary w2-tc-dss-md2-anl.py -S w.22 -s

	.no@tenki7-m3 /data/w22/dat/tc/bdeck/jtwc/2022 1032 > md2a -S w -s
2022 01W TD ONE	: 30 : 0.8; 4.2 : 11.3 112.3 : 032800<->040106 : 6.5<->15.1 :105.0<->120.7 : 0.2 : 0.0 : 0: 0: 0: 0: :tG: 60 9X: A3W 1st: 033012
2022 02W TY MALAKAS	:115 : 8.8;13.8 : 11.3 145.2 : 040206<->041600 : 3.5<->34.4 :135.1<->161.9 : 8.9 :10.5 : 4: 0: 4:ddRI :tG:114 9X: A5W 1st: 040700
2022 03W TS MEGI	: 40 · 2 8·14 A · 9 3 133 5 · A33006<->A41306 · 6 1<->11 5 ·124 A<->155 5 · A 9 : 0.2 : 0: 0: 0: 0: :tG:234 9X: A4W 1st: 040900
2022 04W TY CHABA	: 0 : 4.2; 8.5 : 18.4 116.5 : 062518<->092800 : 13.7<->26.5 :110.5<->130.4 : 2.8 2.2 : 0: 0: 2:ddRW :tG: 96 9X: E7W 1st: 062918
2022 05W TS AERE	: 45 : 7.5;14.0 : 27.1 135 5 : 062700<->071100 : 5.8<->43 0 : 126 5<->146.2 : 3.5 : 1.2 : 0: 0: 0: :tG: 84 9X: B8W 1st: 063012
2022 06W TD SONGDA	30 : 3.2; 5.5 9 of 24 storms did RI 138.7 : 1.1 : 1.0 : 0: 0: 0: :tG: 24 9X: C4W 1st: 072900 30 : 0.5; 4.5 9 of 24 storms did RI 130.8 : 0.1 : 1.0 : 0: 0: 0: :tG: 96 9X: C5W 1st: 080100
2022 07W TD TRASES	
2022 08W TD EIGHT	: 25 : 0.2; 3.2 : 20.6 117.3 : 080106<->080412 : 17.2<->23.2 :112.8<->119.6 : 0.1 : 0.0 : 0: 0: 0: : tG: 66 9X: C6W 1st: 080400
2022 09W TS MEARI	Rapid Intensification (30 kt / 24 h) 1.8 : 0: 0: 0: :tG: 60 9X: COW 1st: 081106 .2 : 1: 0: 1:ddRI :tG:162 9X: D3W 1st: 082112
2022 10W TS MA-ON 2022 11W TY TOKAGE	
2022 11W TY TOKAGE 2022 12W STY HINNAMNOR	: 95 : 4.2; 5.2 : 32.7 152.2 : 082100<->082606 : 21.5<->48.8 :148.5<->165.7 : 4.0 : 1.3 : 5: 0: 4:ddRI :tG: 30 9X: D9W 1st: 082206 :140 : 9.2;17 5 : 26 1 0 D 06<>099618 : 17 8<->47 2 : 4. = D 6 :14.5 :2 : : :::::::::::::::::::::::::::
2022 12W STT HINNAPHOR	140 : 9.2;14 of 19 Rostorms did ED : 14.5 : 2: .: .: .: .: .: .: .: .: .: .
2022 14W TY MUIFA	115 : 9.8; 13.0 . 24.6 130.0 . 050512 . 050512 . 17.0 . 40.0 . 120.2 . 217.1 : 9.9 :11.7 . 5: 0: 4:ddRI :tG: 72 9X: GlW 1st: 090612
2022 15W TY MERBOK	
2022 16W STY NANMADOL	Explosive Deepening (50kt / 24h) 1.6 : 5: 4: 6:ddED :tG: 180 9X: F2W 1st: 091018
2022 17W TD TALAS	: 0 : 2.2; 3.2 : 25.7 137.8 : 091906<->092412 : 10.9<->33.9 :134.8<->141.2 : 0.6 > 0.0 : 0: 0: 0: 0: :tG: 60 9X: F4W 1st: 092118
2022 18W STY NORU	:146, S.E . 10.5 IEEE . SECONDER . 15.5
2022 19W TY KULAP	: 65 : 3.8; 8.2 : 22.4 147.9 : 092112<->092918 : 8.3<->48.6 :141.6<->167.2 : 3.3 : 2.7 : 0: 0: 0: :tG:102 9X: F6W 1st: 092518
2022 20W TY ROKE	: 85 : 5.0; 9.5 : 27.9 144.0 : 092512<->100500 : 12.4<->39.9 :131.7<->163.8 : 5.1 : 4.3 : 4: 1: 1:ddED :tG: 66 9X: E7W 1st: 092806
	: 40 : 2.8; 4.5 : 17.5 153.9 : 101012<->101500 : 13.5<->29.6 :151.1<->158.5 : 1.0 : 0.3 : 0: 0: 0: :tG: 48 9X: E9W 1st: 101212
2022 22W* TS SONCA	: 35 : 1.2; 4.0 : 13.3 114.3 : 101100<->101500 : 11.3<->15.7 : 107.5<->119.2 : 0.4 : 0.1 : 0: 0: 0: : tG: 72 9X: FOW 1st: 101400
2022 23W* TD TWENTYTHR	: 25 : 0.5; 7.8 : 16.1 140.2 : 100706<->101500 : 11.6<->20.3 :126.6<->147.2 : 0.1 : 0.0 : 0: 0: 0: : tG:180 9X: F7W 1st: 101418
2022 AOW TD	: 20 : 0.0; 3.2 : 5.6 127.8 : 043012<->050318 : 5.0<->6.1 :126.0<->132.0 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 20 : 0.0; 5.5 : 9.4 121.5 : 012306<->012818 : 7.3<->15.1 :113.7<->132.4 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 15 : 0.0; 1.0 : 7.1 133.4 : 032500<->032600 : 6.8<->7.5 :130.6<->135.4 : 0.0 : 0.0 : 0: 0: 0: :
	: 20 : 0.0; 2.5 : 9.8 115.5 : 032800<->033012 : 6.5<->12.3 :110.0<->120.7 : 0.0 : 0.0 : 0: 0: 0: 0: : NN: 01W.2022
	: 20 : 0.0; 9.8 : 8.6 136.9 : 033006<->040900 : 6.1<->10.9 :126.6<->155.5 : 0.0 : 0.0 : 0: 0: 0: 0: 0:
	: 20 : 0.0; 4.5 : 4.2 153.7 : 040206<->040618 : 3.5<->4.8 :147.6<->161.9 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 15 : 0.0; 3.5 : 7.9 115.6 : 040618<->041006 : 5.7<->10.7 :113.5<->117.4 : 0.0 : 0.0 : 0: 0: 0: 0: 0: 0:
	: 90 : 0.8; 0.8 : 21.5 137.4 : 041612<->041706 : 19.5<->23.9 :136.8<->138.4 : 1.4 : 0.0 : 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0:
	: 15 : 0.0; 2.8 : 7.0 114.5 : 042700<->042918 : 3.1<->10.8 :107.2<->122.2 : 0.0 : 0.0 : 0: 0: 0: 0: : 15 : 0.0; 1.2 : 3.1 143.0 : 042906<->043012 : 2.6<->3.4 :141.4<->145.4 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 15 : 0.0; 1.2 : 3.1 143.0 : 042906<->043012 : 2.6<->3.4 :141.4<->145.4 : 0.0 : 0.0 : 0: 0: 0: : 20 : 0.0; 6.2 : 15.8 125.8 : 070806<->071412 : 9.4<->22.4 :119.6<->131.3 : 0.0 : 0.0 : 0: 0: 0: :
	: 15 : 0.0; 2.0 : 6.5 130.4 : 051012<->051212 : 5.8<->8.3 :126.5<->136.2 : 0.0 : 0.0 : 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0:
	: 15 : 0.0; 1.0 : 4.0 132.1 : 052406<->052506 : 3.7<->4.4 :131.3<->133.0 : 0.0 : 0.0 : 0: 0: 0: 0: 0:
	: 20 : 0.0; 3.5 : 6.6 132.2 : 052712<->053100 : 3.7<->10.8 :125.8<->137.2 : 0.0 : 0.0 : 0: 0: 0: 0: 0:
	: 15 : 0.0; 1.5 : 6.2 166.4 : 060112<->060300 : 5.0<->7.0 :163.4<->171.2 : 0.0 : 0.0 : 0: 0: 0: :
	: 15 : 0.0; 1.0 : 7.2 134.0 : 060612<->060712 : 7.1<->7.5 :131.6<->136.3 : 0.0 : 0.0 : 0: 0: 0: 0:
	: 15 : 0.0; 0.8 : 6.8 149.2 : 060618<->060712 : 6.7<->7.0 :148.0<->150.4 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 20 : 0.0; 3.8 : 15.4 121.1 : 062518<->062912 : 13.7<->17.2 :115.8<->130.4 : 0.0 : 0.0 : 0: 0: 0: 0:
	: 20 : 0.0; 3.2 : 12.3 131.9 : 062700<->063006 : 5.8<->19.2 :129.1<->135.5 : 0.0 : 0.0 : 0: 0: 0: 0: :
2022 B9W TD	: 15 : 0.0; 3.8 : 15.2 111.0 : 070806<->071200 : 12.6<->17.8 :106.0<->114.2 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 20 : 0.0; 2.2 : 25.7 141.6 : 080818<->081100 : 22.7<->28.7 :136.6<->147.5 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 15 : 0.0; 2.8 : 15.4 139.6 : 051806<->052100 : 14.9<->17.0 :134.2<->145.1 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 20 : 0.0; 5.5 : 25.4 139.0 : 072106<->072618 : 16.3<->35.5 :136.9<->143.2 : 0.0 : 0.0 : 0: 0: 0: 0: :
	: 20 : 0.0; 4.0 : 17.4 142.5 : 072418<->072818 : 13.7<->24.2 :136.9<->146.8 : 0.0 : 0.0 : 0: 0: 0: 0: :
2022 C4W TD	: 25 : 0.0: 0.8 : 24.1 137.6 : 072800<->072818 : 21.6<->25.7 :136.8<->138.7 : 0.2 : 0.0 : 0: 0: 0: 0: :

AORI



WPAC 2022 summary w2-tc-dss-md2-anl.py -S w.22 -s

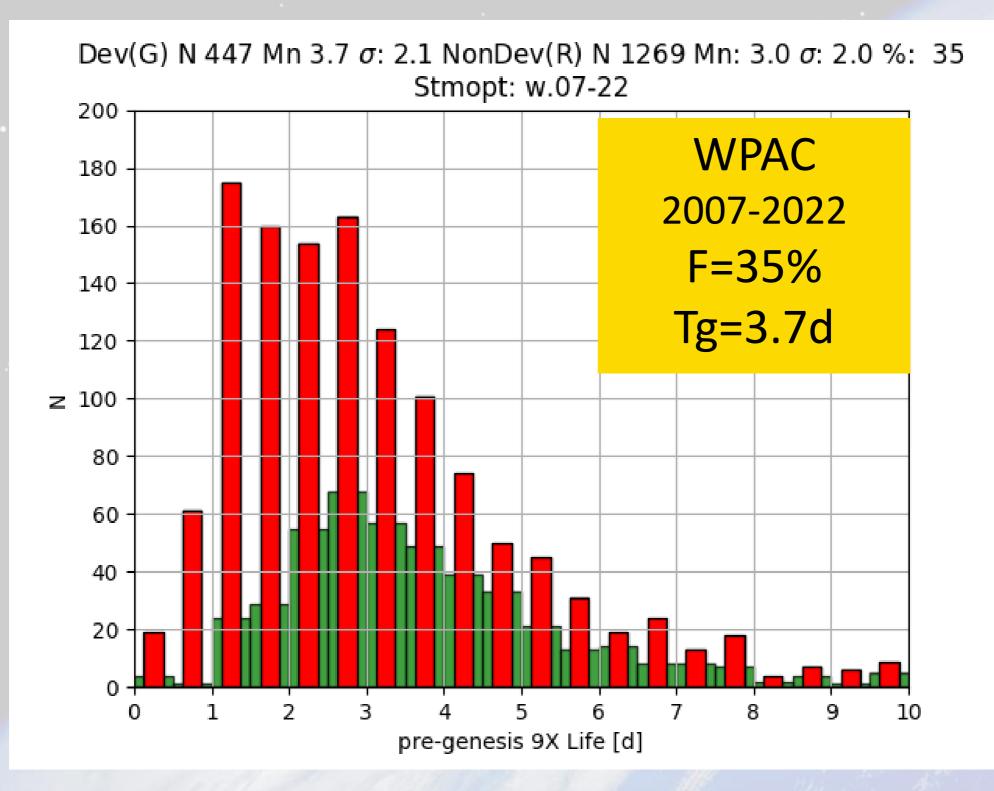
MIKE3-wxmap2 02:47 fiori	lno@tenki7-m3 /data/w22/dat/tc/bdeck/jtwc/2022 1032 > md2a -S w -s	
2022 01W TD ONE	: 30 : 0.8; 4.2 : 11.3 112.3 : 032800<->040106 : 6.5<->15.1 :105.0<->120.7 : 0.2 : 0.0 : 0: 0: 0:	:tG: 60 9X: A3W 1st: 033012
2022 02W TY MALAKAS	:115 : 8.8;13.8 : 11.3 145.2 : 040206<->041600 : 3.5<->34.4 :135.1<->161.9 : 8.9 :10.5 : 4: 0: 4:ddRI	:tG:114 9X: A5W 1st: 040700
2022 03W TS MEGI		:tG:234 9X: A4W 1st: 040900
2022 04W TY CHABA	: 4.2; 8.5 : 18.4 116.5 : 062518<->092800 : 13.7<->26.5 :110.5<->130.4 : 2.8 2.2 : 0: 0: 2:ddRW	
2022 05W TS AERE	· 45 · 7 5 · 14 0 · 27 1 135 5 · 062709<->071100 · 5 8<->43 0 →126 5<->146 2 · 3 5 · 1.2 · 0: 0: 0:	:tG: 84 9X: B8W 1st: 063012
2022 06W TD SONGDA		:tG: 24 9X: C4W 1st: 072900
2022 07W TD TRASES		:tG: 96 9X: C5W 1st: 080100
2022 08W TD EIGHT		:tG: 66 9X: C6W 1st: 080400
2022 09W TS MEARI		:tG: 60 9X: COW 1st: 081106
2022 10W TS MA-ON	Rapid Intensification (30 kt / 24 h)	
2022 10W TS MARON 2022 11W TY TOKAGE	: 95 : 4.2; 5.2 : 32.7 152.2 : 082100<->082606 : 21.5<->48.8 :148.5<->165.7 : 4.0 : ↓.3 : 5: 0: 4:ddRI	
		:tG: 72 9X: DOW 1st: 082806
2022 13W TD THIRTEEN		:tG:186 9X: D8W 1st: 083018
2022 14W TY MUIFA		:tG: 72 9X: G1W 1st: 090612
2022 15W TY MERBOK		:tG: 42 9X: XXW 1st: 091018
2022 16W STY NANMADOL	Explosive Deepening (JUKU / 241) 1.6 : 5: 4: 6:ddED	
2022 17W TD TALAS		:tG: 60 9X: F4W 1st: 092118
2022 18W STY NORU	:140, o 10.0 12.0 . 000012 - 001010 . 10.0 - 10.1 . 102.0 - 10.1 :11.0 : 7: 4: 8:ddED	
2022 19W TY KULAP		:tG:102 9X: F6W 1st: 092518
2022 20W TY ROKE	: 85 : 5.0; 9.5 : 27.9 144.0 : 092512<->100500 : 12.4<->39.9 :131.7<->163.8 : 5.1 : 4.3 : 4: 1: 1:ddED	:tG: 66 9X: E7W 1st: 092806
2022 21W* TS TWENTYONE	: 40 : 2.8; 4.5 : 17.5 153.9 : 101012<->101500 : 13.5<->29.6 :151.1<->158.5 : 1.0 : 0.3 : 0: 0: 0:	:tG: 48 9X: E9W 1st: 101212
2022 22W* TS SONCA	: 35 : 1.2; 4.0 : 13.3 114.3 : 101100<->101500 : 11.3<->15.7 :107.5<->119.2 : 0.4 : 0.1 : 0: 0: 0:	:tG: 72 9X: FOW 1st: 101400
2022 23W* TD TWENTYTHR	: 25 : 0.5; 7.8 : 16.1 140.2 : 100706<->101500 : 11.6<->20.3 :126.6<->147.2 : 0.1 : 0.0 : 0: 0: 0:	:tG:180 9X: F7W 1st: 101418
2022 AOW TD	: 20 : 0.0; 3.2 : 5.6 127.8 : 043012<->050318 : 5.0<->6.1 :126.0<->132.0 : 0.0 : 0.0 : 0: 0: 0: 0:	
2022 A1W TD	: 20 : 0.0; 5.5 : 9.4 121.5 : 012306<->012818 : 7.3<->15.1 :113.7<->132.4 : 0.0 : 0.0 : 0: 0: 0: 0:	
2022 A2W TD	: 15 : 0.0; 1.0 : 7.1 133.4 : 032500<->032600 : 6.8<->7.5 :130.6<->135.4 : 0.0 : 0.0 : 0: 0: 0:	
2022 A3W TD	: 20 : 0.0; 2.5 : 9.8 115.5 : 032800<->033012 : 6.5<->12.3 :110.0<->120.7 : 0.0 : 0.0 : 0: 0: 0:	: NN: 01W.2022
2022 A4W TD	: 20 : 0.0; 9.8 : 8.6 136.9 : 033006<->040900 : 6.1<->10.9 :126.6<->155.5 : 0.0 : 0.0 : 0: 0: 0:	
2022 A5W TD	: 20 : 0.0; 4.5 : 4.2 153.7 : 040206<->040618 : 3.5<->4.8 :147.6<->161.9 : 0.0 : 0.0 : 0: 0: 0: 0:	
2022 A6W TD	: 15 : 0.0; 3.5 : 7.9 115.6 : 040618<->041006 : 5.7<->10.7 :113.5<->117.4 : 0.0 : 0.0 : 0: 0: 0:	
The second se	: 90 : 0.8; 0.8 : 21.5 137.4 : 041612<->041706 : 19.5<->23.9 :136.8<->138.4 : 1.4 : 0.0 : 0: 0: 0:	

WPAC 2022 summary 23 NN storms or 23 TC 61 9X storms or 61 pTCs formation rate: 23/61 = 38%

38% of pTCs became TCs and 62% did not

WPAC 2007-2022 (15 y)

Seasonal Formation Rate (#TC/#pTCs) & time to genesis (from $pTC \rightarrow TC$)

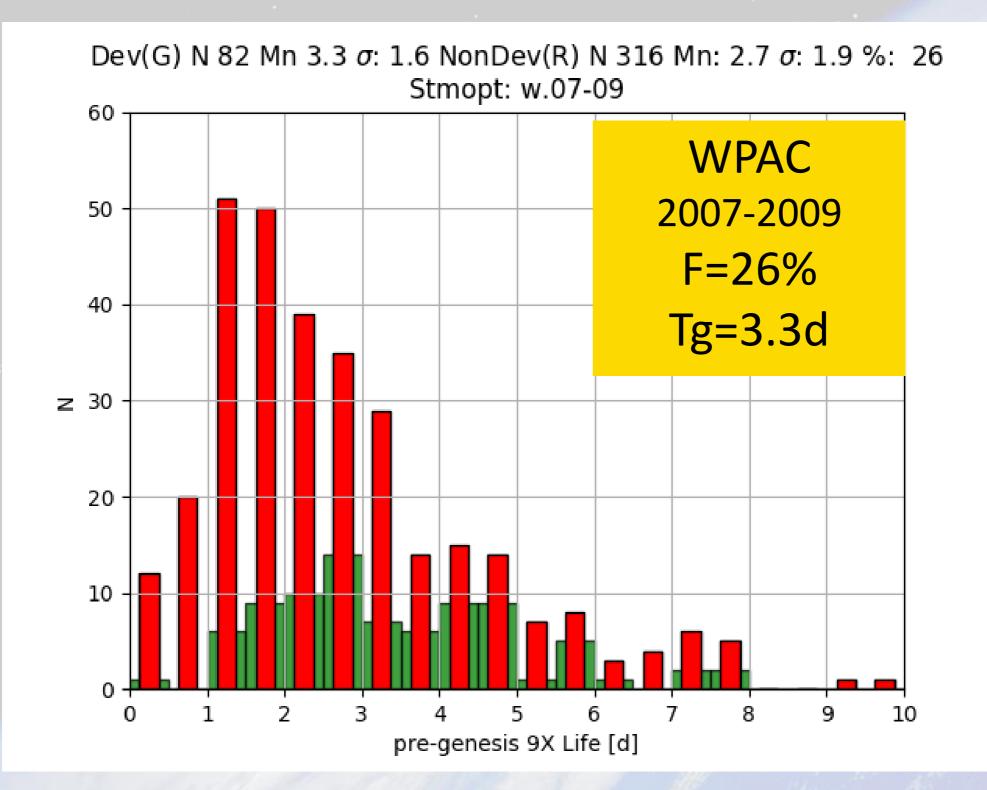






WPAC 2007-2022 (15 y)

Seasonal Formation Rate (#TC/#pTCs) & time to genesis (from $pTC \rightarrow TC$)

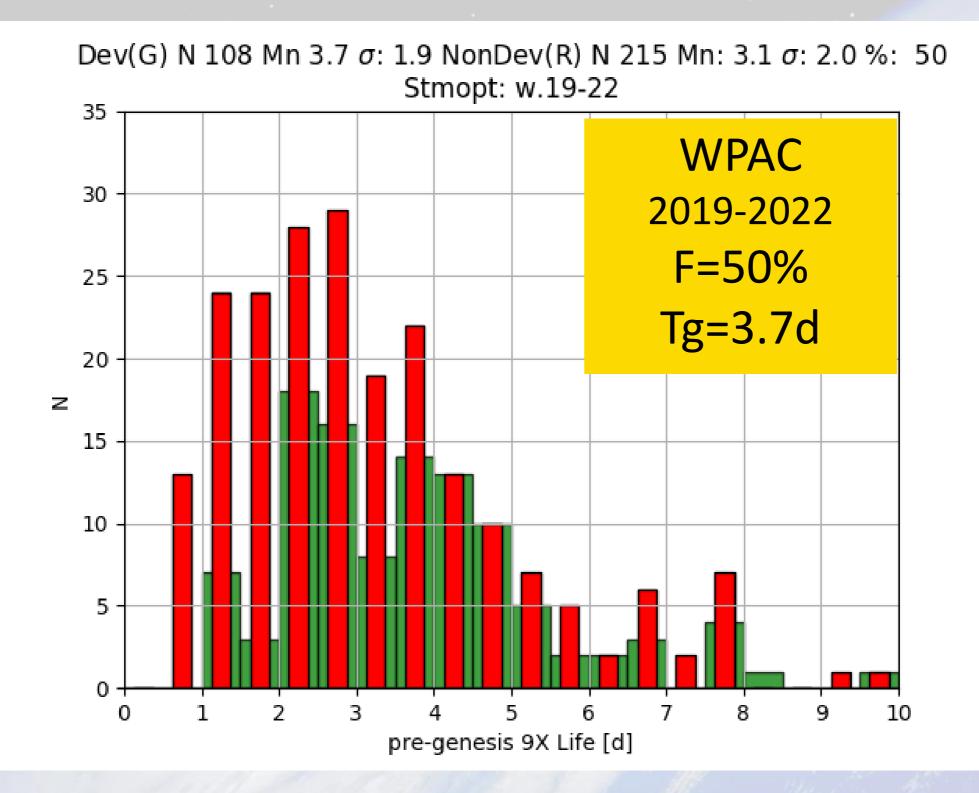


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WPAC 2007-2022 (15 y)

Seasonal Formation Rate (#TC/#pTCs) & time to genesis (from $pTC \rightarrow TC$)

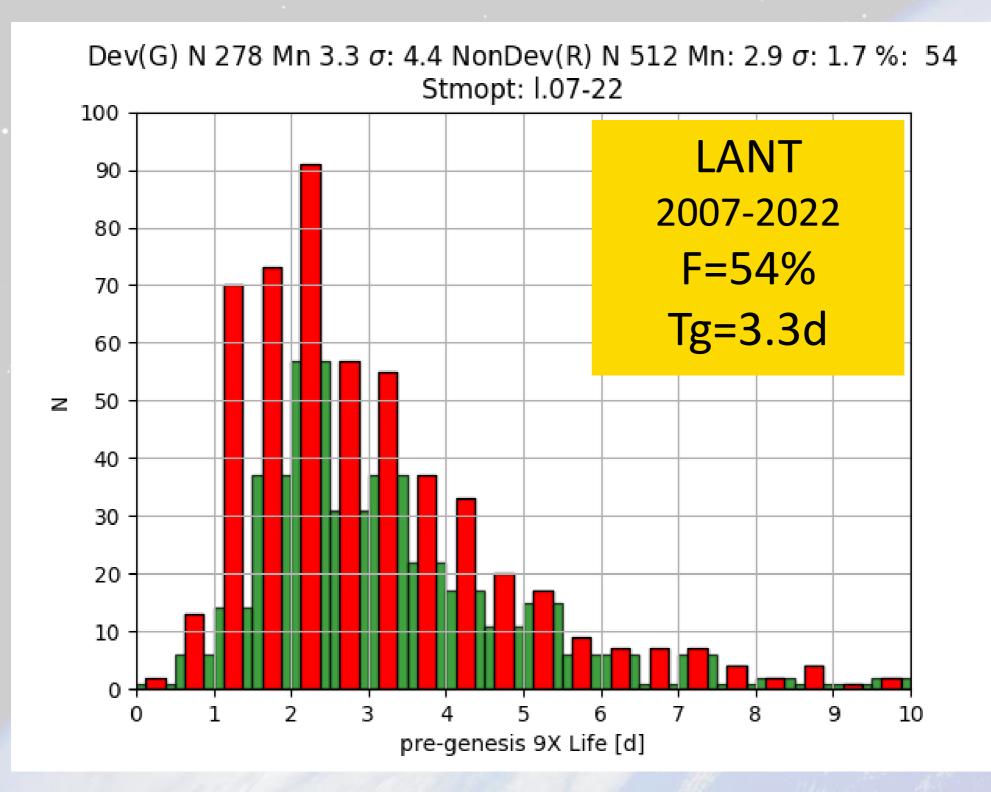


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A superBT for TC studies Mike Fiorino GMU 20221017 **東京大学** THE UNIVERSITY OF TOK

LANT 2007-2022 (15 y)

Seasonal Formation Rate (#TC/#pTCs) & time to genesis (from $pTC \rightarrow TC$)

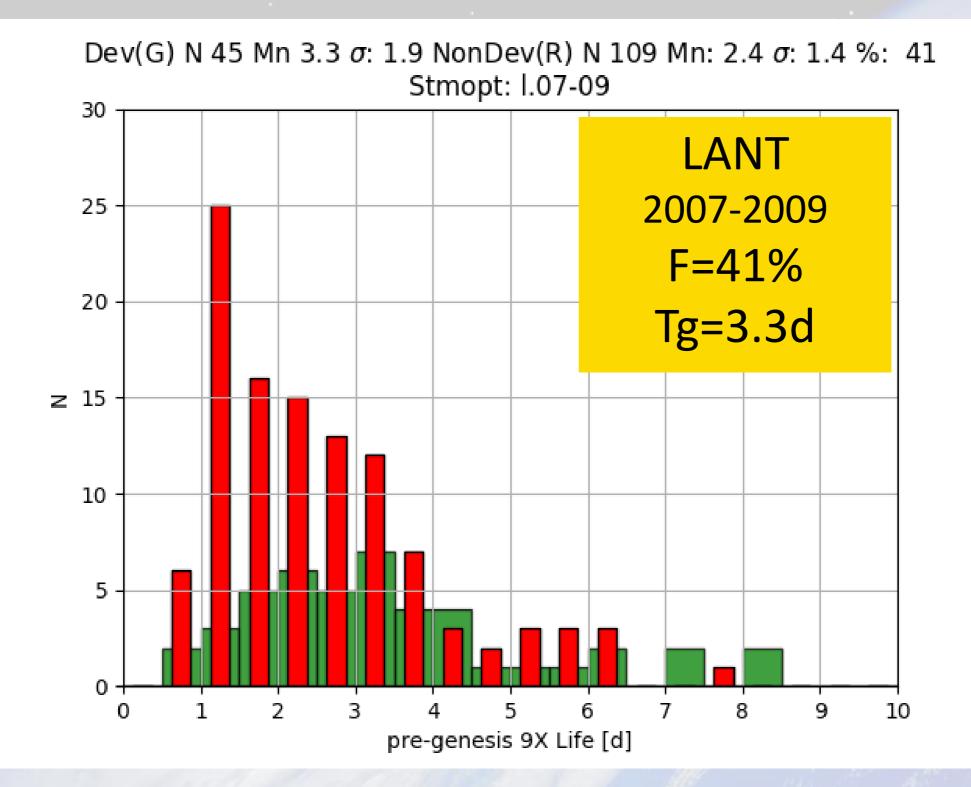




A superBT for TC studies Mike Fiorino GMU 20221017 **EXAMPLE** 東京大学 THE UNIVERSITY OF TOP

LANT 2007-2022 (15 y)

Seasonal Formation Rate (#TC/#pTCs) & time to genesis (from $pTC \rightarrow TC$)

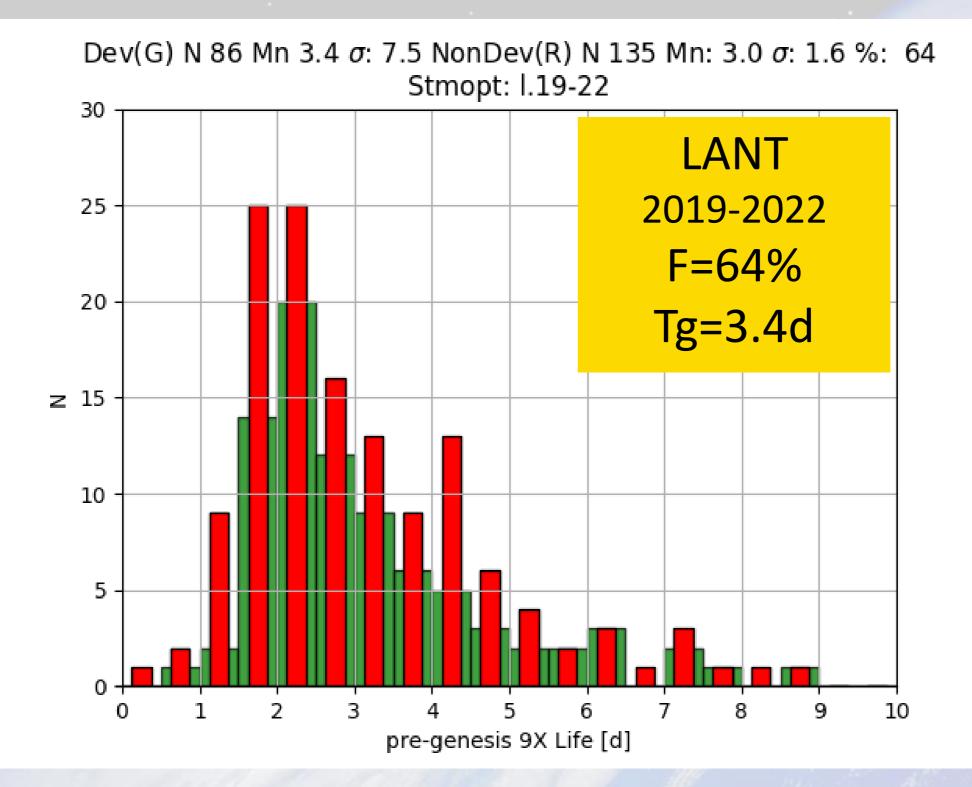




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LANT 2007-2022 (15 y)

Seasonal Formation Rate (#TC/#pTCs) & time to genesis (from $pTC \rightarrow TC$)





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Summary in NHEM basins formation rate (%) & days to genesis (d)

Basin	2007-2009		2019-2022		2007-2022	
WPAC	26%	3.3d	50%	3.7d	35%	3.7d
EPAC	71%	2.5d	73%	3.2d	68%	2.8d
LANT	41%	3.3d	64%	3.4d	54%	3.3d

- NHC & JTWC started more invests (9X or pTC) in the early period (2007-2009) in WPAC and the LANT
- EPAC has highest formation rate (~68%) and fastest time to genesis (~2.8 d)
- WPAC lowest formation rate (~35%) and slowest time to genesis (~3.7 d) → more pTCs





Change gears – pTCs to TC activity

- superBT has a unique pTC data set
- more pTCs in WPAC than LANT \rightarrow formation mechanism
- WPAC monsoon trough
- LANT tropical/easterly waves coming off Africa





My entire NWP/TC s/w & data installed & working at climateb.aori.u-tokyo.ac.jp

- JTWC/NHC best tracks and forecast aids (1947-2022)
- CMORPH precip, CIRA MTCSWA (1998-2022)
- ERA5 forecasts and analyses (1979-2021)
- real-time JTWC/NHC data (crontab)
- front-end and back-end processing

• wxmap2.com – front end web interface to products

https://maps.wxmap2.com	WxMAPs		
https://tcact.wxmap2.com	TC activity sACEd		
https://tcgen.wxmap2.com	TC genesis		
https://jtdiag.wxmap2.com	TC diagnostics file		
https://tceps.wxmap2.com	TC ensemble file		
https://tctrkveri.wxmap2.com	TC tracks & verification		





TC activity metrics

- # of storms by intensity (JTWC supertyphoon, NHC CATI-5)
- wind-duration metrics:
 - Mike: Vmax x duration, e.g., 60kt*6h
 - G. Bell: ACE Accumulated Cyclone Energy Vmax**2 * 6h
 - M. Powell: IKE Integrated Kinetic Energy = f(R34,Vmax)
 - ► K. Emanuel: Power Vmax**3 * 6h
- ACE is fairly standard, only IKE considers TC size...
- Problem with all is dependence on the accuracy of the intensity





Global TC activity variability – depends on accuracy of best track done by humans

- **I.** TC detection "TC or not TC" that is the question
 - a. SHEM << NHEM until around 1990
 - b. pre-1950 ships and islands and landfall
 - c. 1950~1988 (year JTWC went satellite only), A/C recon in WPAC and atLANTic
 - d. 1990-2010 more and better satellite data including quickScat
 - e. 2010 2022 better satellite obs of surface wind reanalysis of wind radii @ JTWC/NHC
 - f. TC location \rightarrow surface wind center

2. Intensity = Vmax != Pmin

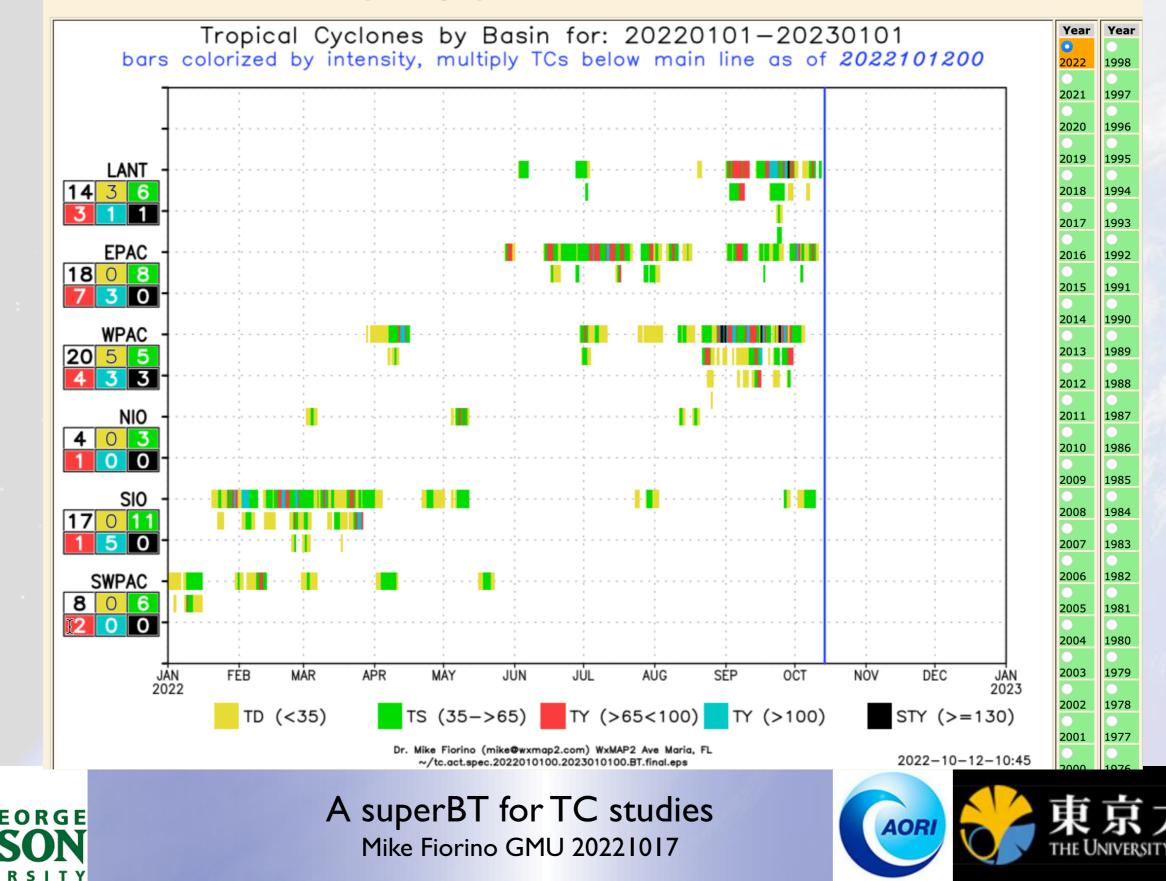
no physical relationship between Pmin and Vmax!!!





spectograph

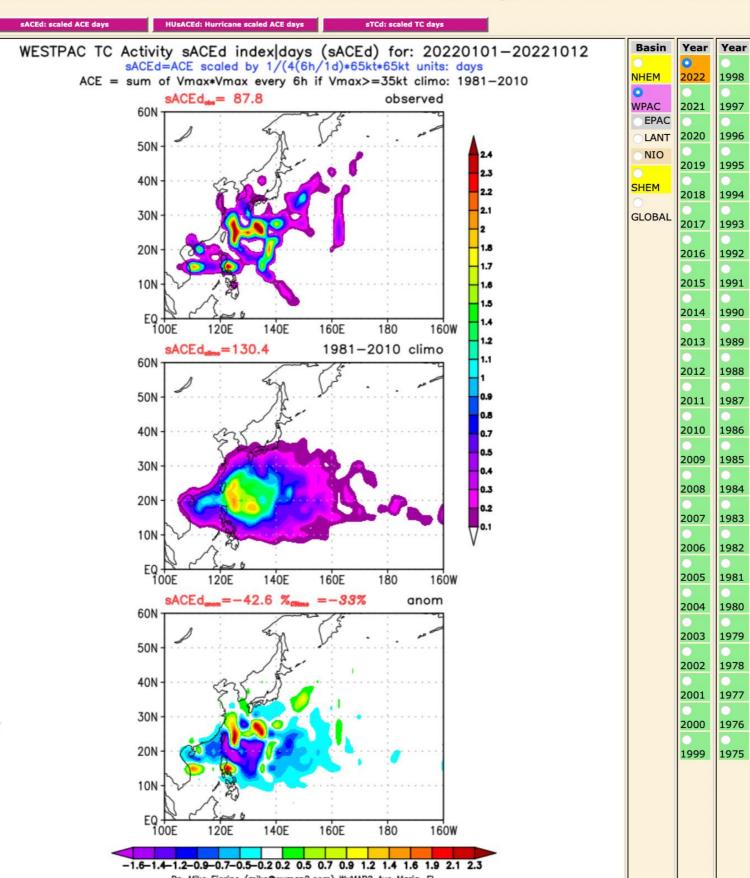




E

maps

TCact MAPS -- scaled sACEd, sHurACEd and sTCd maps thru: 20221012 (main doc)



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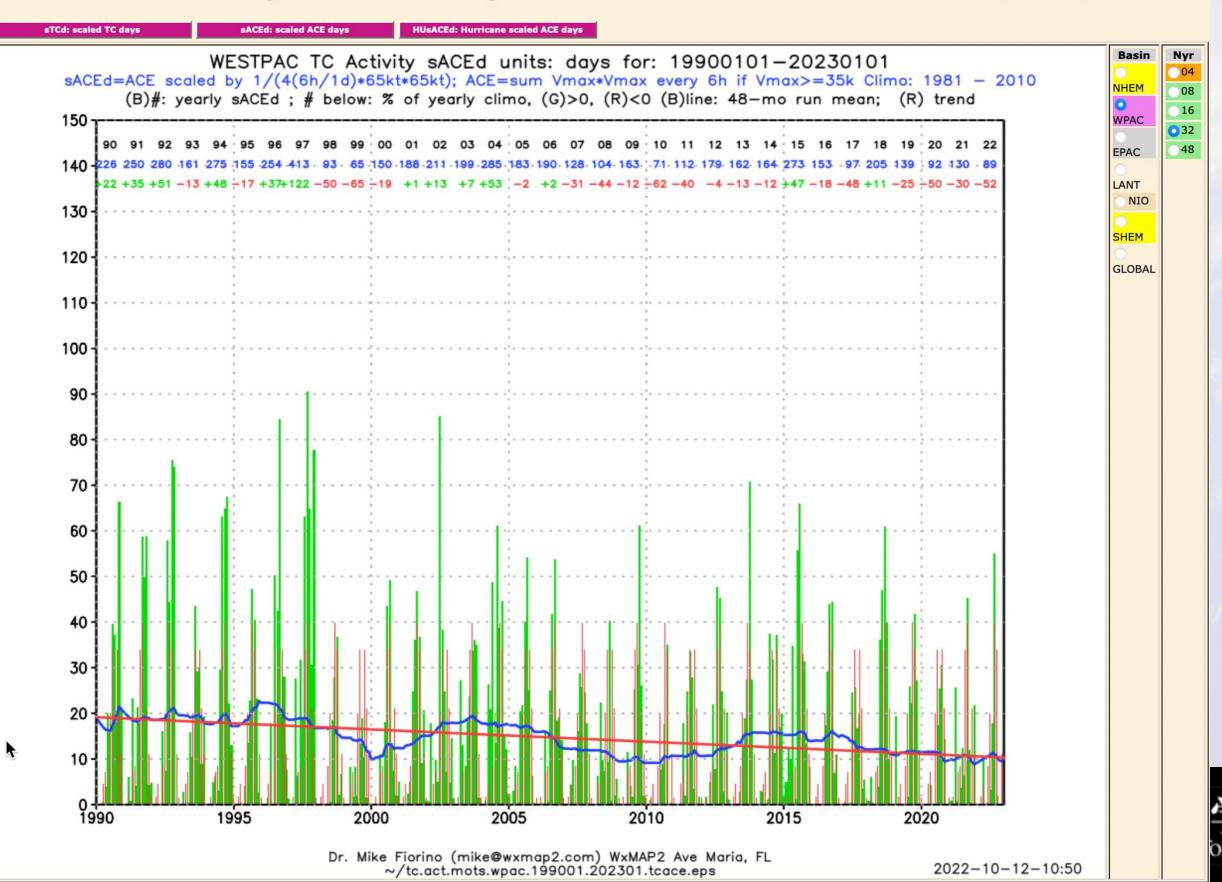
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time series

TCact TS -- scaled TCdays & scaled ACE days Time Series 1975-2022 thru: 20221012 (main doc)



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SHEM TC Activity sACEd units: days for: 19740101-20230101 sACEd=ACE scaled by 1/(4(6h/1d)*65kt*65kt); ACE=sum Vmax*Vmax every 6h if Vmax>=35k Climo: 1981 - 2010 (B)#: yearly sACEd ; # below: % of yearly climo, (G)>0, (R)<0 (B)line: 48-mo run mean; (R) trend 150 -70· 10-Dr. Mike Fiorino (mike@wxmap2.com) WxMAP2 Ave Maria, FL ~/tc.act.mots.shem.197401.202301.tcace.eps 2022-10-16-11:04

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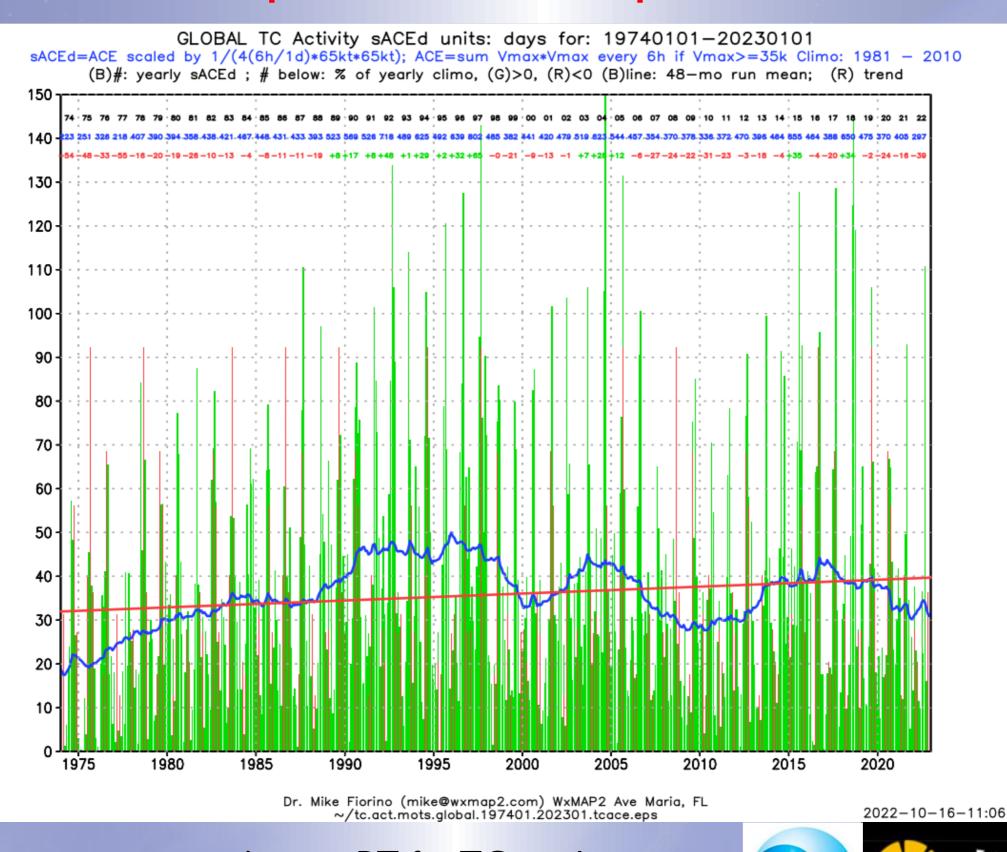


WESTPAC TC Activity sACEd units: days for: 19740101-20230101 sACEd=ACE scaled by 1/(4(6h/1d)*65kt*65kt); ACE=sum Vmax*Vmax every 6h if Vmax>=35k Climo: 1981 - 2010 (B)#: yearly sACEd ; # below: % of yearly climo, (G)>0, (R)<0 (B)line: 48-mo run mean; (R) trend 150 -74 . 75 140 - 25 104 130 120· 110 100· 90 80 70· 60 · 50 40 30 20 10 0 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 Dr. Mike Fiorino (mike@wxmap2.com) WxMAP2 Ave Maria, FL ~/tc.act.mots.wpac.197401.202301.tcace.eps A superBT for TC studies

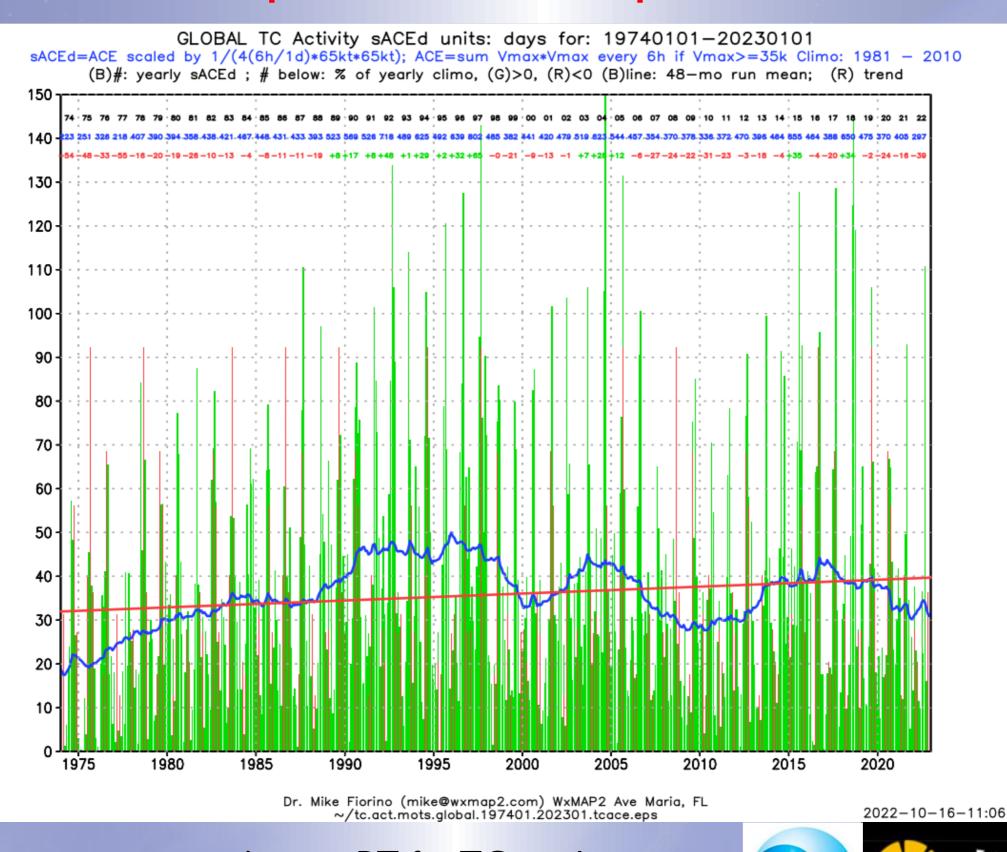
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GLOBAL TC Activity sACEd units: days for: 19900101-20230101 sACEd=ACE scaled by 1/(4(6h/1d)*65kt*65kt); ACE=sum Vmax*Vmax every 6h if Vmax>=35k Climo: 1981 - 2010 (B)#: yearly sACEd ; # below: % of yearly climo, (G)>0, (R)<0 (B)line: 48-mo run mean; (R) trend 150 -90 01 02 03 04 05 06 07 08 10 15 20 21 22 00 09 13 16 17 140 569 526 718 489 625 492 639 802 485 382 441 420 479 519 623 544 457 354 370 378 336 372 470 396 464 655 464 388 650 475 370 405 297 -1 +7 +28 +12 -6 -27 -24 -22 -31 -23 -3 -18 -4 +35 -4 -20 +34 17 +8 +1 +29 +2 +32 +65 -0 -21 -9 -2 -24 -16 -39 130 120· 110 100 · 90 80 70· 60 · 50 40 30· 20 -10 0-1990 1995 2000 2005 2010 2015 2020 Dr. Mike Fiorino (mike@wxmap2.com) WxMAP2 Ave Maria, FL 2022-10-16-11:06 ~/tc.act.mots.global.199001.202301.tcace.eps A superBT for TC studies

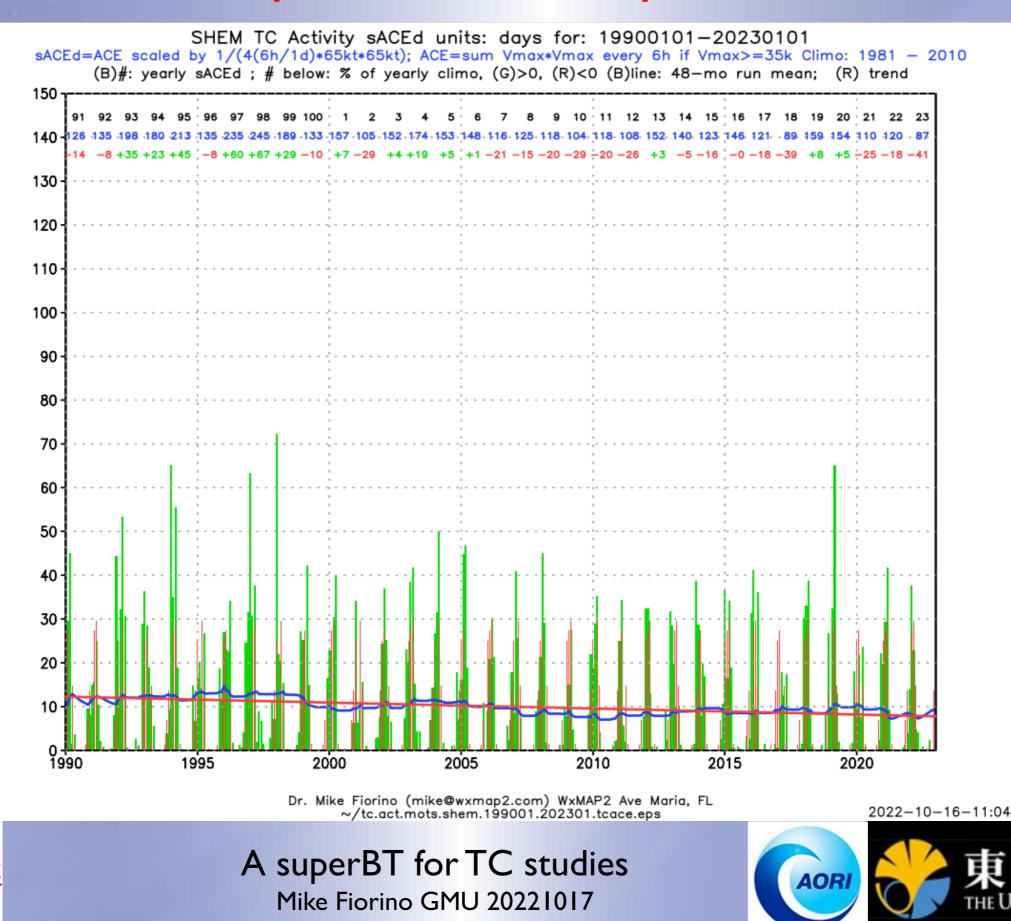
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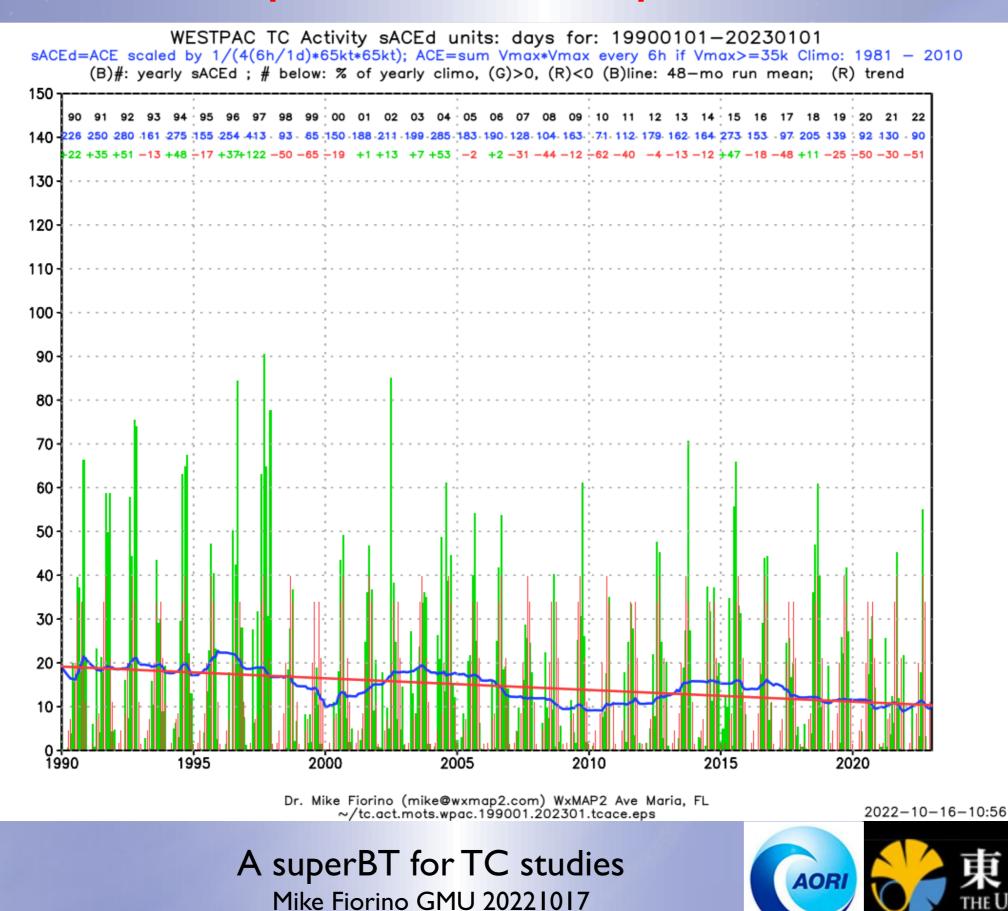
NHEM TC Activity sACEd units: days for: 19900101-20230101 sACEd=ACE scaled by 1/(4(6h/1d)*65kt*65kt); ACE=sum Vmax*Vmax every 6h if Vmax>=35k Climo: 1981 - 2010 (B)#: yearly sACEd ; # below: % of yearly climo, (G)>0, (R)<0 (B)line: 48-mo run mean; (R) trend 150 -90 91 00 01 02 03 04 05 06 07 08 10 12 13 15 20 21 22 09 11 16 17 140 443 392 521 308 412 357 404 557 296 249 283 316 327 345 470 396 341 230 252 273 218 264 318 256 341 509 342 298 491 321 261 285 210 -31 +16 -9+22 +6 +19 +65 -12 -26 -16 -7 -3 +2 +39 +17 +1 -32 -26 -19 -36 -22 -6-24 +1 +50 +1 -12 +45 -5 -23 -16 -38 130 120· 110 100 · 90 80 70 60 50 · 40 30· 20· 10 -0-1990 1995 2000 2005 2010 2015 2020 Dr. Mike Fiorino (mike@wxmap2.com) WxMAP2 Ave Maria, FL 2022-10-16-10:54 ~/tc.act.mots.nhem.199001.202301.tcace.eps A superBT for TC studies

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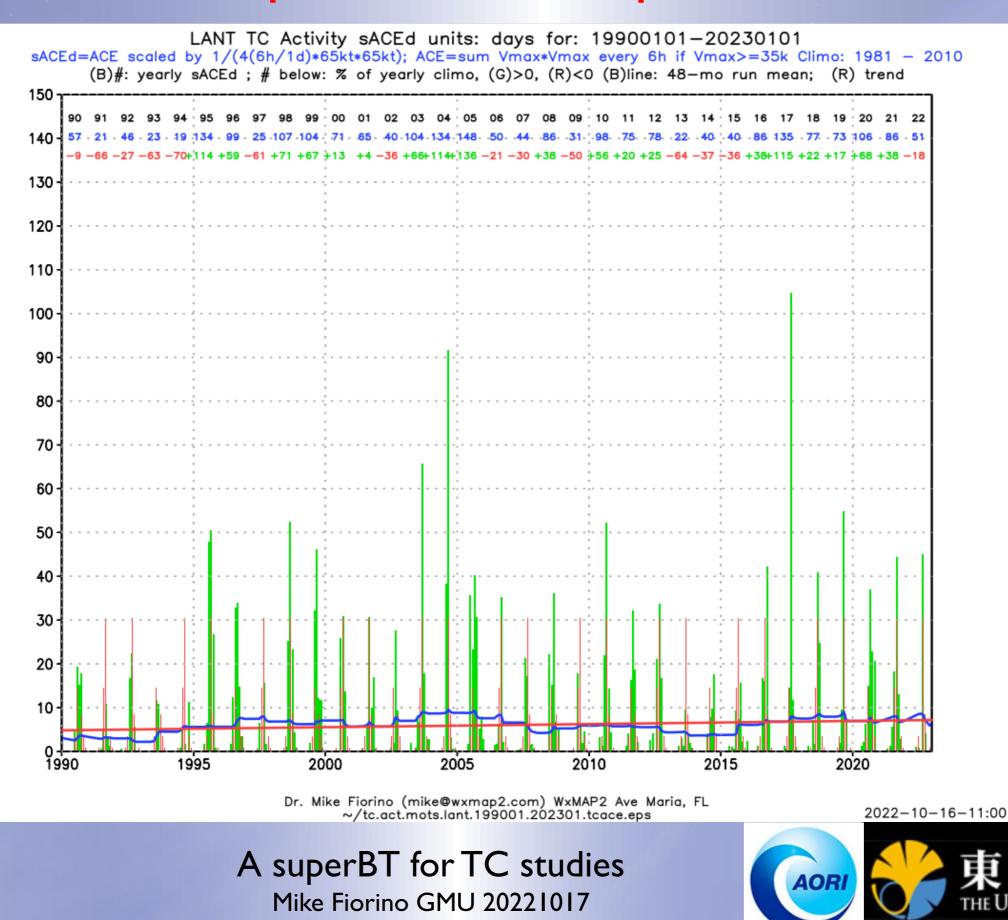
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Summary of pTC \rightarrow TC and TC activity

- I5 years of global pTC data may be long enough to establish a climatology of pTC formation and TC genesis
- there are (many) more pTCs than TCs
 - 30-70% of the pTCs tracked by JTWC/NHC become TCs
 - more pTCs in WPAC (monsoon trough) than in EPAC/LANT
- the mean time from the start of a pTC to forming a TC is about 3 days
- TC genesis studies should account for the pTC stage a complex accounting problem
- understanding environmental differences between developing and non-developing pTCs requires global modeling – reanalysis – NWP





some words of wisdom...

"You're only as good as what you measure" CAPT Vic Addison, USN(ret) 2006 Commanding Officer FNMOC

"Forecasting is the acid test of an analysis" Bob Kistler, NCEP

father of American Reanalysis

NCEP/NCAR RI





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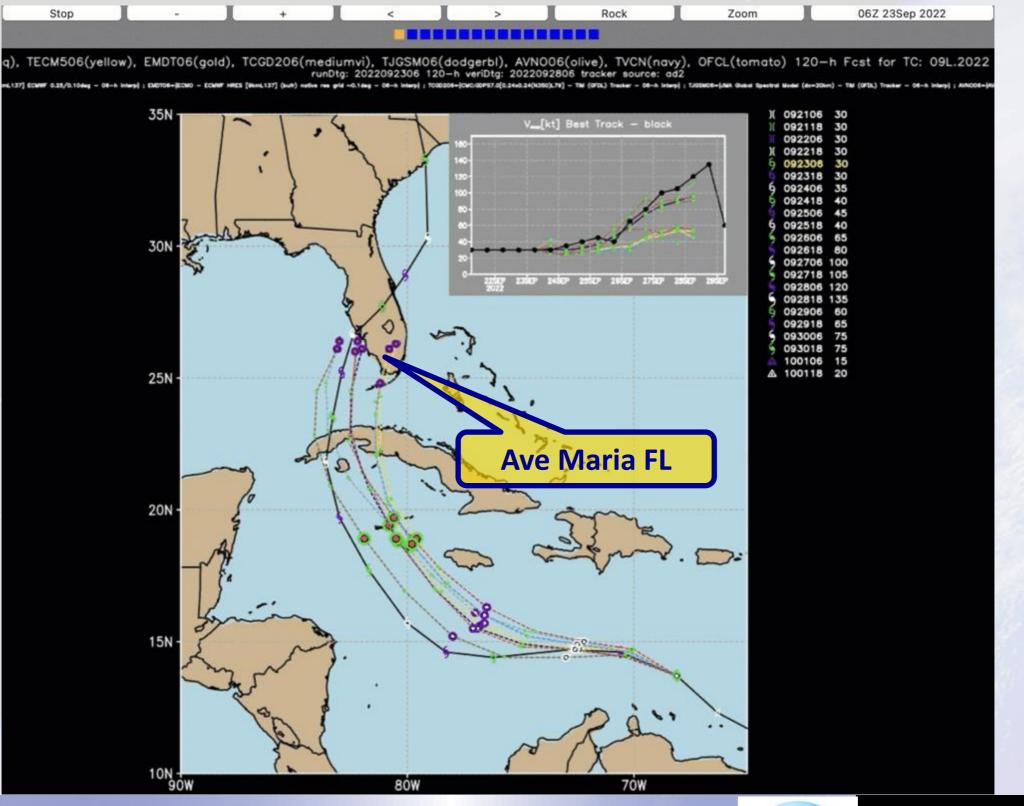
father of American Reanalysis

NCEP/NCAR RI





NWP – hurricane IAN https://tctrkveri.wxmap2.com

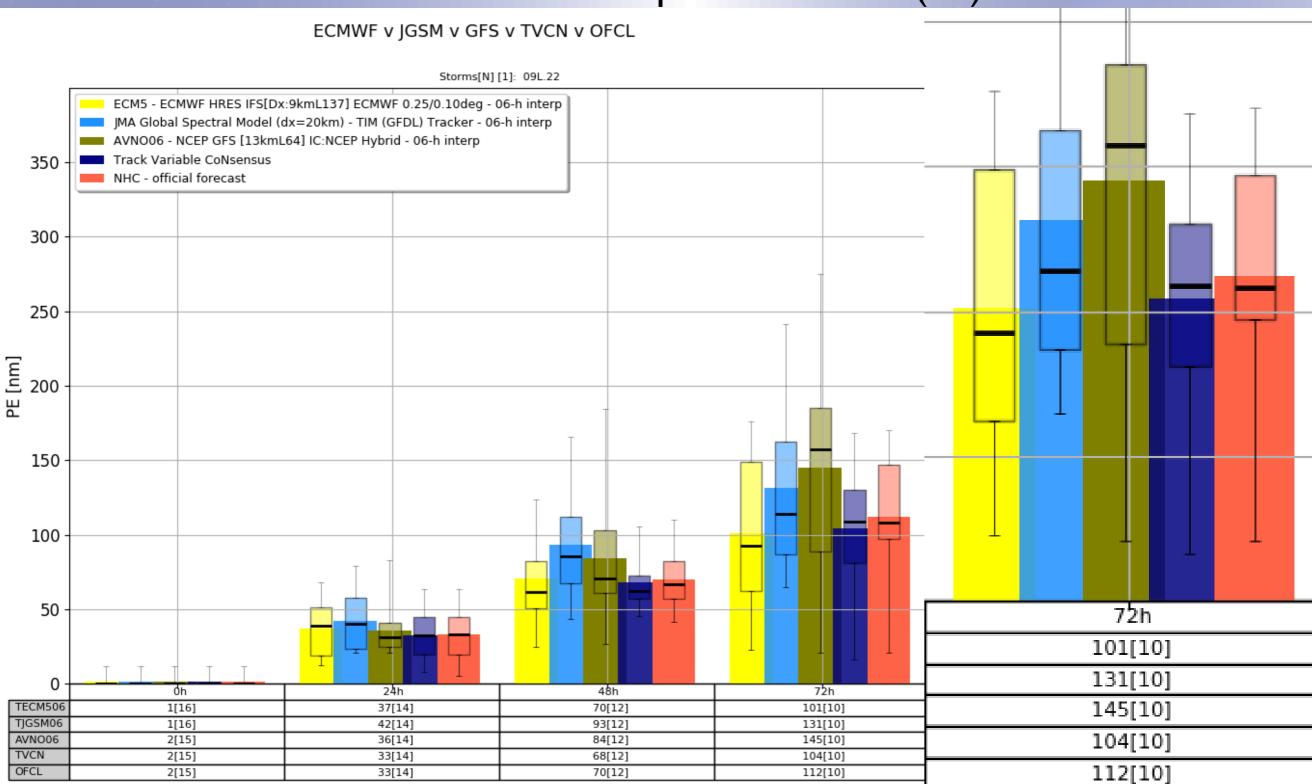






NWP – hurricane IAN

verification – mean position error (PE)



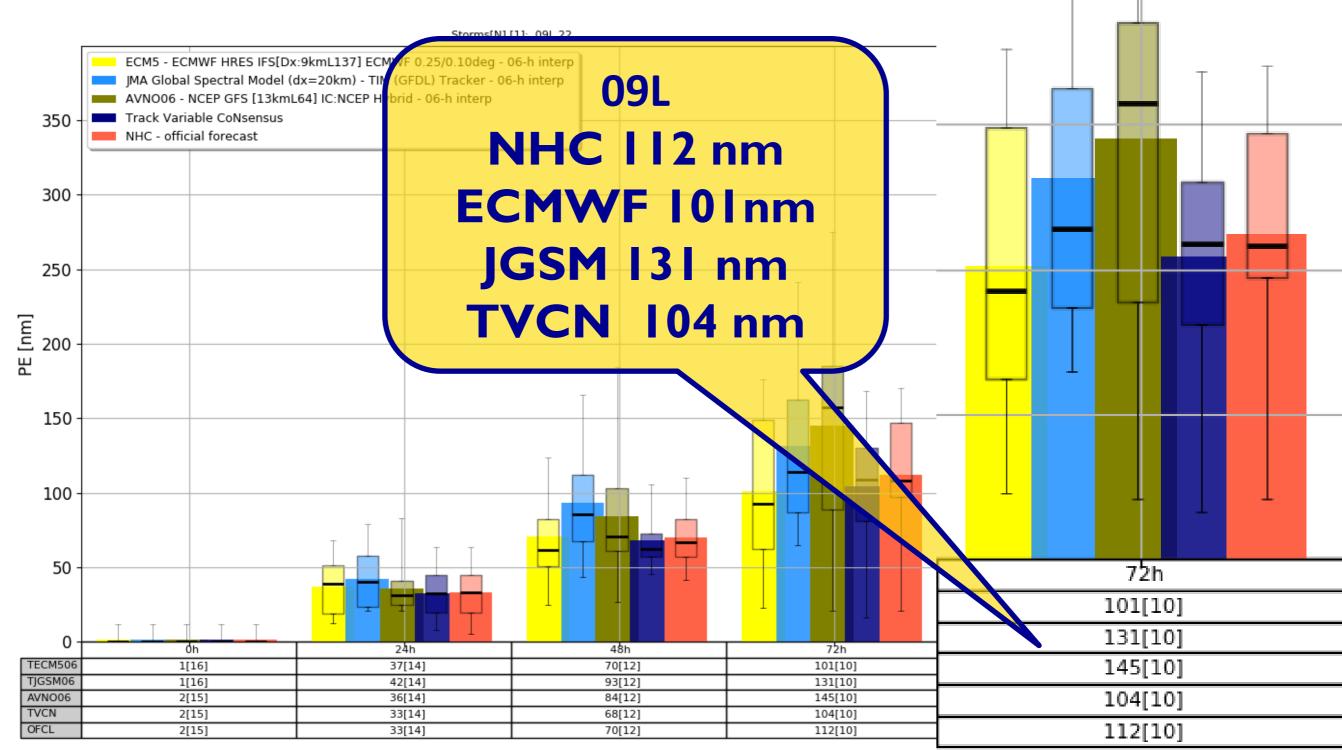




NWP – hurricane IAN

verification – mean position error (PE)



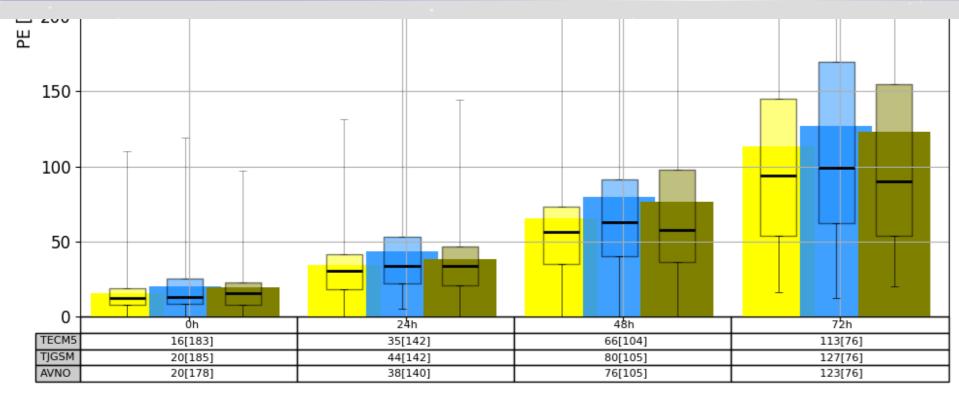


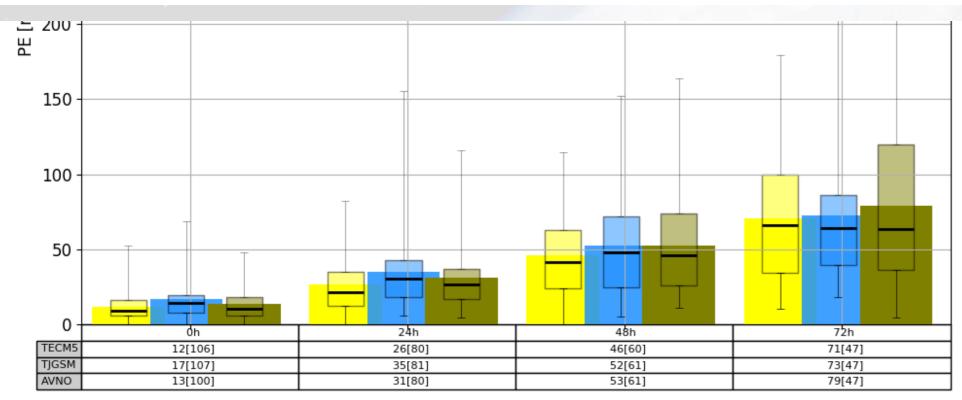




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NWP – WPAC & LANT 2022 verification – mean position error (PE)





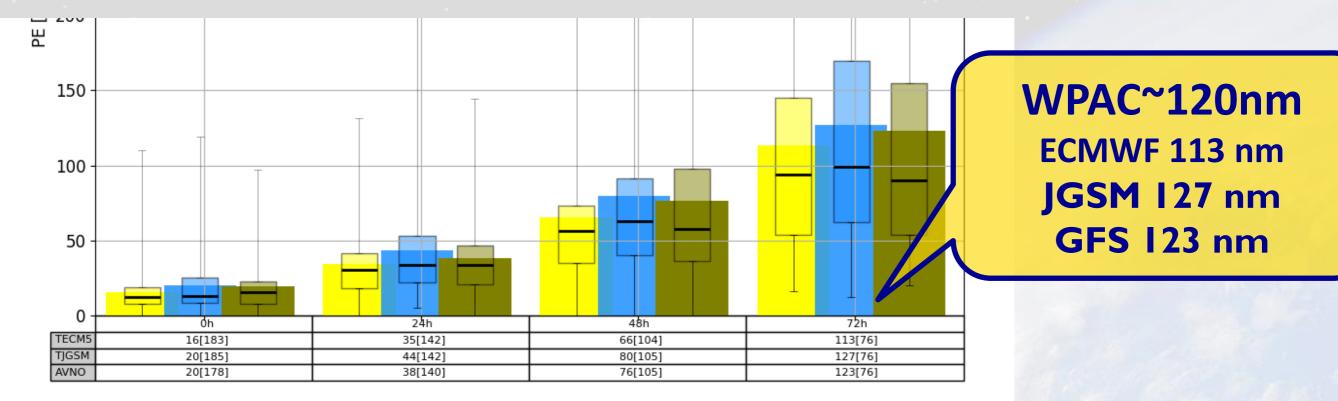


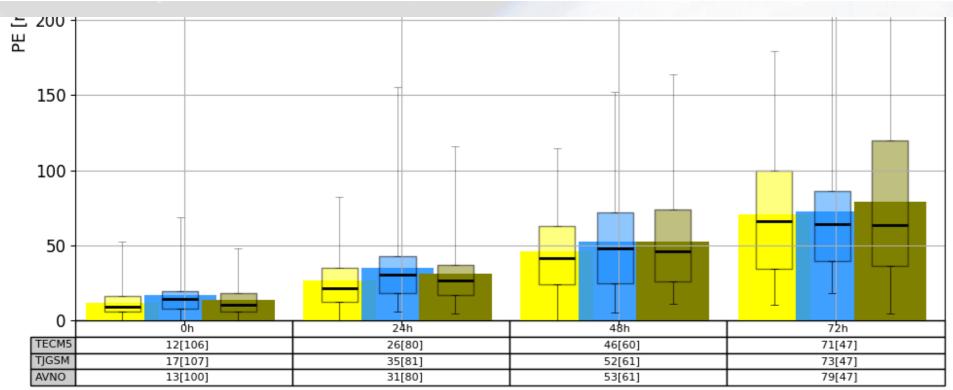




34

NWP – WPAC & LANT 2022 verification – mean position error (PE)



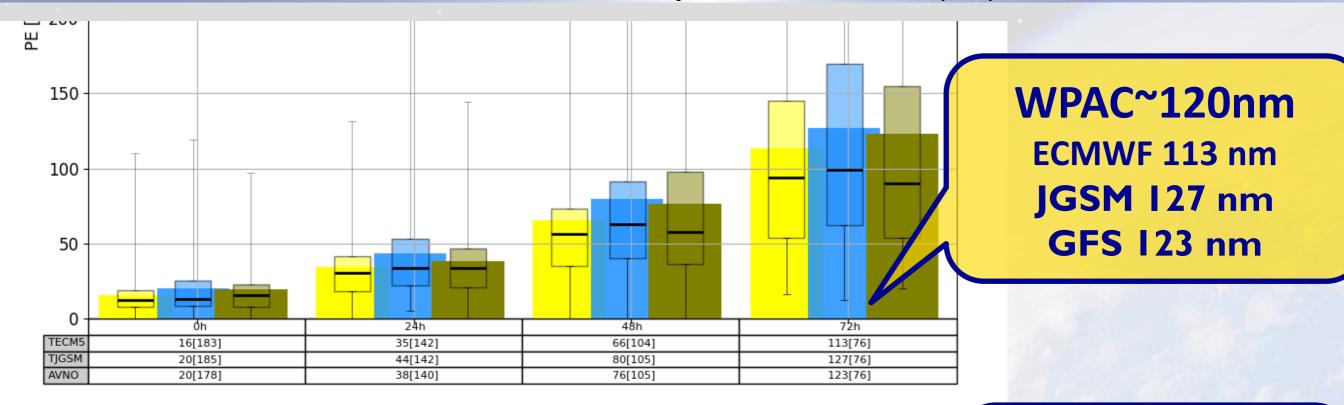


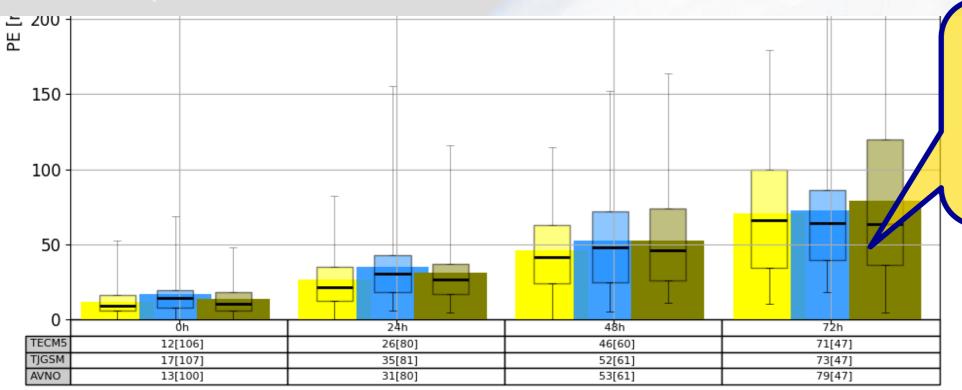






NWP – WPAC & LANT 2022 verification – mean position error (PE)





LANT~80 nm ECMWF 71 nm JGSM 73 nm GFS 79 nm

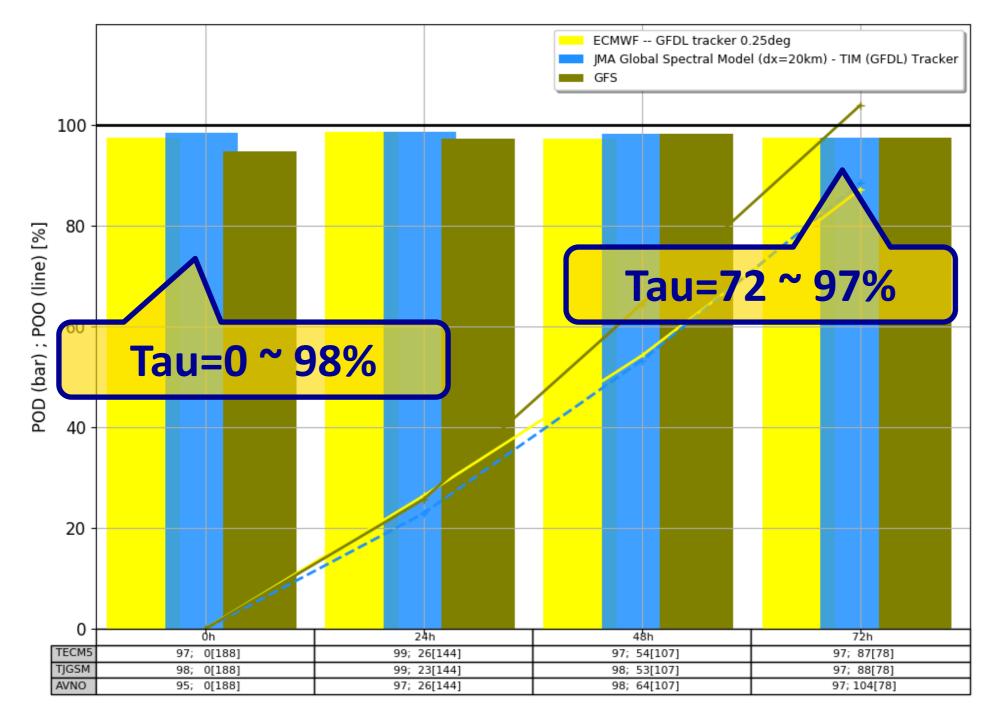






NWP PoD – Probability of Detection WPAC 2022

WPAC POD ECMWF v JGSM v GFS Prob Of Detection [POD;%] -- bars ; Prob Of Overwarn [POO;%] -- lines







NWP metrics 2022

- Good 72 mean PE \rightarrow 100 nm
 - ~ 120 nm in WPAC
 - ~ 100 nm in LANT

• Good PoD \rightarrow 95-100%

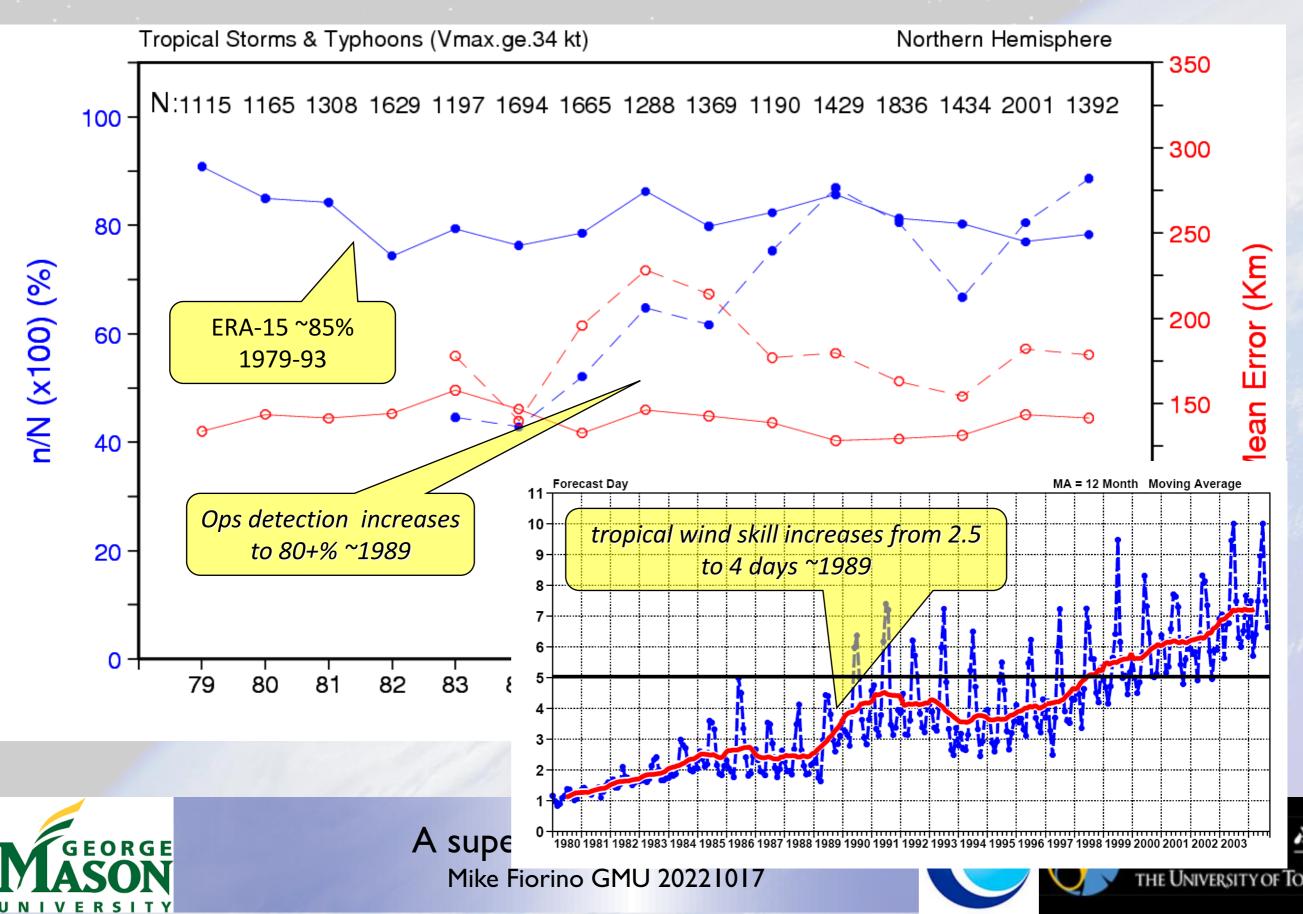
- ► tau 0 (initial) ~ 98%
- ► tau 72 (72-h forecast) ~ 95%

• How does ERA5 compare to ERAI5/40?





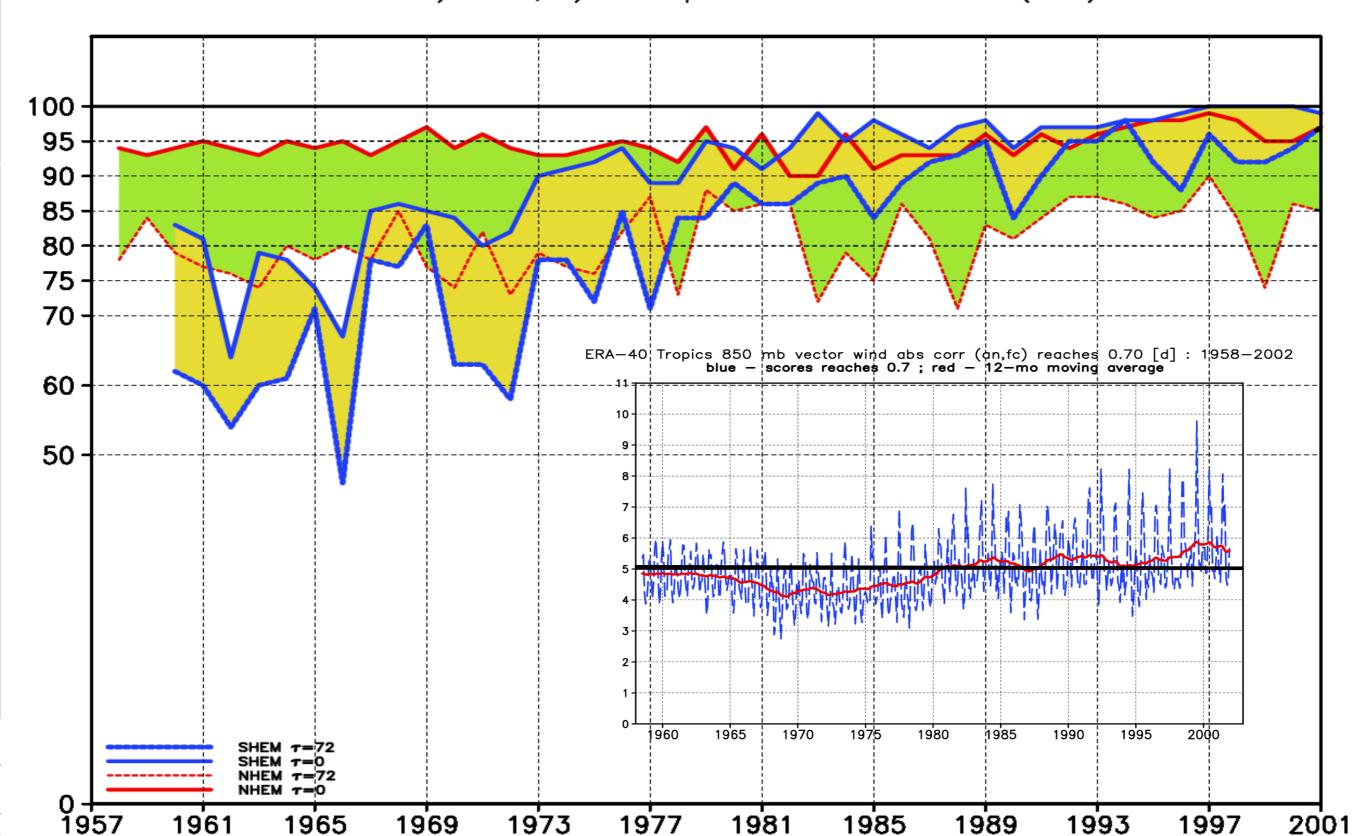
TC Detection in ERA-15 v ECMWF ops



ERA-40 TC detection v tropical wind score

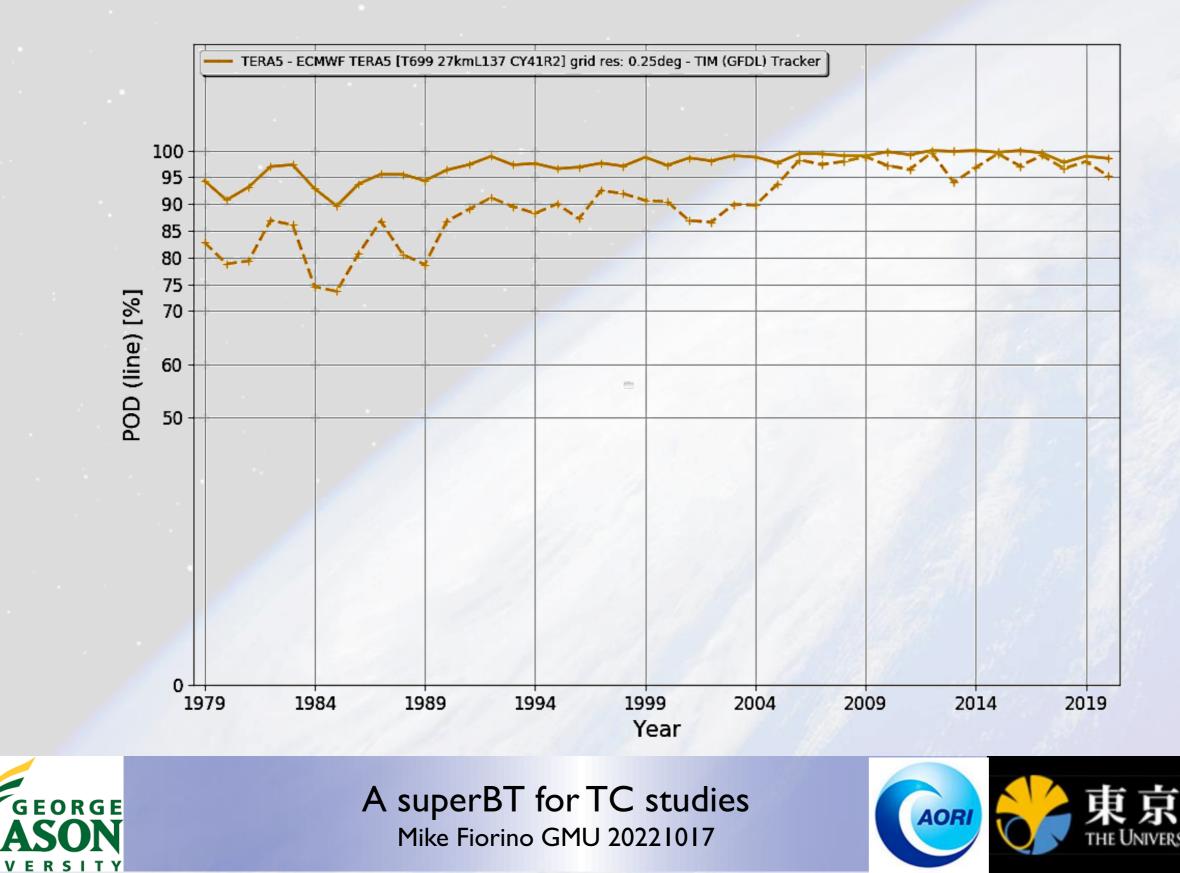
SHEM v NHEM ; tau=0 v tau=72 h

ERA-40 fc TC stats: POD [%] period: 1958 - 2001 Models: ERA-40(e40) | Taus: 1) 0; 2) 72 Basins: 1) NHEM; 2) SHEM | Veri Rules: Hetero JTWC(mod)



NHEM ERA5 PoD at tau=0 and 72 h

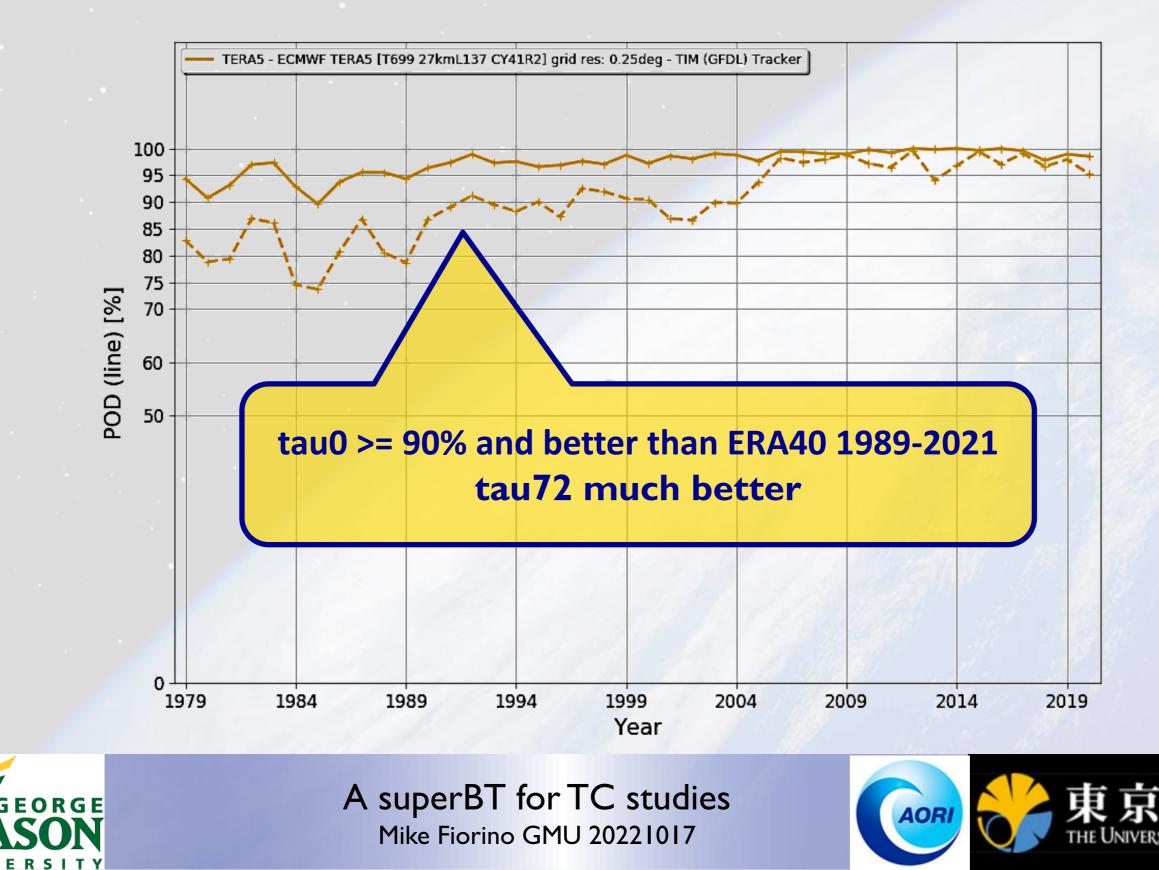
NHEM ERA5 PoD for tau=0 and tau=72h



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NHEM ERA5 PoD at tau=0 and 72 h

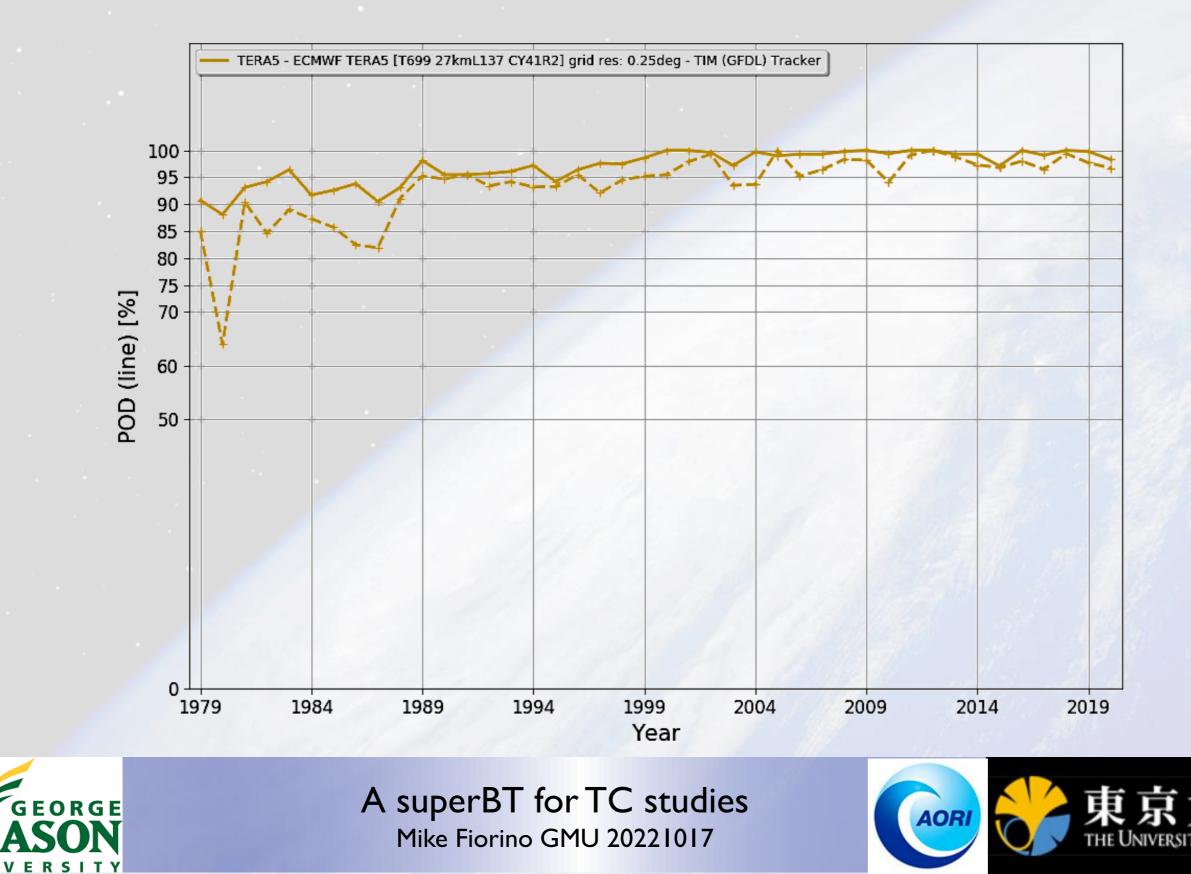
NHEM ERA5 PoD for tau=0 and tau=72h



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SHEM ERA5 PoD at tau=0 and 72 h

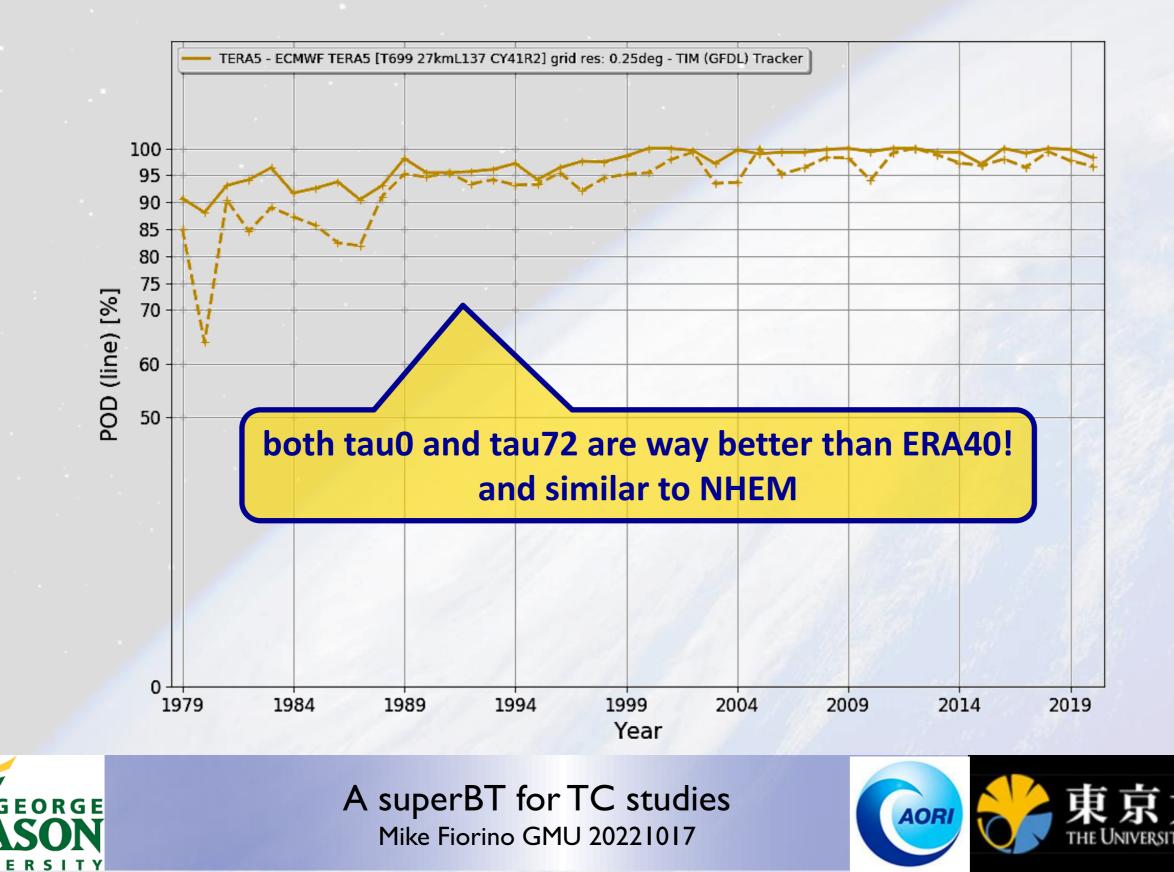
SHEM ERA5 PoD for tau=0 and tau=72h



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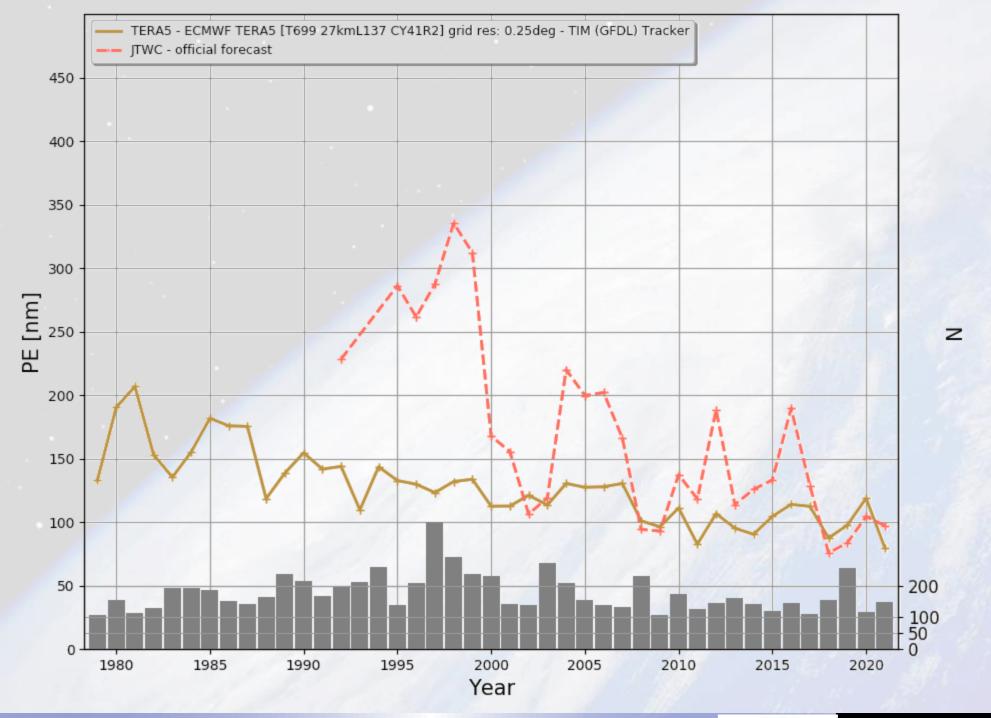
SHEM ERA5 PoD at tau=0 and 72 h

SHEM ERA5 PoD for tau=0 and tau=72h



SHEM ERA5 v JTWC mean 72-h PE

SHEM tau=72 h mean PE ERA5 v JTWC

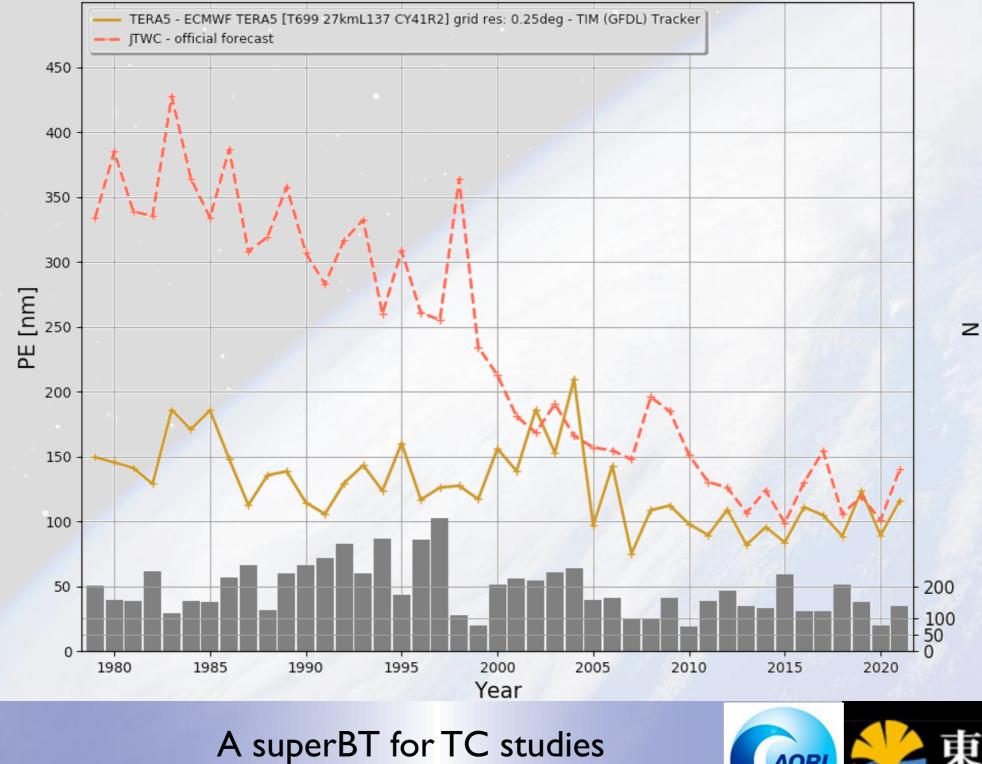






WPAC ERA5 v JTWC mean 72-h PE

WPAC tau=72 h mean PE ERA5 v JTWC

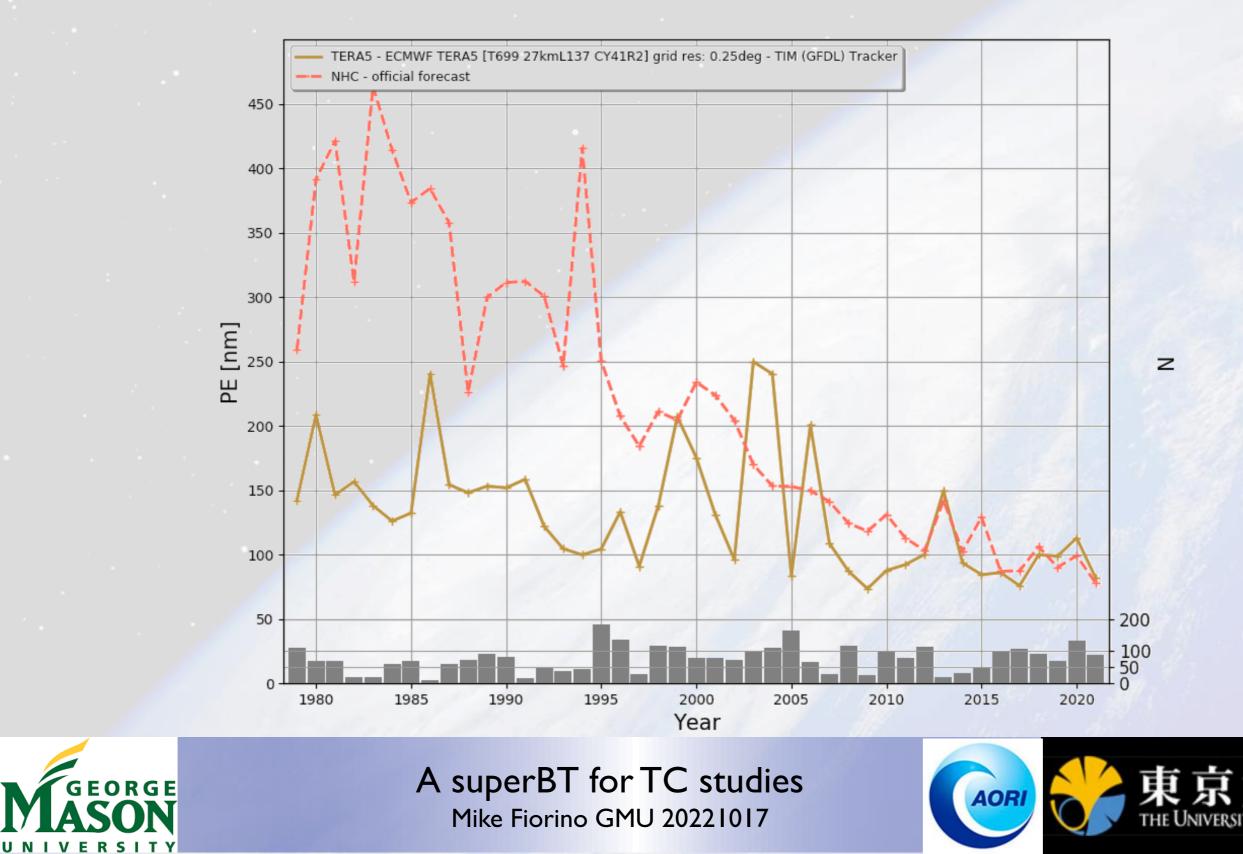


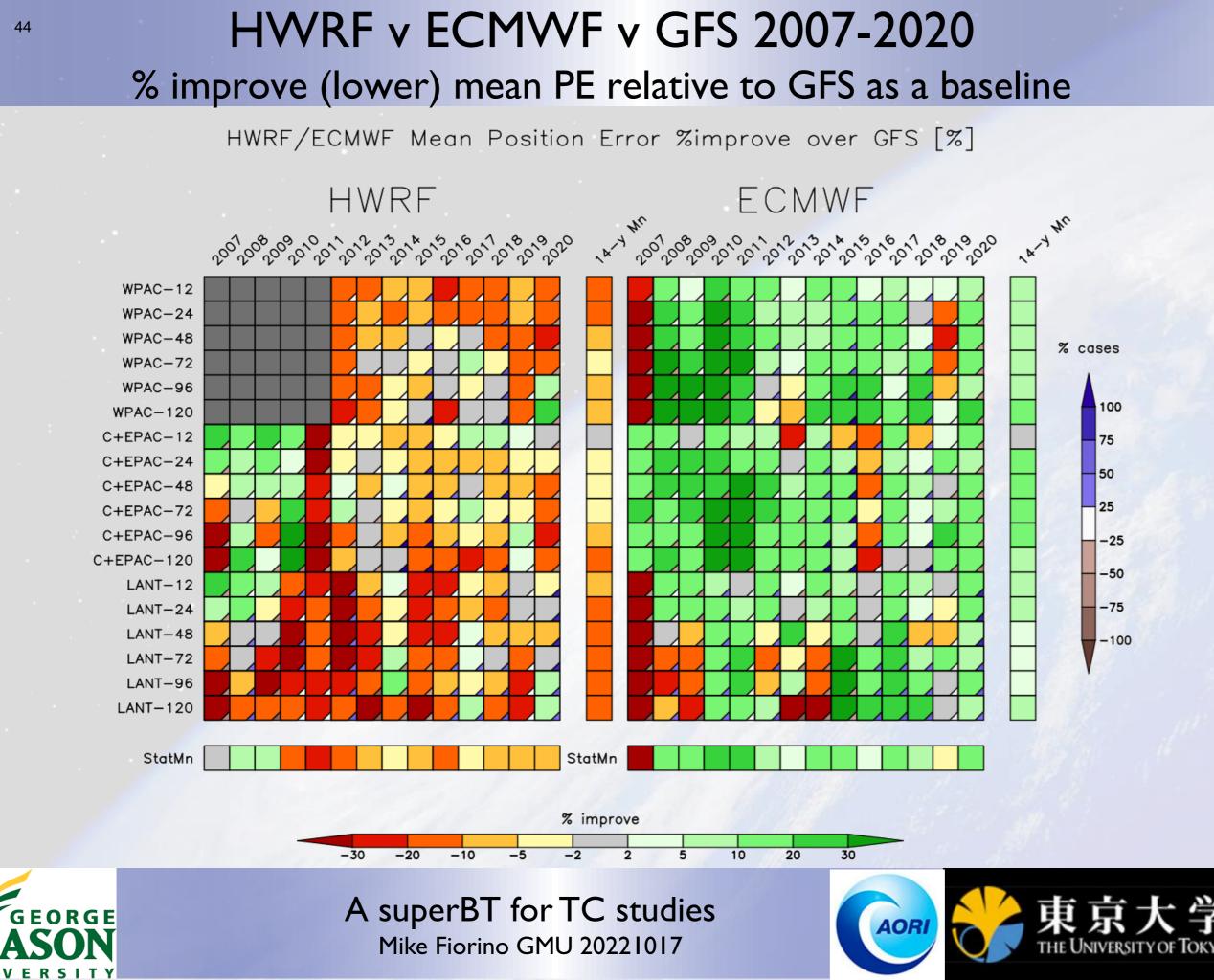


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LANT ERA5 v NHC mean 72-h PE

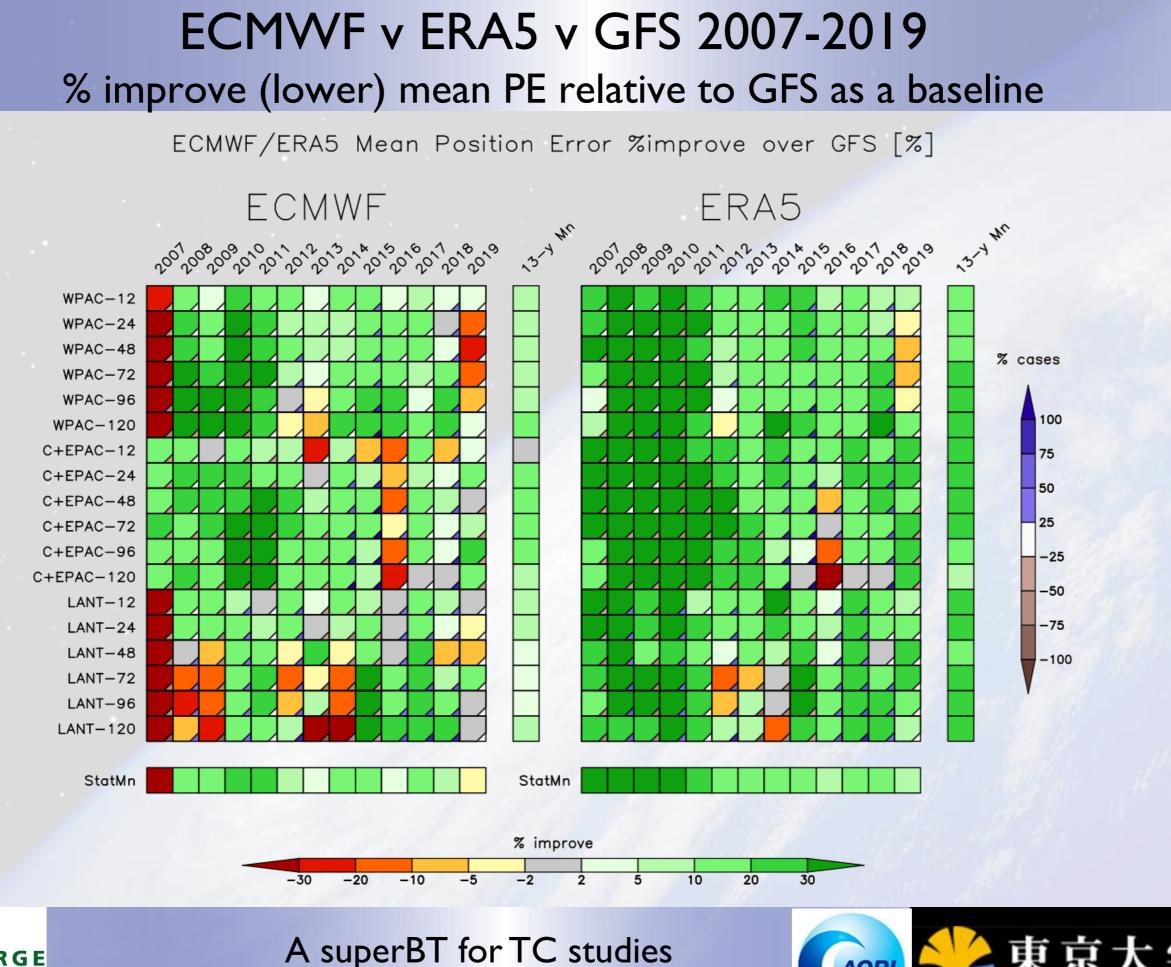
LANT tau=72 h mean PE ERA5 v NHC





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AOR



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Takeaways or **BLOB** Bottom Line On the Backend

- entire NWP/TC/reanalysis s/w & data installed & working at climateb.aori.u-tokyo.ac.jp
- superBT = Best Track of TCs +
 - ► BT of pTCs
 - diagnostic file with storm and environment variables
 - storm structure R34 & ROCI/POCI (TC size) multiple sources
 - TC precipitation CMORPH & GSMaP
- climate time scales BT of TC & pTCs of primary importance, especially pTC for TC genesis
- ERA5 TC forecasts very good with consistent quality over the 43-y period 1979-2021 → analyses are very good





Next steps...

• build TC structure data sets

- ROCI/POCI
- ► R34

• TC precipitation

- ▶ area-average at r=300, 500, 800 km
- area-average at ROCI ? for mostly TC rain?

• Version 1.0 of superBT

- by storm pTC & TC
- Iat/Ion/Vmax/speed/direction
- distance from coast
- R34/POCI
- ► ERA5 rain
- CMORPH (GSMaP) rain





Acknowledgements

a big shoutout まいどどうもありがとございました! Takayabu-sensei and her staff for sponsoring this visit and the opportunity to do science again



