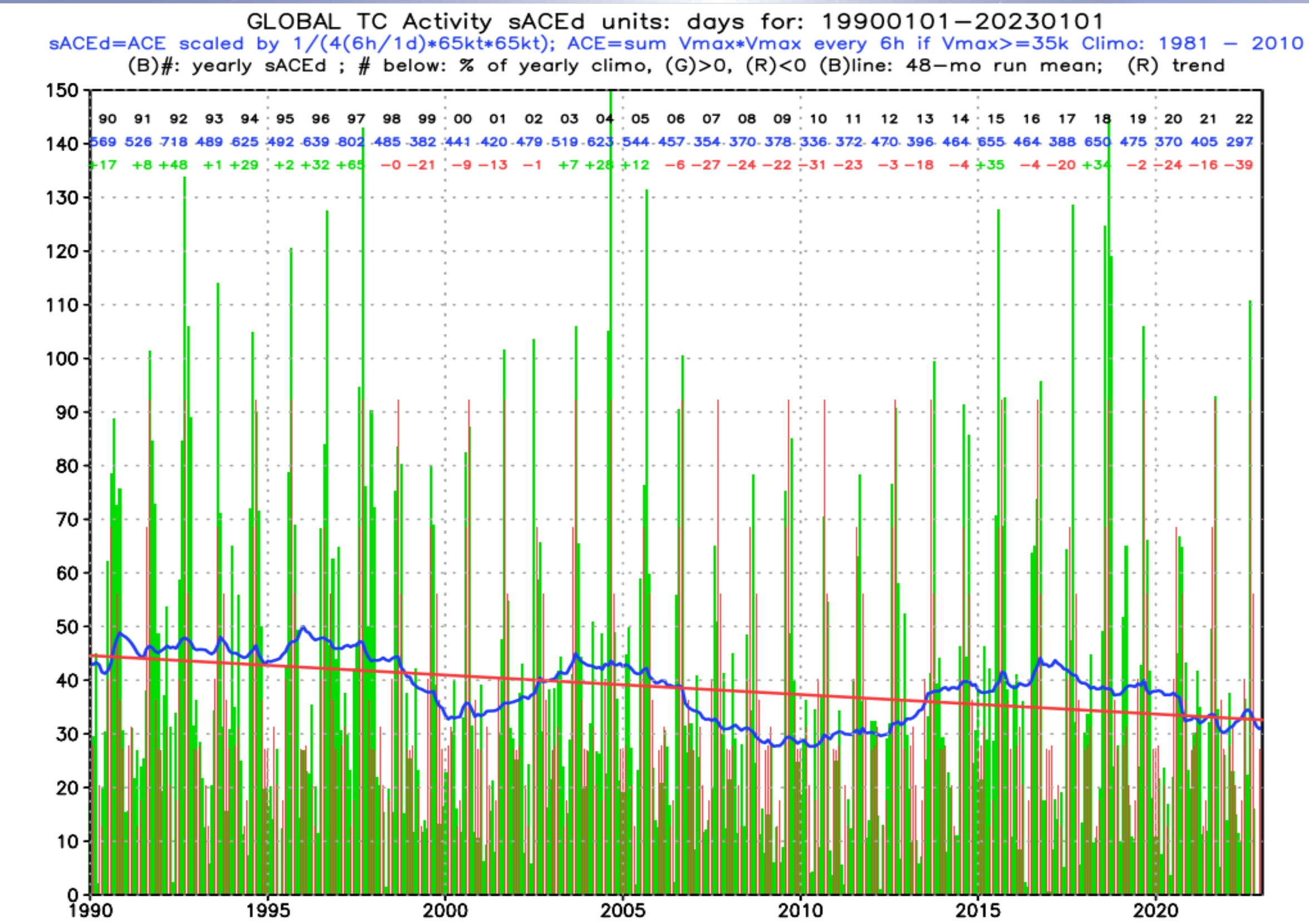
THE クラメトチエンジの質問ですか？



- ***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

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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 **L**ine **U**p 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)

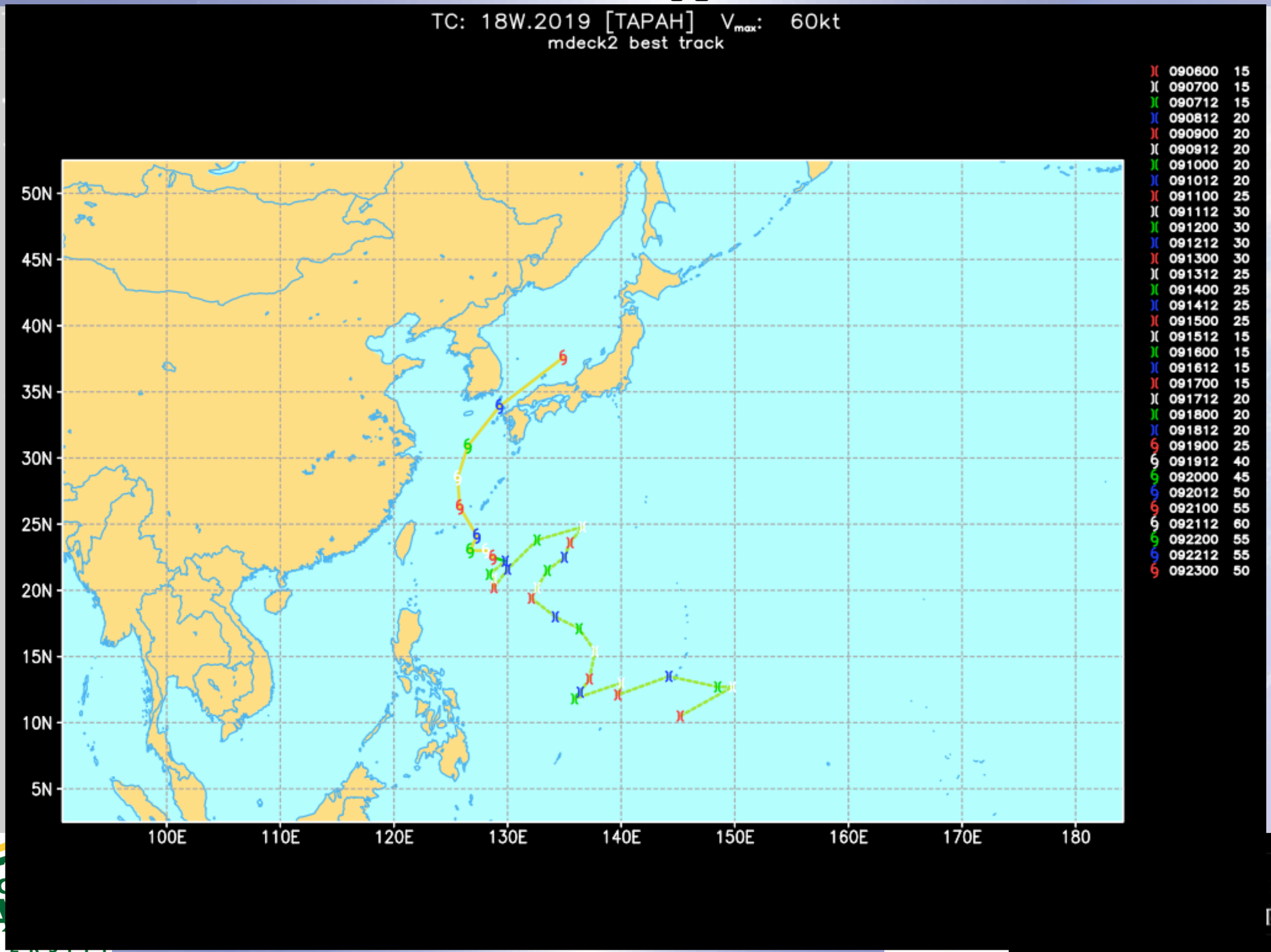
BT part of the superBT

- ***BT data comes from JTWC & NHC***
  - global
  - consistent operations for best tracking and forecasting
  - consistent metrics – knots, nautical miles, ***1-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

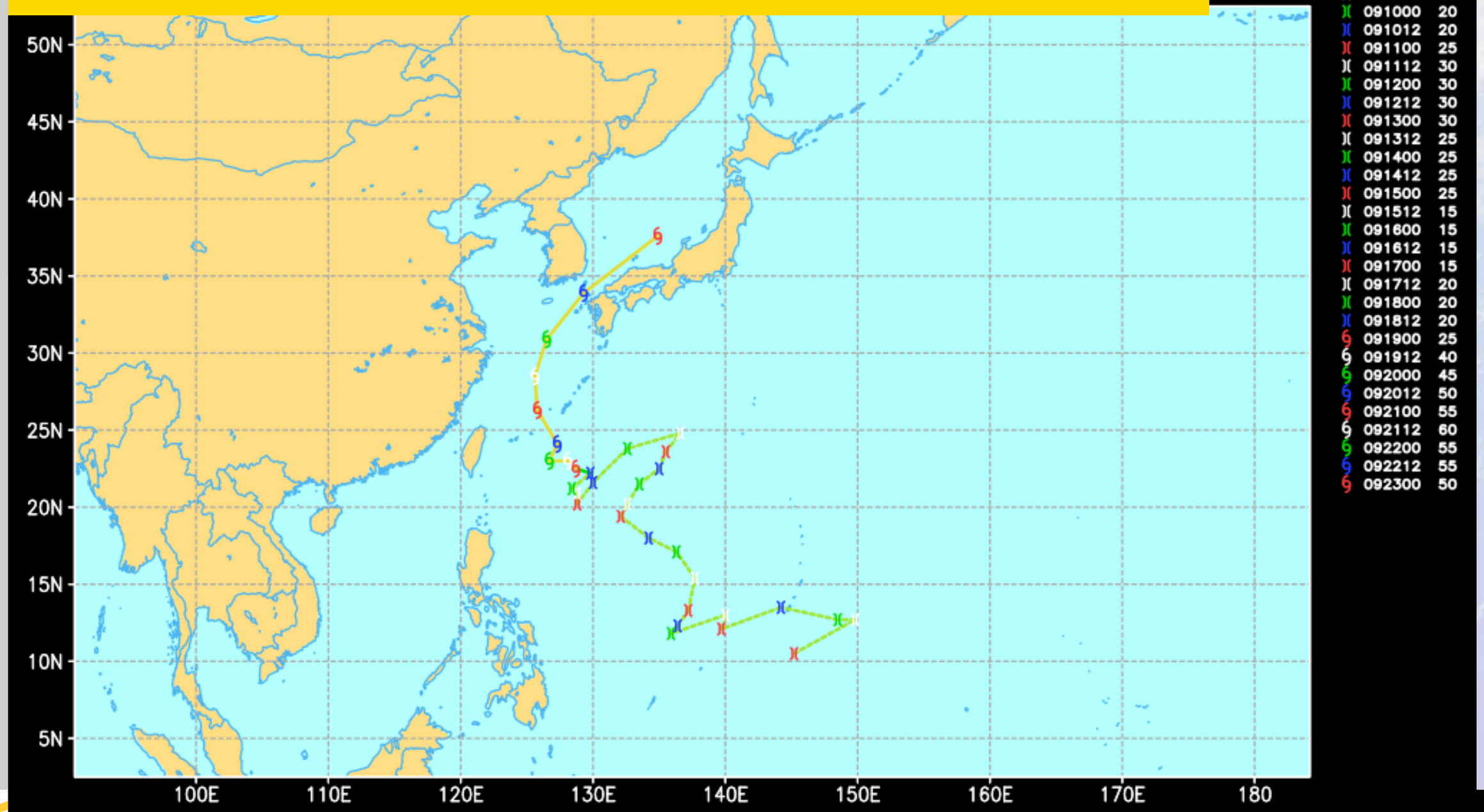
w2-tc-dss-md2-anl.py -S 18w.19 -X



18W.2019 – TS TAPAH

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

a pTC for 312 h before JTWC issued warnings (genesis)

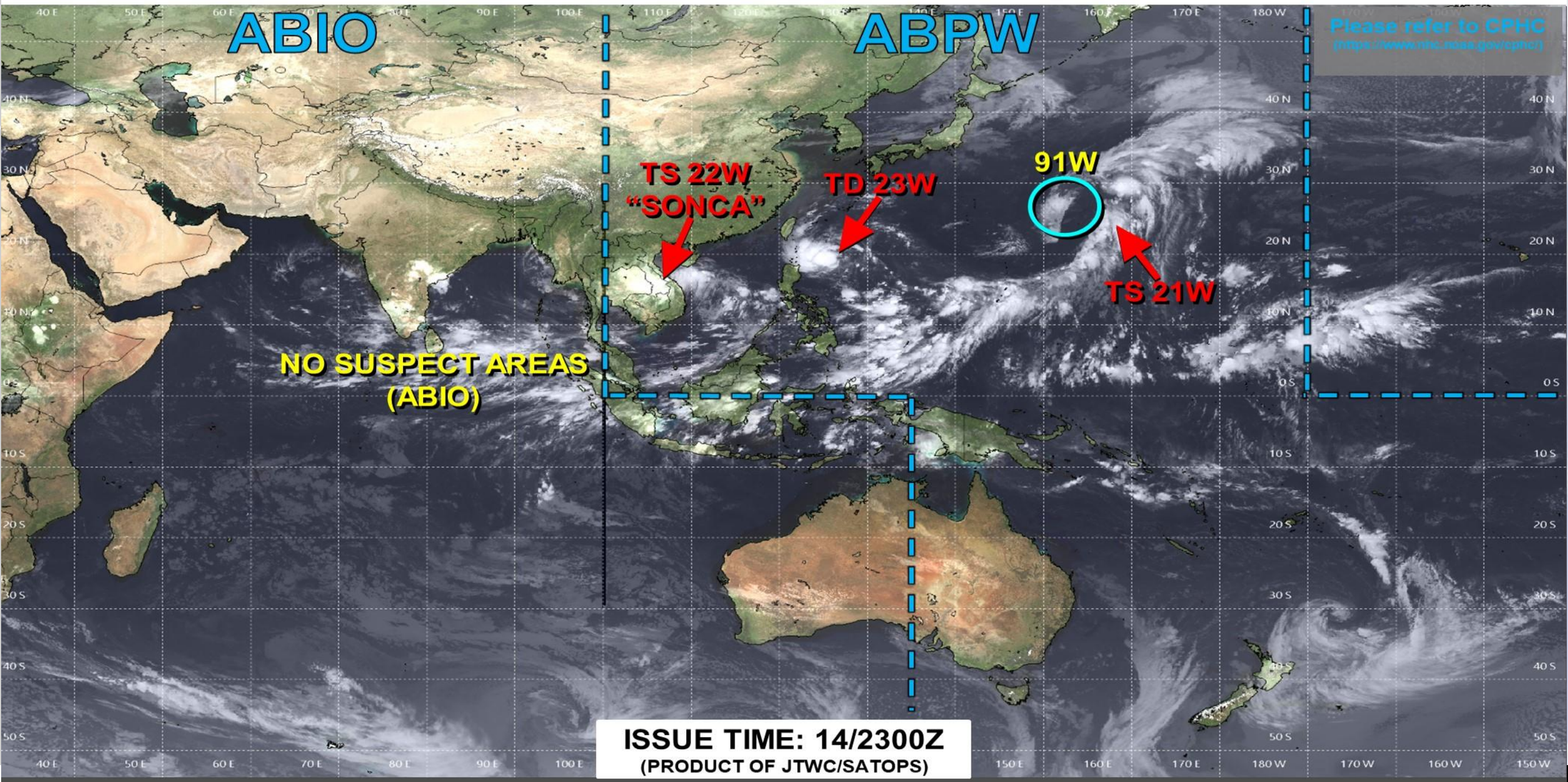


BT part of the superBT

- the ***superBT converts all*** the operational ***TC data*** into ***python objects*** that drive all applications.
  - 1947-2022
  - < 1900 in the atLANTic
- for ***climate applications*** will look at:
  - **TC activity**
  - ***TC genesis*** or ***TC formation from a pTC***

Best Track from the Operational Centers

JOINT TYPHOON WARNING CENTER



LOW — TC development unlikely within 24 hours

MEDIUM — TC development likely, but expected to occur beyond 24 hours

HIGH — TC development likely within 24 hours (Reference TCFA)

SUB TROPICAL — Monitoring for potential transition to TC. Invest label color denotes tropical transition probability

Tropical Cyclone (Reference Warning)

Best Track from the Operational Centers

JOINT TYPHOON WARNING CENTER

ABIO

INVEST (91W) or pTC that is Subtropical

TS 22W
"SONCA"

TD 23W

91W

TS 21W

NO SUSPECT AREAS
(ABIO)

ISSUE TIME: 14/2300Z
(PRODUCT OF JTWC/SATOPS)

LOW	TC development unlikely within 24 hours
MEDIUM	TC development likely, but expected to occur beyond 24 hours
HIGH	TC development likely within 24 hours (Reference TCFA)
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	Tropical Cyclone (Reference Warning)

Best Track from the Operational Centers

JOINT TYPHOON WARNING CENTER

ABIO

INVEST (91W) or pTC that is Subtropical

TS 22W "SONCA"

TD 23W

91W

TS 21W

NO SUSPECT AREAS (ABIO)

final warning on TC 21W – classified as XT or eXtra Tropical

ISSUE TIME: 14/2300Z
(PRODUCT OF JTWC/SATOPS)

LOW — TC development unlikely within 24 hours

MEDIUM — TC development likely, but expected to occur beyond 24 hours

HIGH — TC development likely within 24 hours (Reference TCFA)

SUB TROPICAL — Monitoring for potential transition to TC. Invest label color denotes tropical transition probability

Tropical Cyclone (Reference Warning)

Best Track from the Operational Centers

JOINT TYPHOON WARNING CENTER

ABIO

INVEST (91W) or pTC that is Subtropical

TS 22W "SONCA"

TD 23W

91W

TS 21W

NO SUSPECT AREAS (ABIO)

final warning on TC 21W – classified as XT or eXtra Tropical

warning on a TC with winds < 35 kt

ISSUE TIME: 14/2300Z
(PRODUCT OF JTWC/SATOPS)

LOW — TC development unlikely within 24 hours

MEDIUM — TC development likely, but expected to occur beyond 24 hours

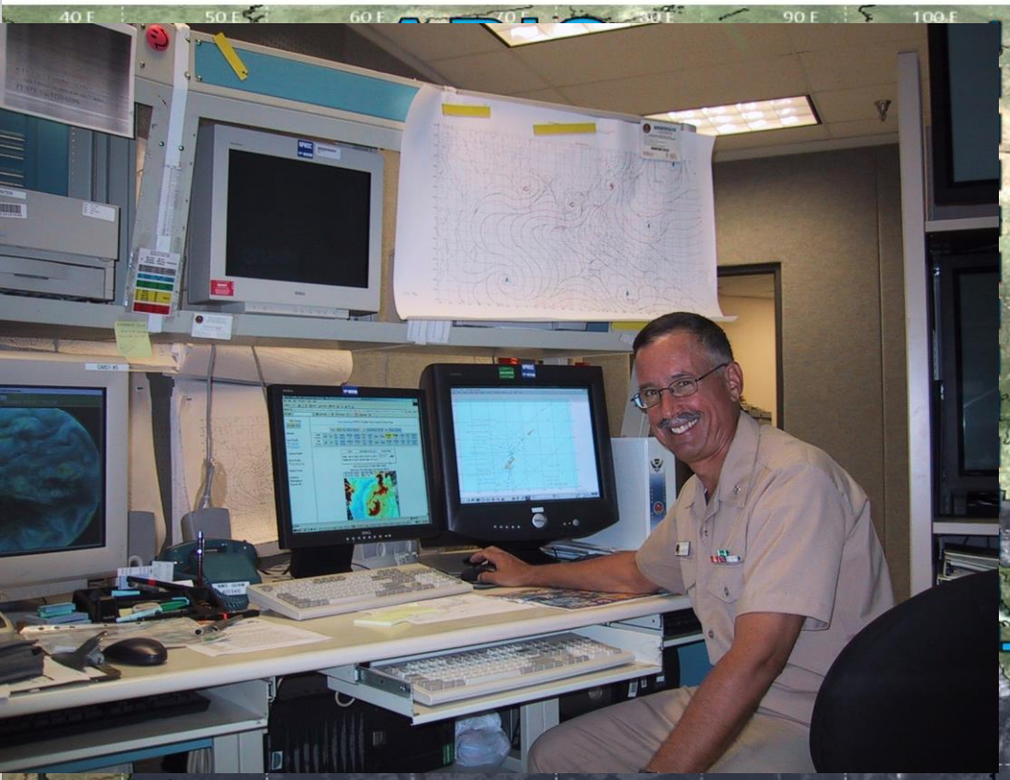
HIGH — TC development likely within 24 hours (Reference TCFA)

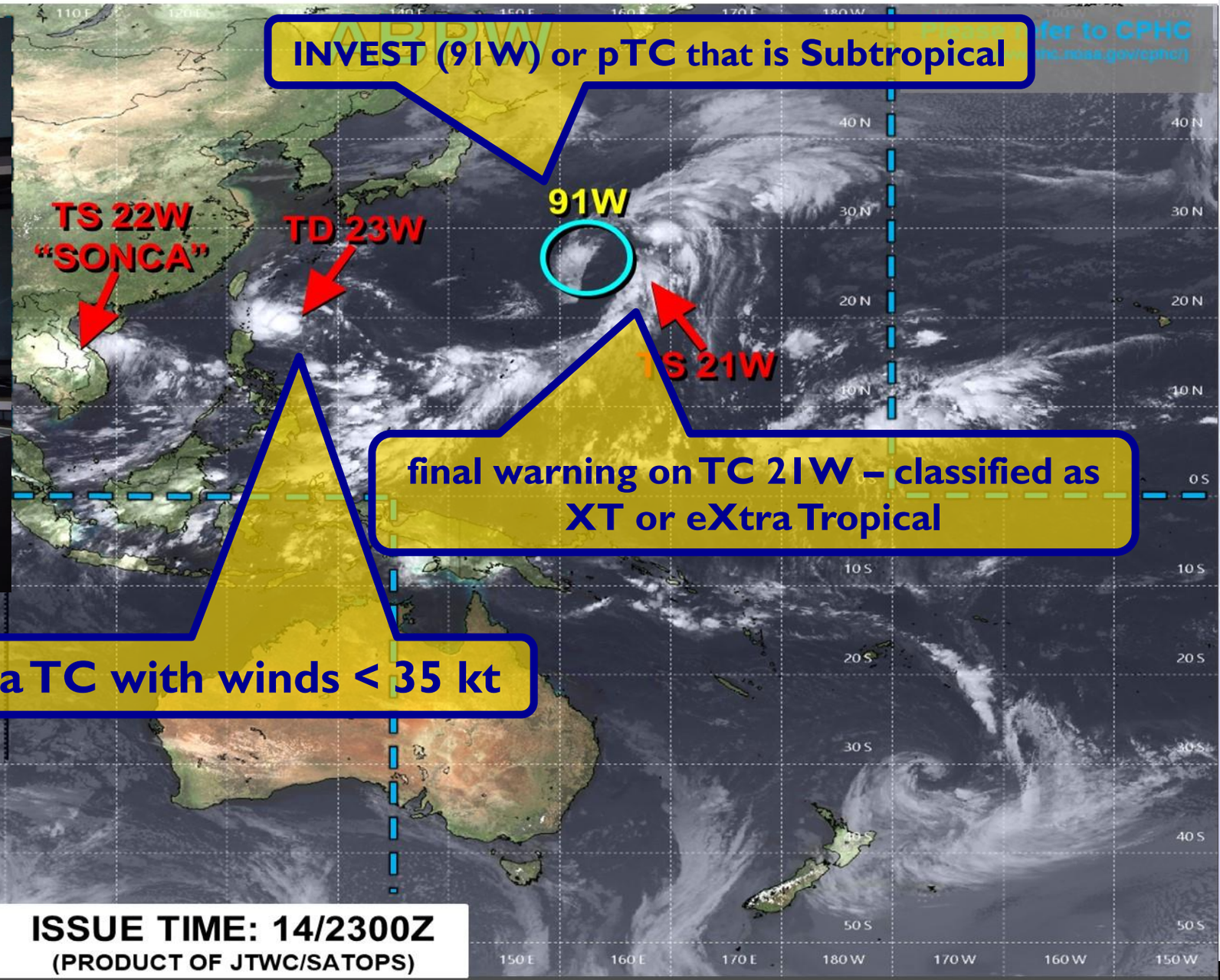
SUB TROPICAL — Monitoring for potential transition to TC. Invest label color denotes tropical transition probability

Tropical Cyclone (Reference Warning)

Best Track from the Operational Centers

JOINT TYPHOON WARNING CENTER





Best Track from the Operational Centers

JOINT TYPHOON WARNING CENTER

これは柏のはですか？

INVEST (91W) or pTC that is Subtropical

TS 22W "SONCA"

TD 23W

91W

TS 21W

final warning on TC 21W – classified as XT or eXtra Tropical

warning on a TC with winds < 35 kt

ISSUE TIME: 14/2300Z
(PRODUCT OF JTWC/SATOPS)

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SUB TROPICAL	Monitoring for potential transition to TC. Invest label color denotes tropical transition probability
	Tropical Cyclone (Reference Warning)

16W.2022 NANMODAL 'bdeck' text file

/braid1/mfiorino/w22/dat/tc/bdeck/jtwc/bwp162022.dat

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16W.2022 NANMODAL 'bdeck' text file

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WP, 16, 2022091200,   , BEST,   0, 228N, 1388E,  20, 1000, DB,   0,    ,    0,    0,    0,    0, 1005,  275,  50,   0,   0,  W,   0,    ,   0,   0,     INVEST, S,
WP, 16, 2022091206,   , BEST,   0, 222N, 1383E,  20, 1000, DB,   0,    ,    0,    0,    0,    0, 1005,  255,  70,   0,   0,  W,   0,    ,   0,   0,     INVEST, S,
WP, 16, 2022091212,   , BEST,   0, 216N, 1381E,  25, 1000, DB,   0,    ,    0,    0,    0,    0, 1005,  230,  70,   0,   0,  W,   0,    ,   0,   0,     INVEST, S,
WP, 16, 2022091218,   , BEST,   0, 216N, 1383E,  25, 1000, TD,   0,    ,    0,    0,    0,    0, 1003,  220,  70,   0,   0,  W,   0,    ,   0,   0,   SIXTEEN, S,
WP, 16, 2022091300,   , BEST,   0, 218N, 1388E,  25,  999, TD,   0,    ,    0,    0,    0,    0, 1003,  245,  25,   0,   0,  W,   0,    ,   0,   0,   SIXTEEN, S,
WP, 16, 2022091306,   , BEST,   0, 221N, 1392E,  25,  997, TD,   0,    ,    0,    0,    0,    0, 1004,  260,  25,   0,   0,  W,   0,    ,   0,   0,   SIXTEEN, S,
WP, 16, 2022091312,   , BEST,   0, 224N, 1399E,  30,  996, TD,   0,    ,    0,    0,    0,    0, 1005,  250,  25,   0,   0,  W,   0,    ,   0,   0,   SIXTEEN, S,
WP, 16, 2022091318,   , BEST,   0, 225N, 1402E,  35,  995, TS,  34, NEQ,    0,  100,    0,    0, 1003,  190,  30,   0,   0,  W,   0,    ,   0,   0,   SIXTEEN, S,
WP, 16, 2022091400,   , BEST,   0, 227N, 1404E,  40,  996, TS,  34, NEQ,   40,   85,   65,    0, 1004,  190,  30,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091406,   , BEST,   0, 229N, 1406E,  45,  993, TS,  34, NEQ,   40,   85,   65,    5, 1004,  300,  30,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091412,   , BEST,   0, 229N, 1403E,  45,  991, TS,  34, NEQ,  110,  130,  100,   35, 1005,  300,  20,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091418,   , BEST,   0, 231N, 1398E,  50,  989, TS,  34, NEQ,  120,  100,   95,  120, 1003,  300,  20,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091418,   , BEST,   0, 231N, 1398E,  50,  989, TS,  50, NEQ,   50,    0,    0,   70, 1003,  300,  20,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091500,   , BEST,   0, 232N, 1389E,  55,  980, TS,  34, NEQ,  155,   70,    0,  160, 1002,  300,  25,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091500,   , BEST,   0, 232N, 1389E,  55,  980, TS,  50, NEQ,   40,   30,    0,   45, 1002,  300,  25,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, M,
WP, 16, 2022091506,   , BEST,   0, 233N, 1381E,  65,  975, TY,  34, NEQ,  170,   75,   40,  180, 1003,  345,  40,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, D,
WP, 16, 2022091506,   , BEST,   0, 233N, 1381E,  65,  975, TY,  50, NEQ,   45,   35,    0,   40, 1003,  345,  40,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, D,
WP, 16, 2022091506,   , BEST,   0, 233N, 1381E,  65,  975, TY,  64, NEQ,   20,    0,    0,   25, 1003,  345,  40,   0,   0,  W,   0,    ,   0,   0,  NANMADOL, D,
WP, 16, 2022091512,   , BEST,   0, 235N, 1372E,  75,  969, TY,  34, NEQ,  160,  145,  130,  140, 1003,  345,  25,  85,   0,  W,   0,    ,   0,   0,  NANMADOL, D,
WP, 16, 2022091512,   , BEST,   0, 235N, 1372E,  75,  969, TY,  50, NEQ,   85,   75,   70,   75, 1003,  345,  25,  85,   0,  W,   0,    ,   0,   0,  NANMADOL, D,
WP, 16, 2022091512,   , BEST,   0, 235N, 1372E,  75,  969, TY,  64, NEQ,   45,   40,   35,   40, 1003,  345,  25,  85,   0,  W,   0,    ,   0,   0,  NANMADOL, D,
WP, 16, 2022091518,   , BEST,   0, 234N, 1364E,  85,  962, TY,  34, NEQ,  175,  130,  120,  170, 1003,  345,  25,   0,  40,  W,   0,    ,   0,   0,  NANMADOL, D,
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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

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

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WP, 16, 2022091918, 01, CARQ, -24, 332N, 1304E,  70,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,   0,   0,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ, -18, 341N, 1311E,  60,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,   0,   0,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ, -12, 350N, 1325E,  55,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,  52,  16,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ,  -6, 361N, 1343E,  50,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,   0,   0,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ,   0, 374N, 1371E,  45,  978, TS,  34, NEQ,  260,   80,  130,  290, 1000,  280,   60,    0,    0,  W,   0,   X,  55,  20,   NANMADOL, M,
WP, 16, 2022091918, 01, CARQ,   0, 374N, 1371E,  45,  978, TS,  50, NEQ,    0,    0,    0,    0, 1000,  280,   60,    0,    0,  W,   0,   X,  55,  20,   NANMADOL, M,
WP, 16, 2022091918, 01, CARQ,   0, 374N, 1371E,  45,  978, TS,  64, NEQ,    0,    0,    0,    0, 1000,  280,   60,    0,    0,  W,   0,   X,  55,  20,   NANMADOL, M,
WP, 16, 2022091918, 02, WRNG, -24, 332N, 1304E,  70,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG, -18, 341N, 1311E,  60,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG, -12, 350N, 1325E,  55,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG,  -6, 361N, 1343E,  50,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG,   0, 374N, 1371E,  45,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 03, AC00,   0, 368N, 1368E,  49,  989, XX,  34, NEQ,  232,  230,  217,  287,
WP, 16, 2022091918, 03, AC00,   6, 384N, 1402E,  32,  995, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AC00,  12, 411N, 1447E,  29,  999, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, ACEI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
WP, 16, 2022091918, 03, ACEI,  12, 420N, 1467E,  34,    0,   ,  34, NEQ,  189,    0,    0,   94,
WP, 16, 2022091918, 03, AEMI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMI,  12, 378N, 1408E,  31,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,   0, 367N, 1367E,  52,  989, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,   6, 375N, 1396E,  35,  994, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,  12, 391N, 1427E,  33,  998, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,  18, 408N, 1459E,  30, 1004, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,  24, 430N, 1491E,  28, 1006, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
WP, 16, 2022091918, 03, AFUI,  12, 381N, 1412E,  35,    0,   ,  34, NEQ,  221,    0,    0,  138,
WP, 16, 2022091918, 03, AFUI,  24, 410N, 1462E,  29,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  36, 435N, 1512E,  24,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  48, 440N, 1541E,  23,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  60, 437N, 1558E,  22,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  72, 439N, 1549E,  21,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  84, 452N, 1519E,  19,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  96, 465N, 1490E,  18,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGD2,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
WP, 16, 2022091918, 03, AGD2,  12, 405N, 1444E,  35,    0,   ,  34, NEQ,  151,   12,    0,   97,
WP, 16, 2022091918, 03, AGD2,  24, 446N, 1529E,  27,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGD2,  36, 487N, 1614E,  19,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
WP, 16, 2022091918, 03, AGDI,  12, 387N, 1422E,  34,    0,   ,  34, NEQ,  130,   14,    0,   96,
WP, 16, 2022091918, 03, AGDI,  24, 409N, 1469E,  28,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDI,  36, 438N, 1528E,  26,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDI,  48, 461N, 1607E,  24,    0,   ,  34, NEQ,    0,    0,    0,    0,
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WP, 16, 2022091918, 03, AGDM,   0, 360N, 1365E,  44,  992, XX,  34, NEQ,  303,    0,   79,  240,
WP, 16, 2022091918, 03, AGDM,   6, 355N, 1387E,  33,  997, XX,  34, NEQ,    0,    0,  212,    0,
WP, 16, 2022091918, 03, AGDM,  12, 350N, 1389E,  30,  998, XX,  34, NEQ,    0,    0,  224,    0,
WP, 16, 2022091918, 03, AGDM,  18, 358N, 1408E,  35, 1004, XX,  34, NEQ,    0,    0,   73,    0,
WP, 16, 2022091918, 03, AGDM,  24, 373N, 1433E,  30, 1005, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDM,  30, 397N, 1468E,  28, 1007, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDM,  36, 423N, 1506E,  26, 1010, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDM,  42, 440N, 1555E,  26, 1014, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDM,  48, 454N, 1610E,  24, 1016, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGDM,  54, 467N, 1667E,  21, 1018, XX,  34, NEQ,    0,    0,    0,    0,
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/braid1/mfiorino/w22/dat/tc/bdeck/jtwc/awp162022.dat

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WP, 16, 2022091918, 01, CARQ, -24, 332N, 1304E,  70,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,   0,   0,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ, -18, 341N, 1311E,  60,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,   0,   0,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ, -12, 350N, 1325E,  55,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,  52,  16,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ,  -6, 361N, 1343E,  50,    0, TS,  34, AAA,    0,    0,    0,    0,    0,    0,    0,    0,    0,  W,   0,   X,   0,   0,   NANMADOL,  ,
WP, 16, 2022091918, 01, CARQ,   0, 374N, 1371E,  45,  978, TS,  34, NEQ,  260,   80,  130,  290, 1000,  280,   60,    0,    0,  W,   0,   X,  55,  20,   NANMADOL, M,
WP, 16, 2022091918, 01, CARQ,   0, 374N, 1371E,  45,  978, TS,  50, NEQ,    0,    0,    0,    0, 1000,  280,   60,    0,    0,  W,   0,   X,  55,  20,   NANMADOL, M,
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WP, 16, 2022091918, 02, WRNG, -18, 341N, 1311E,  60,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG, -12, 350N, 1325E,  55,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG,  -6, 361N, 1343E,  50,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
WP, 16, 2022091918, 02, WRNG,   0, 374N, 1371E,  45,    0,   ,   0,    ,    0,    0,    0,    0,    0,    0,    0,    0,    0,   ,   0, SJB,  60,  26,
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WP, 16, 2022091918, 03, AC00,  12, 411N, 1447E,  29,  999, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, ACEI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
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WP, 16, 2022091918, 03, AEMI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMI,  12, 378N, 1408E,  31,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,   0, 367N, 1367E,  52,  989, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,   6, 375N, 1396E,  35,  994, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,  12, 391N, 1427E,  33,  998, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,  18, 408N, 1459E,  30, 1004, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AEMN,  24, 430N, 1491E,  28, 1006, XX,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
WP, 16, 2022091918, 03, AFUI,  12, 381N, 1412E,  35,    0,   ,  34, NEQ,  221,    0,    0,  138,
WP, 16, 2022091918, 03, AFUI,  24, 410N, 1462E,  29,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  36, 435N, 1512E,  24,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  48, 440N, 1541E,  23,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  60, 437N, 1558E,  22,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  72, 439N, 1549E,  21,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  84, 452N, 1519E,  19,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AFUI,  96, 465N, 1490E,  18,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGD2,   0, 374N, 1371E,  45,    0,   ,  34, NEQ,  260,   80,  130,  290,
WP, 16, 2022091918, 03, AGD2,  12, 405N, 1444E,  35,    0,   ,  34, NEQ,  151,   12,    0,   97,
WP, 16, 2022091918, 03, AGD2,  24, 446N, 1529E,  27,    0,   ,  34, NEQ,    0,    0,    0,    0,
WP, 16, 2022091918, 03, AGD2,  36, 487N, 1614E,  19,    0,   ,  34, NEQ,    0,    0,    0,    0,
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ATCF format – .csv 29 columns

- operational information including forecaster initial (SJB = Steve Barlow)
- previous 12, 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 → A, second →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***

16W.2022 NANMODAL mdeck

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

```
2022090506      F2W.2022 015 1005  20.0N  142.6E  --- ---  313.0  5.1 b  DB NW  ---   1/30  lf: 0.00 INVEST
2022090512      F2W.2022 015 1005  20.3N  141.5E  --- ---  313.0  5.1 b  DB NW  ---   2/30  lf: 0.00 INVEST
2022090518      F2W.2022 015 1005  20.7N  141.8E  --- ---  313.0  5.1 c  DB NW  ---   3/30  lf: 0.00
2022090600      F2W.2022 015 1005  21.0N  141.9E  --- ---  345.0  3.6 c  DB NW  ---   4/30  lf: 0.00
2022090606      F2W.2022 015 1005  20.7N  142.3E  --- ---   51.3  2.4 c  DB NW  ---   5/30  lf: 0.00
2022090612      F2W.2022 015 1005  21.2N  142.2E  --- ---  360.0  3.5 c  DB NW  ---   6/30  lf: 0.00
2022090618      F2W.2022 015 1006  21.8N  142.3E  --- ---  338.3  3.8 c  DB NW  ---   7/30  lf: 0.00
2022090700      F2W.2022 015 1006  21.9N  142.1E  --- ---  308.9  2.4 c  DB NW  ---   8/30  lf: 0.00
2022090706      F2W.2022 015 1006  22.2N  142.0E  --- ---  325.2  2.4 c  DB NW  ---   9/30  lf: 0.00
2022090712      F2W.2022 015 1006  22.5N  141.7E  --- ---  328.3  3.5 c  DB NW  ---  10/30  lf: 0.00
2022090718      F2W.2022 015 1008  22.8N  141.5E  --- ---  322.4  3.8 c  DB NW  ---  11/30  lf: 0.00
2022090800      F2W.2022 015 1008  24.2N  142.9E  --- ---   40.0  7.8 c  DB NW  ---  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  --- ---   59.5  8.9 c  DB NW  ---  16/30  lf: 0.00
2022090906      F2W.2022 020 1007  27.1N  145.7E  --- ---   63.1 11.0 c  DB NW  ---  17/30  lf: 0.00
2022090912      F2W.2022 020 1007  27.4N  146.9E  --- ---   74.3 11.1 c  DB NW  ---  18/30  lf: 0.00
2022090918      F2W.2022 020 1007  27.3N  147.9E  --- ---   86.4  8.0 c  DB NW  ---  19/30  lf: 0.00
2022091000      F2W.2022 020 1002  26.6N  147.5E  --- ---  153.0  3.9 c  DB NW  ---  20/30  lf: 0.00
2022091006      F2W.2022 020 1002  26.6N  147.3E  --- ---  209.1  4.6 c  DB NW  ---  21/30  lf: 0.00
2022091012      F2W.2022 020 1002  26.8N  146.6E  --- ---  284.0  4.1 c  DB NW  ---  22/30  lf: 0.00
2022091018      F2W.2022 020 1002  27.1N  144.4E  --- ---  280.9 13.2 b  DB NW  ---  23/30  lf: 0.00 INVEST
2022091100      F2W.2022 020 1003  26.8N  143.4E  --- ---  270.0  9.0 C  DB NW  ---  24/30  lf: 0.00 INVEST
2022091106      F2W.2022 020 1003  27.1N  141.7E  --- ---  275.0 12.0 C  DB NW  ---  25/30  lf: 0.00 INVEST
2022091112      F2W.2022 020 1003  26.6N  139.4E  --- ---  265.0 15.0 C  DB NW  ---  26/30  lf: 0.00 INVEST
2022091118      F2W.2022 020 1000  23.4N  139.1E  --- ---  260.0 10.0 C  DB NW  ---  27/30  lf: 0.00 INVEST
2022091200*     F2W.2022 020 1000  22.9N  139.1E  --- ---  240.0  7.0 C  DB NW  ---  28/30  lf: 0.00 INVEST    <**Genesis
2022091206*     F2W.2022 020 1000  22.6N  137.4E  --- ---  245.0  9.0 C  DB NW  ---  29/30  lf: 0.00 INVEST    <**Genesis
2022091212*     F2W.2022 020 1000  22.3N  138.2E  --- ---  225.0  5.0 C  DB NW  ---  30/30  lf: 0.00 INVEST    <**Genesis
2022091218*     16W.2022 025 1000  21.7N  138.5E  --- ---  159.6  2.7 c  TD WN  BCH  28/57  lf: 0.00           <**Genesis
2022091300*     16W.2022 025  999  21.7N  138.5E  --- ---  160.0  2.0 C  TD WN  BCH  29/57  lf: 0.00 SIXTEEN   <**Genesis
2022091306*     16W.2022 025  997  22.1N  139.2E  --- ---   65.0  4.0 C  TD WN  WAD  30/57  lf: 0.00 SIXTEEN   <**Genesis
2022091312      16W.2022 030  996  22.5N  139.6E  --- ---   55.0  5.0 C  TD WN  WAD  31/57  lf: 0.00 SIXTEEN
2022091318      16W.2022 035  999  22.5N  140.2E   50 ---   60.0  5.0 C  TS WN  BRS  32/57  lf: 0.00 SIXTEEN
2022091400      16W.2022 040  996  22.7N  140.4E   63 ---   60.0  4.0 C  TS WN  BRS  33/57  lf: 0.00 NANMADOL
2022091406      16W.2022 045  993  22.9N  140.6E   49 ---   50.0  3.0 C  TS WN  WAD  34/57  lf: 0.00 NANMADOL
2022091412      16W.2022 045  991  22.9N  140.5E   94 ---   35.0  2.0 C  TS WN  WAD  35/57  lf: 0.00 NANMADOL
2022091418      16W.2022 050  989  23.1N  139.8E  109  60  305.0  2.0 C  TS WN  CRM  36/57  lf: 0.00 NANMADOL
2022091500      16W.2022 055  980  23.3N  138.8E  168  91  285.0  6.0 C  TS WN  OHS  37/57  lf: 0.00 NANMADOL
2022091506      16W.2022 065  975  23.5N  137.9E  118  40  285.0  8.0 C  TY WN  RCB  38/57  lf: 0.00 NANMADOL
2022091512      16W.2022 070  970  23.4N  137.3E  144  76  280.0  8.0 C  TY WN  RCB  39/57  lf: 0.00 NANMADOL
2022091518      16W.2022 085  962  23.4N  136.4E  149  80  275.0  8.0 C  TY WN  LPC  40/57  lf: 0.00 NANMADOL
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
2022091606      16W.2022 115  935  24.2N  135.3E  166  94  290.0  6.0 C  TY WN  RCB  42/57  lf: 0.00 NANMADOL
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
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
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
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
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
```

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16W.2022 NANMODAL mdeck

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

was a pTC for 180 h or 7.5 d

2022090506	F2W.2022	015	1005	20.0N	142.6E	---	---	313.0	5.1	b	DB	NW	---	1/30	lf: 0.00 INVEST
2022090512	F2W.2022	015	1005	20.3N	141.5E	---	---	313.0	5.1	b	DB	NW	---	2/30	lf: 0.00 INVEST
2022090518	F2W.2022	015	1005	20.7N	141.8E	---	---	313.0	5.1	c	DB	NW	---	3/30	lf: 0.00
2022090600	F2W.2022	015	1005	21.0N	141.9E	---	---	345.0	3.6	c	DB	NW	---	4/30	lf: 0.00
2022090606	F2W.2022	015	1005	20.7N	142.3E	---	---	51.3	2.4	c	DB	NW	---	5/30	lf: 0.00
2022090612	F2W.2022	015	1005	21.2N	142.2E	---	---	360.0	3.5	c	DB	NW	---	6/30	lf: 0.00
2022090618	F2W.2022	015	1006	21.8N	142.3E	---	---	338.3	3.8	c	DB	NW	---	7/30	lf: 0.00
2022090700	F2W.2022	015	1006	21.9N	142.1E	---	---	308.9	2.4	c	DB	NW	---	8/30	lf: 0.00
2022090706	F2W.2022	015	1006	22.2N	142.0E	---	---	325.2	2.4	c	DB	NW	---	9/30	lf: 0.00
2022090712	F2W.2022	015	1006	22.5N	141.7E	---	---	328.3	3.5	c	DB	NW	---	10/30	lf: 0.00
2022090718	F2W.2022	015	1008	22.8N	141.5E	---	---	322.	3.8	c	DB	NW	---	11/30	lf: 0.00
2022090800	F2W.2022	015	1008	23.2N	142.9E	---	---	40.0	7.8	C	DB	NW	---	12/30	lf: 0.00
2022090806	F2W.2022	015	1009	24.7N	143.0E	---	---	32.0	5.0	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	---	---	59.5	8.9	c	DB	NW	---	16/30	lf: 0.00
2022090906	F2W.2022	020	1007	27.1N	145.7E	---	---	63.1	11.0	c	DB	NW	---	17/30	lf: 0.00
2022090912	F2W.2022	020	1007	27.4N	146.9E	---	---	74.3	11.1	c	DB	NW	---	18/30	lf: 0.00
2022090918	F2W.2022	020	1007	27.3N	147.9E	---	---	86.4	8.0	c	DB	NW	---	19/30	lf: 0.00
2022091000	F2W.2022	020	1002	26.6N	147.5E	---	---	153.0	3.9	c	DB	NW	---	20/30	lf: 0.00
2022091006	F2W.2022	020	1002	26.6N	147.3E	---	---	209.1	4.6	c	DB	NW	---	21/30	lf: 0.00
2022091012	F2W.2022	020	1002	26.8N	146.6E	---	---	284.0	4.1	c	DB	NW	---	22/30	lf: 0.00
2022091018	F2W.2022	020	1002	27.1N	144.4E	---	---	280.9	13.2	b	DB	NW	---	23/30	lf: 0.00 INVEST
2022091100	F2W.2022	020	1003	26.8N	143.4E	---	---	270.0	9.0	C	DB	NW	---	24/30	lf: 0.00 INVEST
2022091106	F2W.2022	020	1003	27.1N	141.7E	---	---	275.0	12.0	C	DB	NW	---	25/30	lf: 0.00 INVEST
2022091112	F2W.2022	020	1003	26.6N	139.4E	---	---	265.0	15.0	C	DB	NW	---	26/30	lf: 0.00 INVEST
2022091118	F2W.2022	020	1000	23.4N	139.1E	---	---	260.0	10.0	C	DB	NW	---	27/30	lf: 0.00 INVEST
2022091200*	F2W.2022	020	1000	22.9N	139.1E	---	---	240.0	7.0	C	DB	NW	---	28/30	lf: 0.00 INVEST <**Genesis
2022091206*	F2W.2022	020	1000	22.6N	137.4E	---	---	245.0	9.0	C	DB	NW	---	29/30	lf: 0.00 INVEST <**Genesis
2022091212*	F2W.2022	020	1000	22.3N	138.2E	---	---	225.0	5.0	C	DB	NW	---	30/30	lf: 0.00 INVEST <**Genesis
2022091218*	16W.2022	025	1000	21.7N	138.5E	---	---	159.6	2.7	c	TD	WN	BCH	28/57	lf: 0.00 <**Genesis
2022091300*	16W.2022	025	999	21.7N	138.5E	---	---	160.0	2.0	C	TD	WN	BCH	29/57	lf: 0.00 SIXTEEN <**Genesis
2022091306*	16W.2022	025	997	22.1N	139.2E	---	---	65.0	4.0	C	TD	WN	WAD	30/57	lf: 0.00 SIXTEEN <**Genesis
2022091312	16W.2022	030	996	22.5N	139.6E	---	---	55.0	5.0	C	TD	WN	WAD	31/57	lf: 0.00 SIXTEEN
2022091318	16W.2022	035	999	22.5N	140.2E	50	---	60.0	5.0	C	TS	WN	BRS	32/57	lf: 0.00 SIXTEEN
2022091400	16W.2022	040	996	22.7N	140.4E	63	---	60.0	4.0	C	TS	WN	BRS	33/57	lf: 0.00 NANMADOL
2022091406	16W.2022	045	993	22.9N	140.6E	49	---	50.0	3.0	C	TS	WN	WAD	34/57	lf: 0.00 NANMADOL
2022091412	16W.2022	045	991	22.9N	140.5E	94	---	35.0	2.0	C	TS	WN	WAD	35/57	lf: 0.00 NANMADOL
2022091418	16W.2022	050	989	23.1N	139.8E	109	60	305.0	2.0	C	TS	WN	CRM	36/57	lf: 0.00 NANMADOL
2022091500	16W.2022	055	980	23.3N	138.8E	168	91	285.0	6.0	C	TS	WN	OHS	37/57	lf: 0.00 NANMADOL
2022091506	16W.2022	065	975	23.5N	137.9E	118	40	285.0	8.0	C	TY	WN	RCB	38/57	lf: 0.00 NANMADOL
2022091512	16W.2022	070	970	23.4N	137.3E	144	76	280.0	8.0	C	TY	WN	RCB	39/57	lf: 0.00 NANMADOL
2022091518	16W.2022	085	962	23.4N	136.4E	149	80	275.0	8.0	C	TY	WN	LPC	40/57	lf: 0.00 NANMADOL
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
2022091606	16W.2022	115	935	24.2N	135.3E	166	94	290.0	6.0	C	TY	WN	RCB	42/57	lf: 0.00 NANMADOL
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
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
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
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
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

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16W.2022 NANMODAL mdeck

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

```
2022090506     F2W.2022 015 1005  20.0N  142.6E  --- ---  313.0  5.1 b  DB NW  ---   1/30  lf: 0.00 INVEST
2022090512     F2W.2022 015 1005  20.3N  141.5E  --- ---  313.0  5.1 b  DB NW  ---   2/30  lf: 0.00 INVEST
2022090518     F2W.2022 015 1005  20.7N  141.8E  --- ---  313.0  5.1 c  DB NW  ---   3/30  lf: 0.00
2022090600     F2W.2022 015 1005  21.0N  141.9E  --- ---  345.0  3.6 c  DB NW  ---   4/30  lf: 0.00
2022090606     F2W.2022 015 1005  20.7N  142.3E  --- ---   51.3  2.4 c  DB NW  ---   5/30  lf: 0.00
2022090612     F2W.2022 015 1005  21.2N  142.2E  --- ---  360.0  3.5 c  DB NW  ---   6/30  lf: 0.00
2022090618     F2W.2022 015 1006  21.8N  142.3E  --- ---  338.3  3.8 c  DB NW  ---   7/30  lf: 0.00
2022090700     F2W.2022 015 1006  21.9N  142.1E  --- ---  308.9  2.4 c  DB NW  ---   8/30  lf: 0.00
2022090706     F2W.2022 015 1006  22.2N  142.0E  --- ---  325.2  2.4 c  DB NW  ---   9/30  lf: 0.00
2022090712     F2W.2022 015 1006  22.5N  141.7E  --- ---  328.3  3.5 c  DB NW  ---  10/30  lf: 0.00
2022090718     F2W.2022 015 1008  22.8N  141.5E  --- ---  322.4  3.8 c  DB NW  ---  11/30  lf: 0.00
2022090800     F2W.2022 015 1008  24.2N  142.9E  --- ---   40.0  7.8 c  DB NW  ---  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  --- ---   59.5  8.9 c  DB NW  ---  16/30  lf: 0.00
2022090906     F2W.2022 020 1007  27.1N  145.7E  --- ---   63.1 11.0 c  DB NW  ---  17/30  lf: 0.00
2022090912     F2W.2022 020 1007  27.4N  146.9E  --- ---   74.3 11.1 c  DB NW  ---  18/30  lf: 0.00
2022090918     F2W.2022 020 1007  27.3N  147.9E  --- ---   86.4  8.0 c  DB NW  ---  19/30  lf: 0.00
2022091000     F2W.2022 020 1002  26.6N  147.5E  --- ---  153.0  3.9 c  DB NW  ---  20/30  lf: 0.00
2022091006     F2W.2022 020 1002  26.6N  147.3E  --- ---  209.1  4.6 c  DB NW  ---  21/30  lf: 0.00
2022091012     F2W.2022 020 1002  26.8N  146.6E  --- ---  284.0  4.1 c  DB NW  ---  22/30  lf: 0.00
2022091812      16W.2022 080  958  31.9N  130.6E  222 128  350.0 12.0 C
2022091818      16W.2022 070  965  33.1N  130.5E  222 131  355.0 11.0 C
2022091900      16W.2022 060  975  34.1N  131.1E  216 120    5.0 11.0 C
2022091906      16W.2022 055  971  34.8N  132.4E  239  96   25.0 11.0 C
2022091912      16W.2022 050  971  36.1N  134.3E  250  88   45.0 14.0 C
2022091918      16W.2022 045  978  37.4N  137.1E  190 ---   55.0 20.0 C
2022092000      16W.2022 040  993  38.5N  141.2E  191 ---   66.4 29.9 c
2022 16W  STY NANMADOL   :135 : 7.2;14.8 : 25.5 139.3 : 090506<->092000
 TY WN  SMB  51/57  lf: 0.72 NANMADOL
 TY WN  BCH  52/57  lf: 0.75 NANMADOL
 TS WN  BCH  53/57  lf: 0.51 NANMADOL
 TS WN  MEK  54/57  lf: 0.73 NANMADOL
 TS WN  MEK  55/57  lf: 0.11 NANMADOL
 TS WN  SJB  56/57  lf: 0.16 NANMADOL
 EX NW  ---  57/57  lf: 0.77
: 20.0<->38.5  :130.5<->147.9 : 8.2 :11.6 : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
```

16W.2022 NANMODAL mdeck

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

```
2022090506     F2W.2022 015 1005  20.0N  142.6E  --- ---  313.0  5.1 b  DB NW  ---   1/30  lf: 0.00 INVEST
2022090512     F2W.2022 015 1005  20.3N  141.5E  --- ---  313.0  5.1 b  DB NW  ---   2/30  lf: 0.00 INVEST
2022090518     F2W.2022 015 1005  20.7N  141.8E  --- ---  313.0  5.1 c  DB NW  ---   3/30  lf: 0.00
2022090600     F2W.2022 015 1005  21.0N  141.9E  --- ---  345.0  3.6 c  DB NW  ---   4/30  lf: 0.00
2022090606     F2W.2022 015 1005  20.7N  142.3E  --- ---   51.3  2.4 c  DB NW  ---   5/30  lf: 0.00
2022090612     F2W.2022 015 1005  21.2N  142.2E  --- ---  360.0  3.5 c  DB NW  ---   6/30  lf: 0.00
2022090618     F2W.2022 015 1006  21.8N  142.3E  --- ---  338.3  3.8 c  DB NW  ---   7/30  lf: 0.00
2022090700     F2W.2022 015 1006  21.9N  142.1E  --- ---  308.9  2.4 c  DB NW  ---   8/30  lf: 0.00
2022090706     F2W.2022 015 1006  22.2N  142.0E  --- ---  325.2  2.4 c  DB NW  ---   9/30  lf: 0.00
2022090712     F2W.2022 015 1006  22.5N  141.7E  --- ---  328.3  3.5 c  DB NW  ---  10/30  lf: 0.00
2022090718     F2W.2022 015 1008  22.8N  141.5E  --- ---  322.4  3.8 c  DB NW  ---  11/30  lf: 0.00
2022090800     F2W.2022 015 1008  24.2N  142.9E  --- ---   40.0  7.8 c  DB NW  ---  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  --- ---   59.5  8.9 c  DB NW  ---  16/30  lf: 0.00
2022090906     F2W.2022 020 1007  27.1N  145.7E  --- ---   63.1 11.0 c  DB NW  ---  17/30  lf: 0.00
2022090912     F2W.2022 020 1007  27.4N  146.9E  --- ---   74.3 11.1 c  DB NW  ---  18/30  lf: 0.00
2022090918     F2W.2022 020 1007  27.3N  147.9E  --- ---   86.4  8.0 c  DB NW  ---  19/30  lf: 0.00
2022091000     F2W.2022 020 1002  26.6N  147.5E  --- ---  153.0  3.9 c  DB NW  ---  20/30  lf: 0.00
2022091006     F2W.2022 020 1002  26.6N  147.3E  --- ---  209.1  4.6 c  DB NW  ---  21/30  lf: 0.00
2022091012     F2W.2022 020 1002  26.8N  146.6E  --- ---  284.0  4.1 c  DB NW  ---  22/30  lf: 0.00
2022091812     16W.2022 080  958  31.9N  130.6E  222 128  350.0 12.0 C
2022091818     16W.2022 070  965  33.1N  130.5E  222 131  355.0 11.0 C
2022091900     16W.2022 060  975  34.1N  131.1E  216 120    5.0 11.0 C
2022091906     16W.2022 055  971  34.8N  132.4E  239  96   25.0 11.0 C
2022091912     16W.2022 050  971  36.1N  134.3E  250  88   45.0 14.0 C
2022091918     16W.2022 045  978  37.4N  137.1E  190 ---   55.0 20.0 C
2022092000     16W.2022 040  993  38.5N  141.2E  191 ---   66.4 29.9 c
2022 16W  STY NANMADOL   :135 : 7.2;14.8 : 25.5 139.3 : 090506<->092000
 TY WN  SMB  51/57  lf: 0.72 NANMADOL
 TY WN  BCH  52/57  lf: 0.75 NANMADOL
 TS WN  BCH  53/57  lf: 0.51 NANMADOL
 TS WN  MEK  54/57  lf: 0.73 NANMADOL
 TS WN  MEK  55/57  lf: 0.11 NANMADOL
 TS WN  SJB  56/57  lf: 0.16 NANMADOL
 EX NW  ---  57/57  lf: 0.77
: 20.0<->38.5  :130.5<->147.9 : 8.2 :11.6 : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
```

summary stats

ED – Explosive Deeping >= 50 kt / 24 h

16W.2022 NANMODAL mdeck

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

```
2022090506     F2W.2022 015 1005  20.0N  142.6E  --- ---  313.0  5.1 b  DB NW  ---   1/30  lf: 0.00 INVEST
2022090512     F2W.2022 015 1005  20.3N  141.5E  --- ---  313.0  5.1 b  DB NW  ---   2/30  lf: 0.00 INVEST
2022090518     F2W.2022 015 1005  20.7N  141.8E  --- ---  313.0  5.1 c  DB NW  ---   3/30  lf: 0.00
2022090600     F2W.2022 015 1005  21.0N  141.9E  --- ---  345.0  3.6 c  DB NW  ---   4/30  lf: 0.00
2022090606     F2W.2022 015 1005  20.7N  142.3E  --- ---   51.3  2.4 c  DB NW  ---   5/30  lf: 0.00
2022090612     F2W.2022 015 1005  21.2N  142.2E  --- ---  360.0  3.5 c  DB NW  ---   6/30  lf: 0.00
2022090618     F2W.2022 015 1006  21.8N  142.3E  --- ---  338.3  3.8 c  DB NW  ---   7/30  lf: 0.00
2022090700     F2W.2022 015 1006  21.9N  142.1E  --- ---  308.9  2.4 c  DB NW  ---   8/30  lf: 0.00
2022090706     F2W.2022 015 1006  22.2N  142.0E  --- ---  325.2  2.4 c  DB NW  ---   9/30  lf: 0.00
2022090712     F2W.2022 015 1006  22.5N  141.7E  --- ---  328.3  3.5 c  DB NW  ---  10/30  lf: 0.00
2022090718     F2W.2022 015 1008  22.8N  141.5E  --- ---  322.4  3.8 c  DB NW  ---  11/30  lf: 0.00
2022090800     F2W.2022 015 1008  24.2N  142.9E  --- ---   40.0  7.8 c  DB NW  ---  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  --- ---   59.5  8.9 c  DB NW  ---  16/30  lf: 0.00
2022090906     F2W.2022 020 1007  27.1N  145.7E  --- ---   63.1 11.0 c  DB NW  ---  17/30  lf: 0.00
2022090912     F2W.2022 020 1007  27.4N  146.9E  --- ---   74.3 11.1 c  DB NW  ---  18/30  lf: 0.00
2022090918     F2W.2022 020 1007  27.3N  147.9E  --- ---   86.4  8.0 c  DB NW  ---  19/30  lf: 0.00
2022091000     F2W.2022 020 1002  26.6N  147.5E  --- ---  153.0  3.9 c  DB NW  ---  20/30  lf: 0.00
2022091006     F2W.2022 020 1002  26.6N  147.3E  --- ---  209.1  4.6 c  DB NW  ---  21/30  lf: 0.00
2022091012     F2W.2022 020 1002  26.8N  146.6E  --- ---  284.0  4.1 c  DB NW  ---  22/30  lf: 0.00
2022091812     16W.2022 080  958  31.9N  130.6E  222 128  350.0 12.0 C
2022091818     16W.2022 070  965  33.1N  130.5E  222 131  355.0 11.0 C
2022091900     16W.2022 060  975  34.1N  131.1E  216 120    5.0 11.0 C
2022091906     16W.2022 055  971  34.8N  132.4E  239  96   25.0 11.0 C
2022091912     16W.2022 050  971  36.1N  134.3E  250  88   45.0 14.0 C
2022091918     16W.2022 045  978  37.4N  137.1E  190 ---   55.0 20.0 C
2022092000     16W.2022 040  993  38.5N  141.2E  191 ---   66.4 29.9 c
2022 16W  STY NANMADOL   :13  : 7.2  14.8 : 25.5 139.3 : 090506<->092000
TY WN  SMB  51/57  lf: 0.72  NANMADOL
TY WN  BCH  52/57  lf: 0.75  NANMADOL
TS WN  BCH  53/57  lf: 0.51  NANMADOL
TS WN  MEK  54/57  lf: 0.73  NANMADOL
TS WN  MEK  55/57  lf: 0.11  NANMADOL
TS WN  SJB  56/57  lf: 0.16  NANMADOL
EX NW  ---  57/57  lf: 0.77
: 20.0<->38.5  :130.5<->147.9 : 8.2 :11.6 : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
```

summary stats
sACEd

summary stats
ED – Explosive Deeping >= 50 kt / 24 h

16W.2022 NANMODAL mdeck

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

```
2022090506     F2W.2022 015 1005  20.0N  142.6E  --- ---  313.0  5.1 b  DB NW  ---   1/30  lf: 0.00 INVEST
2022090512     F2W.2022 015 1005  20.3N  141.5E  --- ---  313.0  5.1 b  DB NW  ---   2/30  lf: 0.00 INVEST
2022090518     F2W.2022 015 1005  20.7N  141.8E  --- ---  313.0  5.1 c  DB NW  ---   3/30  lf: 0.00
2022090600     F2W.2022 015 1005  21.0N  141.9E  --- ---  345.0  3.6 c  DB NW  ---   4/30  lf: 0.00
2022090606     F2W.2022 015 1005  20.7N  142.3E  --- ---   51.3  2.4 c  DB NW  ---   5/30  lf: 0.00
2022090612     F2W.2022 015 1005  21.2N  142.2E  --- ---  360.0  3.5 c  DB NW  ---   6/30  lf: 0.00
2022090618     F2W.2022 015 1006  21.8N  142.3E  --- ---  338.3  3.8 c  DB NW  ---   7/30  lf: 0.00
2022090700     F2W.2022 015 1006  21.9N  142.1E  --- ---  308.9  2.4 c  DB NW  ---   8/30  lf: 0.00
2022090706     F2W.2022 015 1006  22.2N  142.0E  --- ---  325.2  2.4 c  DB NW  ---   9/30  lf: 0.00
2022090712     F2W.2022 015 1006  22.5N  141.7E  --- ---  328.3  3.5 c  DB NW  ---  10/30  lf: 0.00
2022090718     F2W.2022 015 1008  22.8N  141.5E  --- ---  322.4  3.8 c  DB NW  ---  11/30  lf: 0.00
2022090800     F2W.2022 015 1008  24.2N  142.9E  --- ---   40.0  7.8 c  DB NW  ---  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  --- ---   59.5  8.9 c  DB NW  ---  16/30  lf: 0.00
2022090906     F2W.2022 020 1007  27.1N  145.7E  --- ---   63.1 11.0 c  DB NW  ---  17/30  lf: 0.00
2022090912     F2W.2022 020 1007  27.4N  146.9E  --- ---   74.3 11.1 c  DB NW  ---  18/30  lf: 0.00
2022090918     F2W.2022 020 1007  27.3N  147.9E  --- ---   86.4  8.0 c  DB NW  ---  19/30  lf: 0.00
2022091000     F2W.2022 020 1002  26.6N  147.5E  --- ---  153.0  3.9 c  DB NW  ---  20/30  lf: 0.00
2022091006     F2W.2022 020 1002  26.6N  147.3E  --- ---  209.1  4.6 c  DB NW  ---  21/30  lf: 0.00
2022091012     F2W.2022 020 1002  26.8N  146.6E  --- ---  284.0  4.1 c  DB NW  ---  22/30  lf: 0.00
2022091812     16W.2022 080  958   31.9N  130.6E  222 128  350.0 12.0 C
2022091818     16W.2022 070  965   33.1N  130.5E  222 131  355.0 11.0 C
2022091900     16W.2022 060  975   34.1N  131.1E  216 120    5.0 11.0 C
2022091906     16W.2022 055  971   34.8N  132.4E  239  96   25.0 11.0 C
2022091912     16W.2022 050  971   36.1N  134.3E  250  88   45.0 14.0 C
2022091918     16W.2022 045  978   37.4N  137.1E  190 ---   55.0 20.0 C
2022092000     16W.2022 040  993   38.5N  141.2E  191 ---   66.4 29.9 C
2022 16W  STY NANMADOL  :15  : 7.2  14.8 : 25.5 139.3 : 090506<->092000
 TY WN  SMB  51/57  lf: 0.72 NANMADOL
 TY WN  [illegible]  lf: 0.75 NANMADOL
 TS WN  BCH  53/57  lf: 0.51 NANMADOL
 TS WN  MEK  54/57  lf: 0.73 NANMADOL
 TS WN  MEK  55/57  lf: 0.11 NANMADOL
 TS WN  SJB  56/57  lf: 0.16 NANMADOL
 EX NW  --   57/57  lf: 0.77
: 20.0<->38.5  :130.5<->147.9 : 8.2 :11.6 : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
```

summary stats
sACEd

summary stats
lat/lon range

summary stats
ED – Explosive Deeping >= 50 kt / 24 h

16W.2022 NANMODAL mdeck

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

```
2022090506     F2W.2022 015 1005  20.0N  142.6E  --- ---  313.0  5.1 b  DB NW  ---   1/30  lf: 0.00 INVEST
2022090512     F2W.2022 015 1005  20.3N  141.5E  --- ---  313.0  5.1 b  DB NW  ---   2/30  lf: 0.00 INVEST
2022090518     F2W.2022 015 1005  20.7N  141.8E  --- ---  313.0  5.1 c  DB NW  ---   3/30  lf: 0.00
2022090600     F2W.2022 015 1005  21.0N  141.9E  --- ---  345.0  3.6 c  DB NW  ---   4/30  lf: 0.00
2022090606     F2W.2022 015 1005  20.7N  142.3E  --- ---   51.3  2.4 c  DB NW  ---   5/30  lf: 0.00
2022090612     F2W.2022 015 1005  21.2N  142.2E  --- ---  360.0  3.5 c  DB NW  ---   6/30  lf: 0.00
2022090618     F2W.2022 015 1006  21.8N  142.3E  --- ---  338.3  3.8 c  DB NW  ---   7/30  lf: 0.00
2022090700     F2W.2022 015 1006  21.9N  142.1E  --- ---  308.9  2.4 c  DB NW  ---   8/30  lf: 0.00
2022090706     F2W.2022 015 1006  22.2N  142.0E  --- ---  325.2  2.4 c  DB NW  ---   9/30  lf: 0.00
2022090712     F2W.2022 015 1006  22.5N  141.7E  --- ---  328.3  3.5 c  DB NW  ---  10/30  lf: 0.00
2022090718     F2W.2022 015 1008  22.8N  141.5E  --- ---  322.4  3.8 c  DB NW  ---  11/30  lf: 0.00
2022090800     F2W.2022 015 1008  24.2N  142.9E  --- ---   40.0  7.8 c  DB NW  ---  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  --- ---   59.5  8.9 c  DB NW  ---  16/30  lf: 0.00
2022090906     F2W.2022 020 1007  27.1N  145.7E  --- ---   63.1 11.0 c  DB NW  ---  17/30  lf: 0.00
2022090912     F2W.2022 020 1007  27.4N  146.9E  --- ---   74.3 11.1 c  DB NW  ---  18/30  lf: 0.00
2022090918     F2W.2022 020 1007  27.3N  147.9E  --- ---   86.4  8.0 c  DB NW  ---  19/30  lf: 0.00
2022091000     F2W.2022 020 1002  26.6N  147.5E  --- ---  153.0  3.9 c  DB NW  ---  20/30  lf: 0.00
2022091006     F2W.2022 020 1002  26.6N  147.3E  --- ---  209.1  4.6 c  DB NW  ---  21/30  lf: 0.00
2022091012     F2W.2022 020 1002  26.8N  146.6E  --- ---  284.0  4.1 c  DB NW  ---  22/30  lf: 0.00
2022091812     16W.2022 080  958   31.9N  130.6E  222 128  350.0 12.0 C
2022091818     16W.2022 070  965   33.1N  130.5E  222 131  355.0 11.0 C
2022091900     16W.2022 060  975   34.1N  131.1E  216 120    5.0 11.0 C
2022091906     16W.2022 055  971   34.8N  132.4E  239  96   25.0 11.0 C
2022091912     16W.2022 050  971   36.1N  134.3E  250  88   45.0 14.0 C
2022091918     16W.2022 045  978   37.4N  137.1E  190 ---   55.0 20.0 C
2022092000     16W.2022 040  993   38.5N  141.2E  191 ---   66.4 29.9 C
2022 16W  STY NANMADOL  :15  : 7.2  14.8 : 25.5 139.3 : 090506<->092000
 TY WN  SMB  51/57  lf: 0.72 NANMADOL
 TY WN  [illegible]  lf: 0.75 NANMADOL
 TS WN  BCH  53/57  lf: 0.51 NANMADOL
 TS WN  MEK  54/57  lf: 0.73 NANMADOL
 TS WN  MEK  55/57  lf: 0.11 NANMADOL
 TS WN  SJB  56/57  lf: 0.16 NANMADOL
 EX NW  --   57/57  lf: 0.77
: 20.0<->38.5  :130.5<->147.9 : 8.2 :11.6 : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
```

summary stats
sACEd

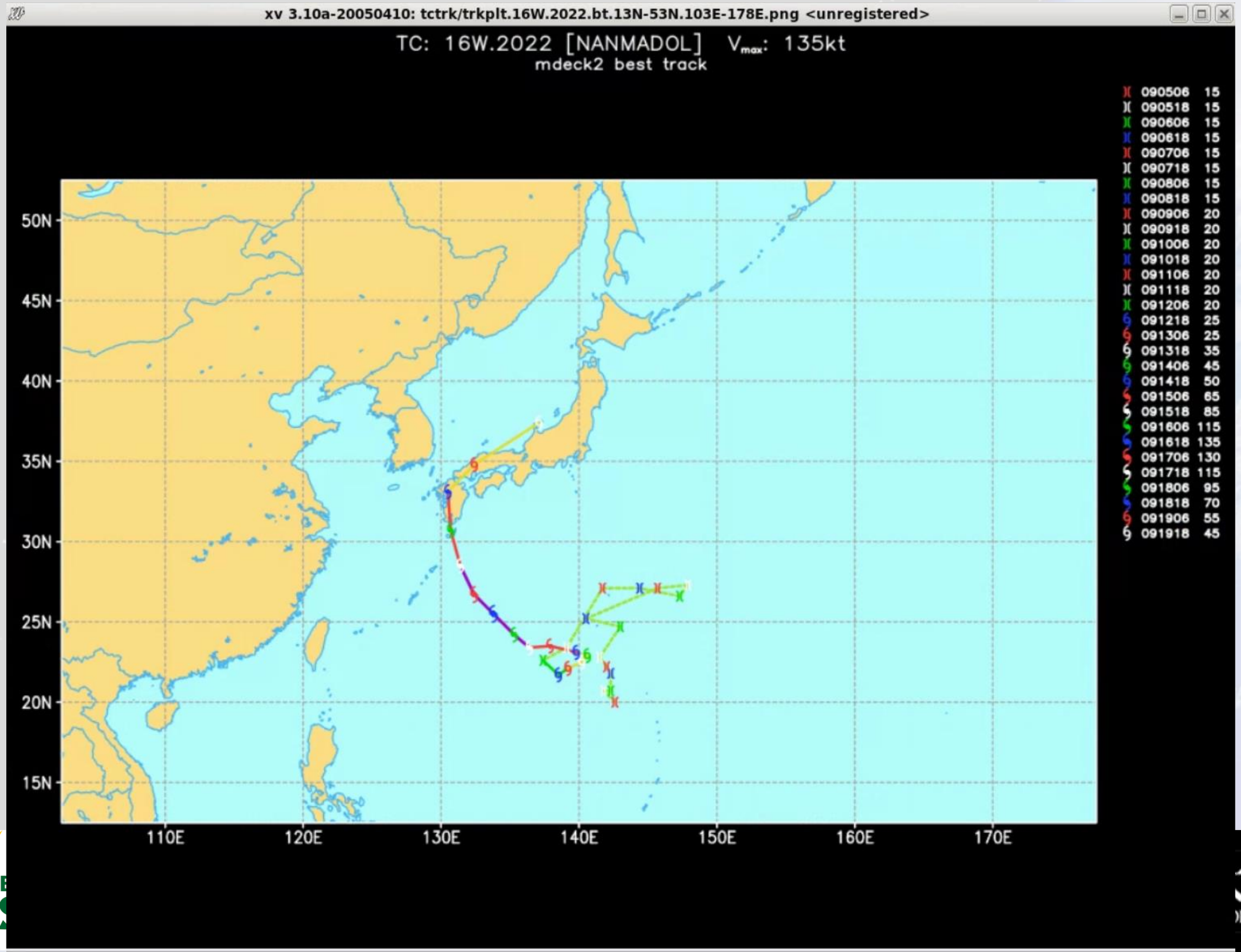
summary stats
lat/lon range

summary stats
ED – Explosive Deeping >= 50 kt / 24 h

summary stats
time to genesis and pTC

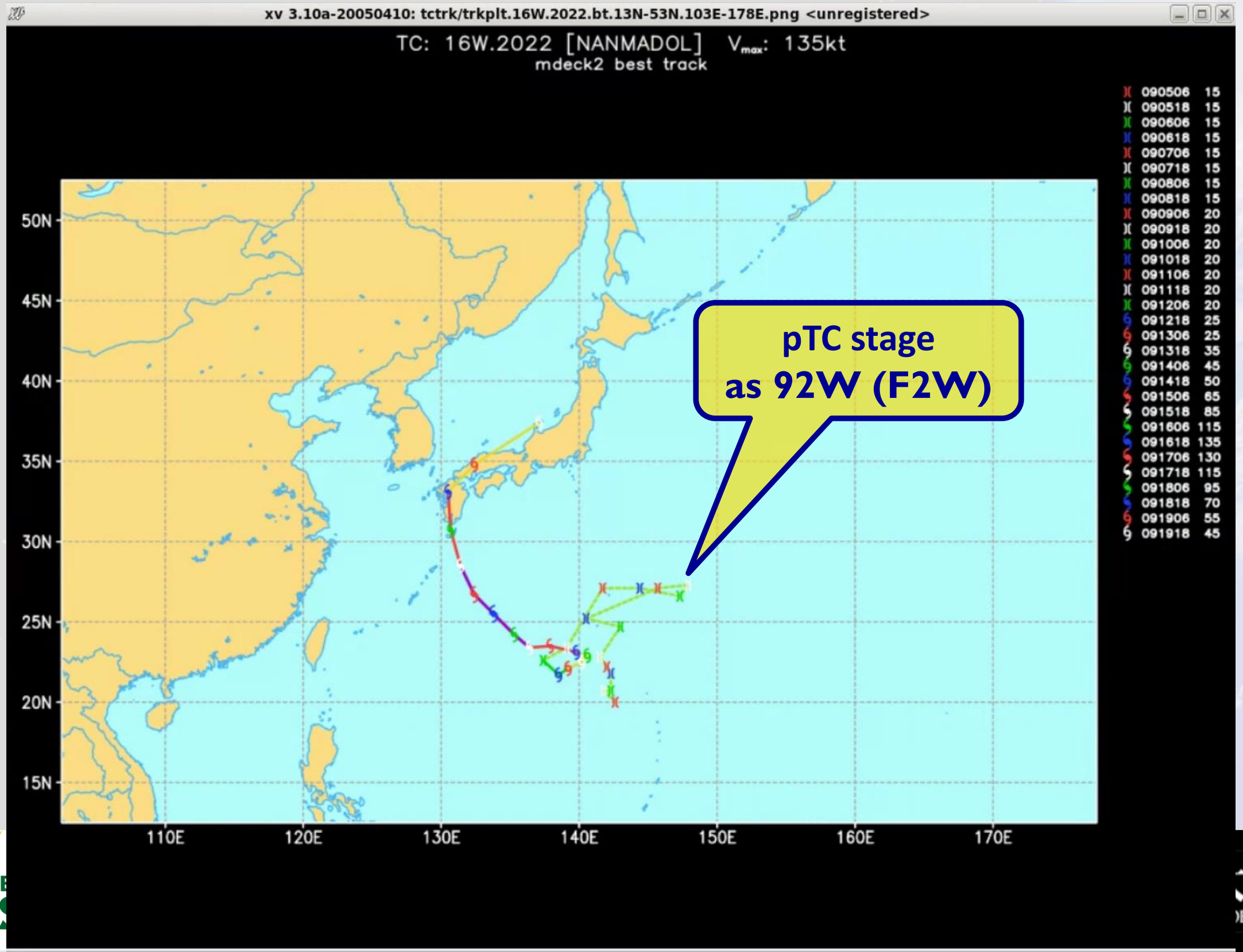
16W.2022 SuperTyphoon NANMODAL

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



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

```
MIKE3-wxmap2 02:47 fiorino@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        : 40 : 2.8;14.0 :  9.3 133.5 : 033006<->041306 :  6.1<->11.5  :124.0<->155.5 : 0.9 : 0.2 : 0: 0: 0:     :tG:234 9X: A4W  1st: 040900
2022 04W   TY CHABA       : 75 : 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 : 31.9 127.6 : 072800<->080212 : 21.6<->39.2  :122.8<->138.7 : 1.1 : 0.0 : 0: 0: 0:     :tG: 24 9X: C4W  1st: 072900
2022 07W   TD TRASES      : 30 : 0.5; 4.5 : 24.8 128.3 : 072800<->080112 : 18.7<->35.6  :126.1<->130.8 : 0.1 : 0.0 : 0: 0: 0:     :tG: 96 9X: C5W  1st: 080100
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       : 40 : 3.2; 5.8 : 30.6 140.4 : 080818<->081412 : 22.7<->43.6  :135.8<->149.2 : 1.6 : 0.8 : 0: 0: 0:     :tG: 60 9X: C0W  1st: 081106
2022 10W   TS MA-ON       : 60 : 4.5;11.5 : 15.9 130.4 : 081418<->082606 :  7.8<->22.0  :102.7<->160.8 : 3.0 : 2.2 : 1: 0: 1:ddRI :tG:162 9X: D3W  1st: 082112
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 : 4.3 : 5: 0: 4:ddRI :tG: 30 9X: D9W  1st: 082206
2022 12W  STY HINNAMNOR   :140 : 9.2;12.5 : 26.3 136.0 : 082506<->090618 : 17.8<->47.1  :124.5<->155.6 :14.5 :23.3 : 8: 4: 8:ddED :tG: 72 9X: D0W  1st: 082806
2022 13W   TD THIRTEEN    : 30 : 1.5; 9.8 : 20.8 136.0 : 082300<->090118 : 18.2<->24.5  :123.3<->143.2 : 0.4 : 0.0 : 0: 0: 0:     :tG:186 9X: D8W  1st: 083018
2022 14W   TY MUIFA       :115 : 9.8;13.0 : 24.6 130.0 : 090312<->091612 : 17.0<->40.8  :120.2<->147.1 : 9.9 :11.7 : 3: 0: 4:ddRI :tG: 72 9X: G1W  1st: 090612
2022 15W   TY MERBOK      : 70 : 5.2; 6.8 : 26.9 161.9 : 090900<->091518 : 20.0<->48.3  :157.5<->170.0 : 3.9 : 3.2 : 0: 0: 0:     :tG: 42 9X: XXW  1st: 091018
2022 16W  STY NANMADOL    :135 : 7.2;14.8 : 25.5 139.3 : 090506<->092000 : 20.0<->38.5  :130.5<->147.9 : 8.2 :11.6 : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
2022 17W   TD TALAS       : 30 : 2.2; 5.2 : 25.7 137.8 : 091906<->092412 : 16.9<->33.9  :134.8<->141.2 : 0.6 : 0.0 : 0: 0: 0:     :tG: 60 9X: F4W  1st: 092118
2022 18W  STY NORU        :140 : 7.0; 8.2 : 16.5 122.9 : 092012<->092818 : 15.0<->18.1  :102.9<->134.7 : 7.7 :11.0 : 7: 4: 8:ddED :tG: 36 9X: F5W  1st: 092200
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
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: F0W  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 A0W   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:     :
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:     :
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:     :
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:     :
2022 A7W   TY ---------   : 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:     :
2022 A8W   TD ---------   : 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:     :
2022 A9W   TD ---------   : 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:     :
2022 B0W   TD ---------   : 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:     :
2022 B1W   TD ---------   : 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:     :
2022 B2W   TD ---------   : 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:     :
2022 B3W   TD ---------   : 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:     :
2022 B4W   TD ---------   : 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:     :
2022 B5W   TD ---------   : 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:     :
2022 B6W   TD ---------   : 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:     :
2022 B7W   TD ---------   : 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:     :
2022 B8W   TD ---------   : 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:     :
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:     :
2022 C0W   TD ---------   : 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:     :
2022 C1W   TD ---------   : 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:     :
2022 C2W   TD ---------   : 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:     :
2022 C3W   TD ---------   : 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:     :
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:     :
```

WPAC 2022 summary

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

```
MIKE3-wxmap2 02:47 fiorino@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      : 40 : 2.8;14.0 :  9.3 133.5 : 033006<->041306 :  6.1<->11.5  :124.0<->155.5 : 0.9 : 0.2 : 0: 0: 0:      :tG:234 9X: A4W  1st: 040900
2022 04W   TY CHABA     : [illegible] 2.2 : 0: 0: 2:ddRW :tG: 96 9X: E7W  1st: 062918
2022 05W   TS AERE      : [illegible] : 0: 0: 0:      :tG: 84 9X: B8W  1st: 063012
2022 06W   TD SONGDA    : [illegible] : 0: 0: 0:      :tG: 24 9X: C4W  1st: 072900
2022 07W   TD TRASES    : [illegible] : 0: 0: 0:      :tG: 96 9X: C5W  1st: 080100
2022 08W   TD EIGHT     : [illegible] : 0: 0: 0:      :tG: 66 9X: C6W  1st: 080400
2022 09W   TS MEARI     : [illegible] : 0: 0: 0:      :tG: 60 9X: C0W  1st: 081106
2022 10W   TS MA-ON     : [illegible] : 1: 0: 1:ddRI :tG:162 9X: D3W  1st: 082112
2022 11W   TY TOKAGE    : [illegible] : 5: 0: 4:ddRI :tG: 30 9X: D9W  1st: 082206
2022 12W  STY HINNAMNOR : [illegible] ddED :tG: 72 9X: D0W  1st: 082806
2022 13W   TD THIRTEEN  : [illegible] 0:      :tG:186 9X: D8W  1st: 083018
2022 14W   TY MUIFA     : [illegible] 0: 4:ddRI :tG: 72 9X: G1W  1st: 090612
2022 15W   TY MERBOK    : [illegible] : 0: 0: 0:      :tG: 42 9X: XXW  1st: 091018
2022 16W  STY NANMADOL  : [illegible] : 5: 4: 6:ddED :tG:180 9X: F2W  1st: 091218
2022 17W   TD TALAS     : [illegible] 0.0 : 0: 0: 0:      :tG: 60 9X: F4W  1st: 092118
2022 18W  STY NORU      :140 [illegible] :11.0 : 7: 4: 8:ddED :tG: 36 9X: F5W  1st: 092200
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
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: F0W  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 A0W   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:      :
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:      :
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:      :
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:      :
2022 A7W   TY --------- : 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:      :
2022 A8W   TD --------- : 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:      :
2022 A9W   TD --------- : 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:      :
2022 B0W   TD --------- : 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:      :
2022 B1W   TD --------- : 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:      :
2022 B2W   TD --------- : 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:      :
2022 B3W   TD --------- : 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:      :
2022 B4W   TD --------- : 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:      :
2022 B5W   TD --------- : 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:      :
2022 B6W   TD --------- : 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:      :
2022 B7W   TD --------- : 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:      :
2022 B8W   TD --------- : 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:      :
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:      :
2022 C0W   TD --------- : 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:      :
2022 C1W   TD --------- : 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:      :
2022 C2W   TD --------- : 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:      :
2022 C3W   TD --------- : 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:      :
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:      :
```

9 of 24 storms did RI

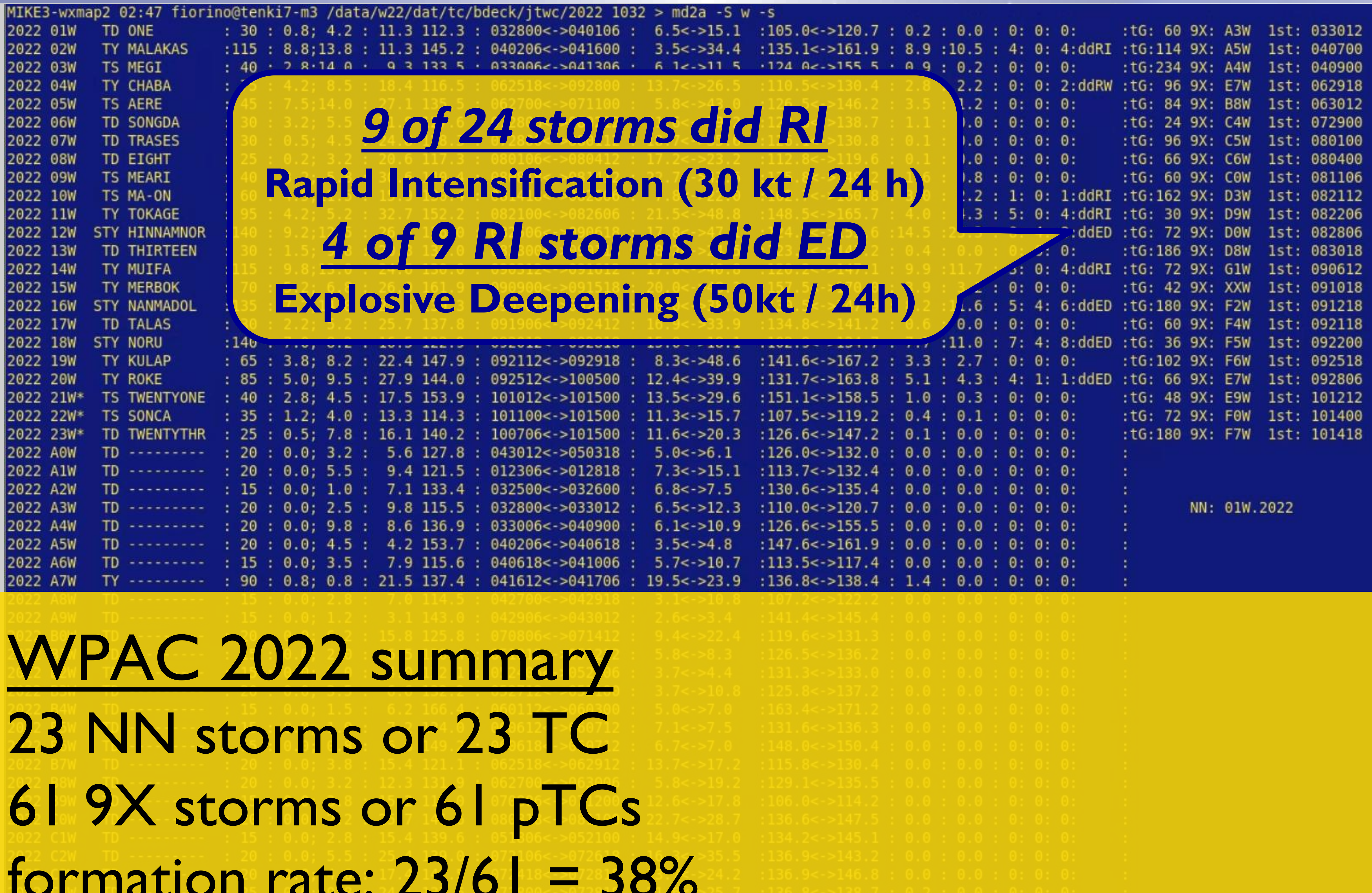
Rapid Intensification (30 kt / 24 h)

4 of 9 RI storms did ED

Explosive Deepening (50kt / 24h)

WPAC 2022 summary

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



9 of 24 storms did RI

Rapid Intensification (30 kt / 24 h)

4 of 9 RI storms did ED

Explosive Deepening (50kt / 24h)

WPAC 2022 summary

23 NN storms or 23 TC

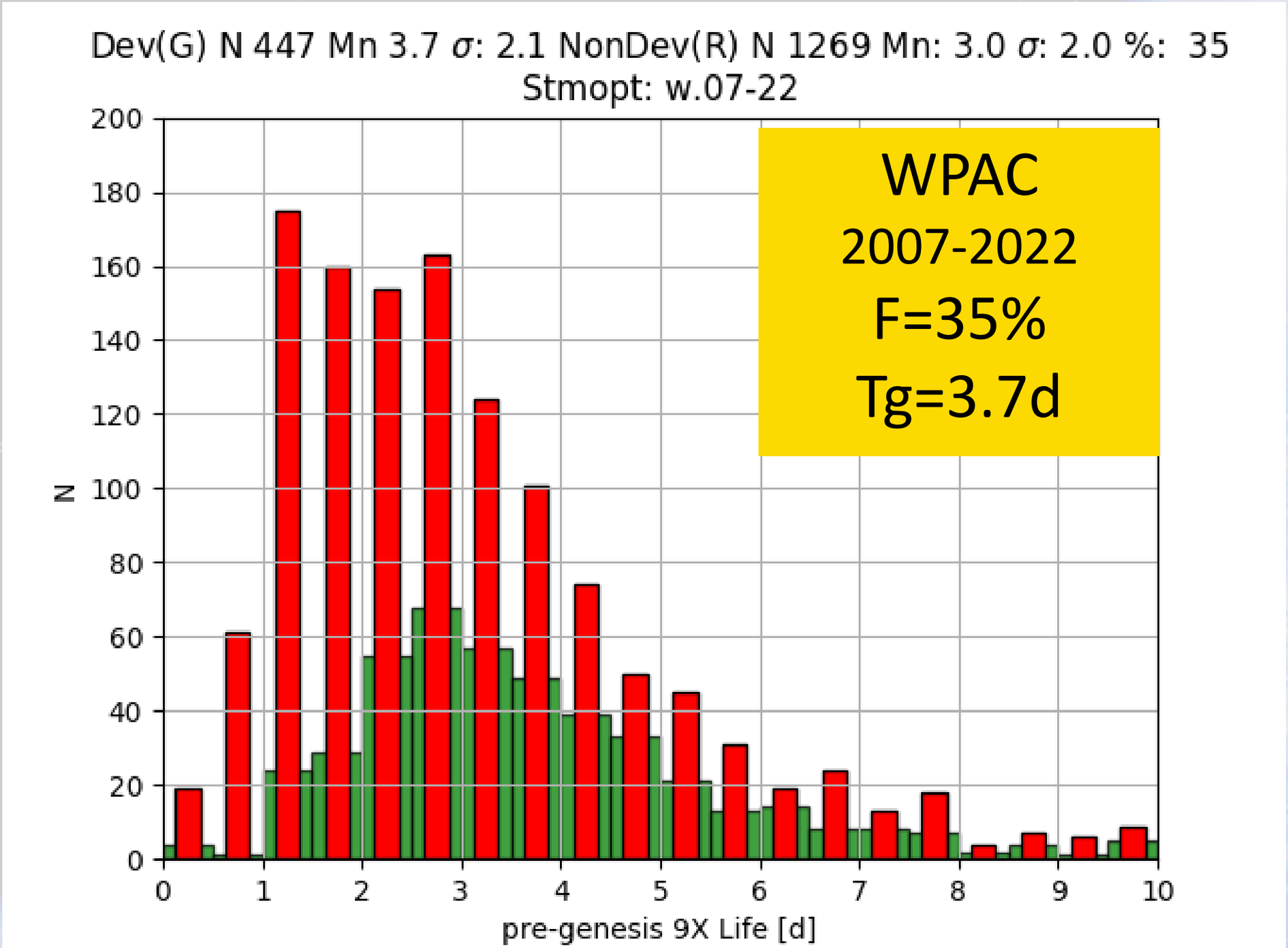
61 9X storms or 61 pTCs

formation rate: 23/61 = 38%

38% of pTCs became TCs and 62% did not

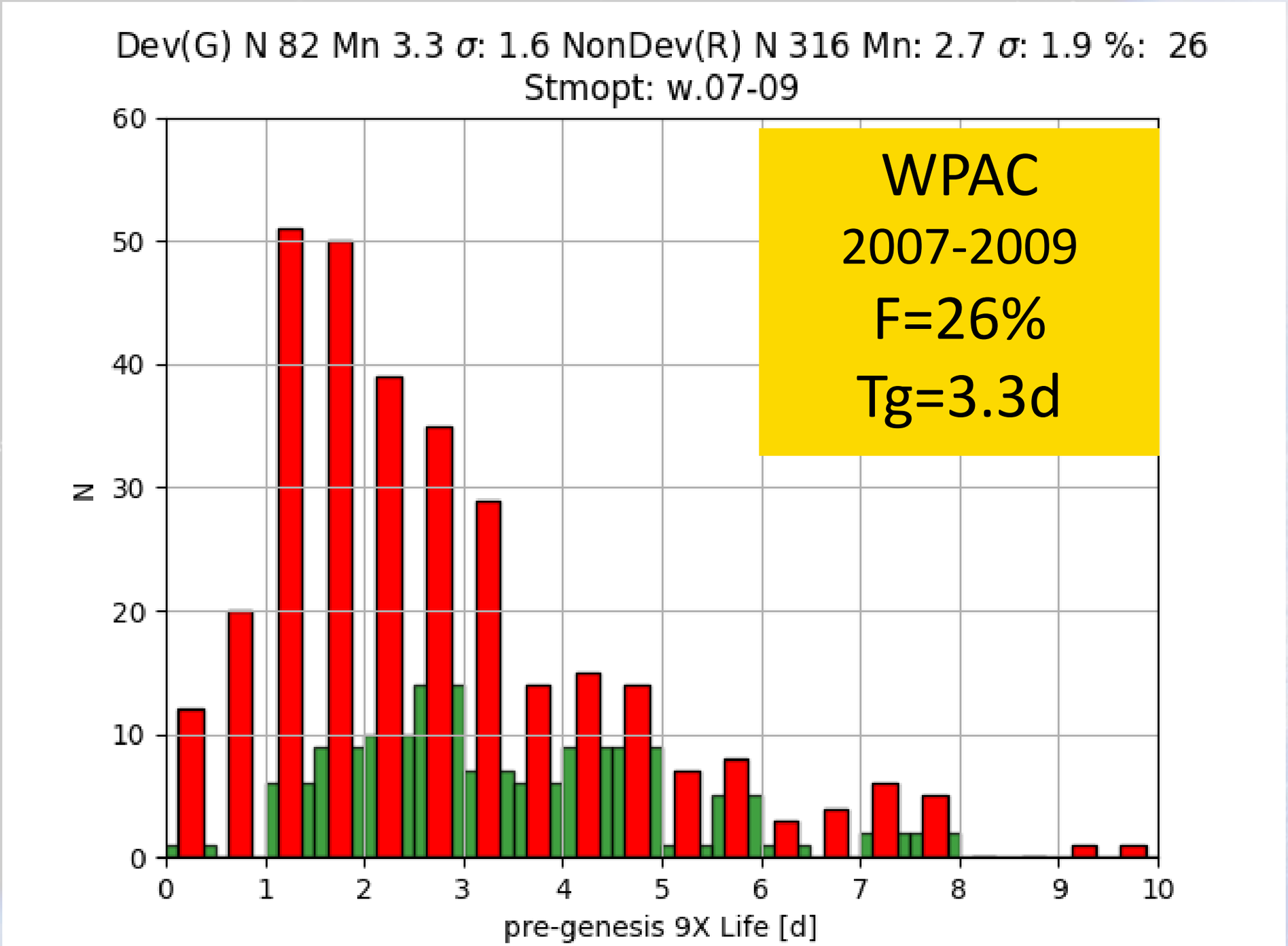
WPAC 2007-2022 (15 y)

Seasonal ***Formation*** Rate (#TC/#pTCs) & ***time to genesis*** (from pTC →TC)



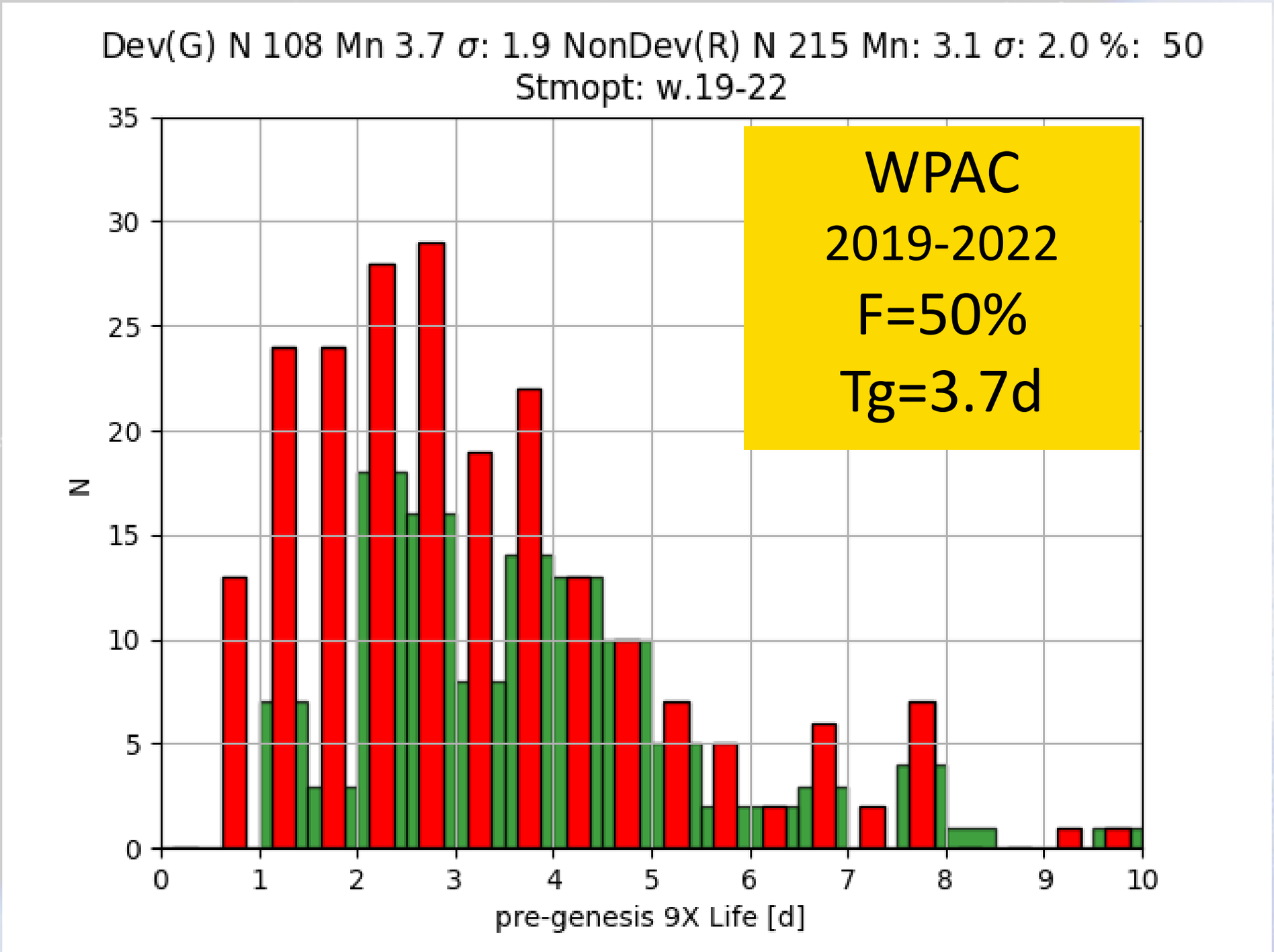
WPAC 2007-2022 (15 y)

Seasonal ***Formation*** Rate (#TC/#pTCs) & ***time to genesis*** (from pTC →TC)



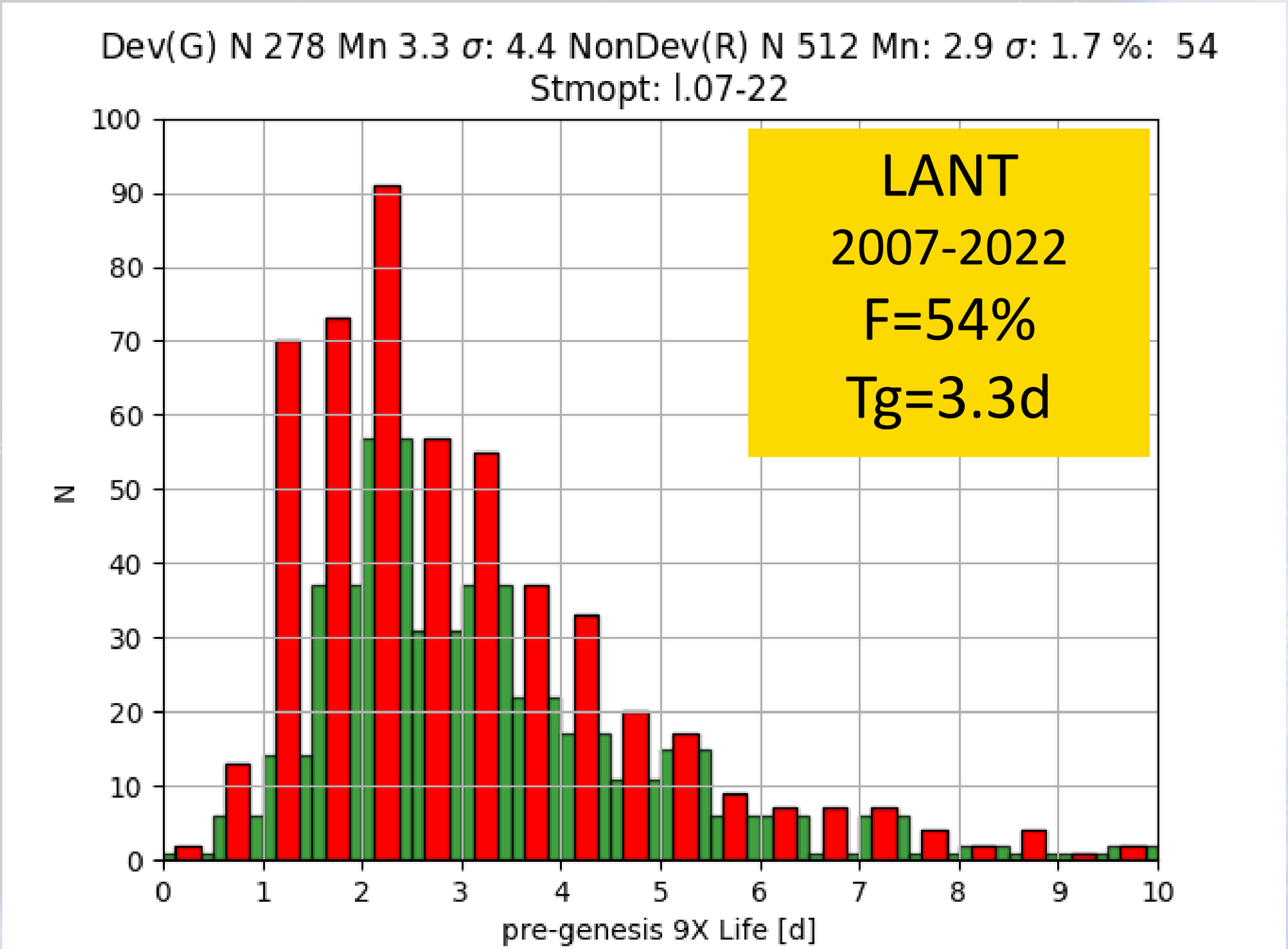
WPAC 2007-2022 (15 y)

Seasonal ***Formation*** Rate (#TC/#pTCs) & ***time to genesis*** (from pTC →TC)



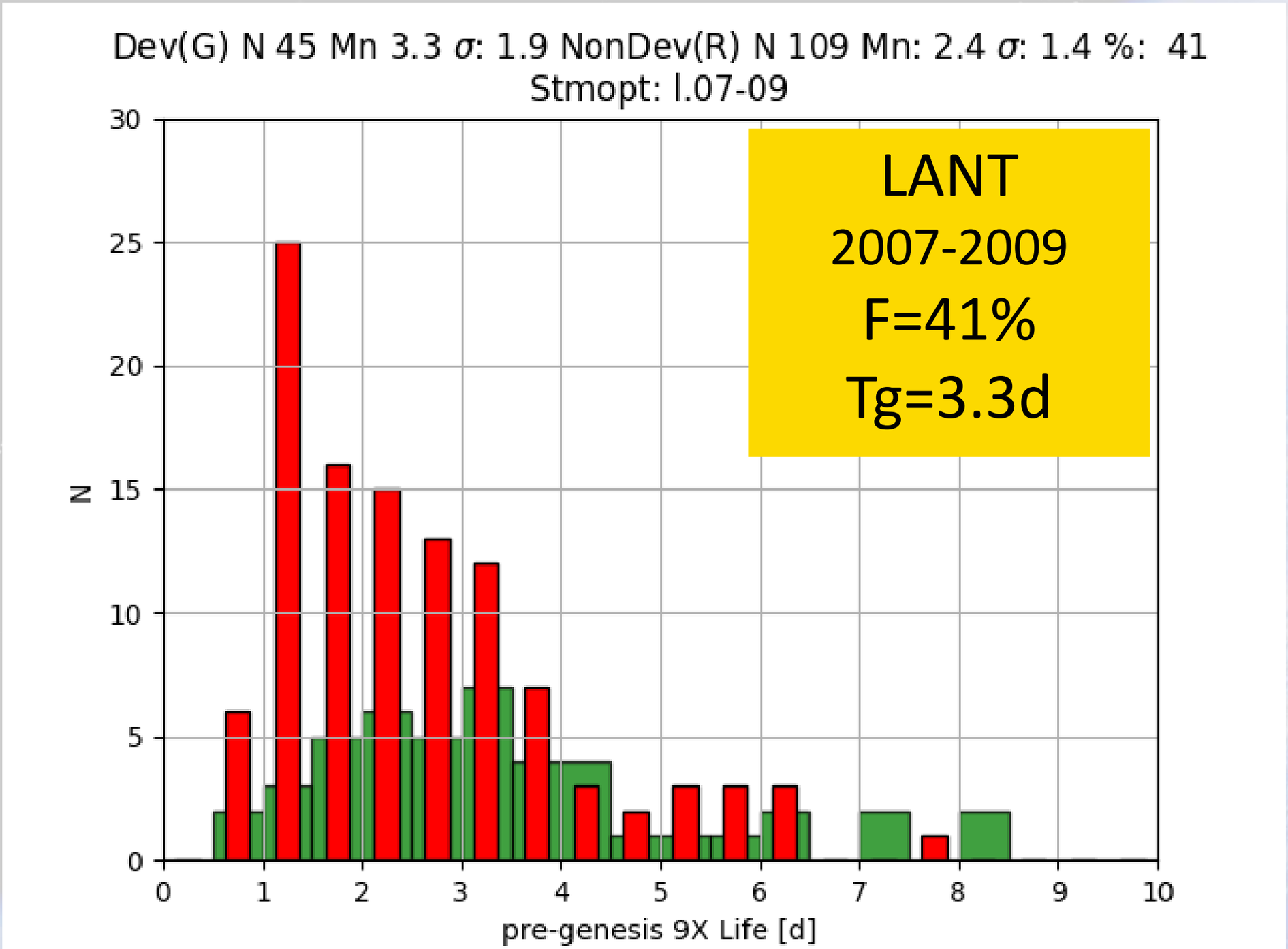
LANT 2007-2022 (15 y)

Seasonal ***Formation*** Rate (#TC/#pTCs) & ***time to genesis*** (from pTC →TC)



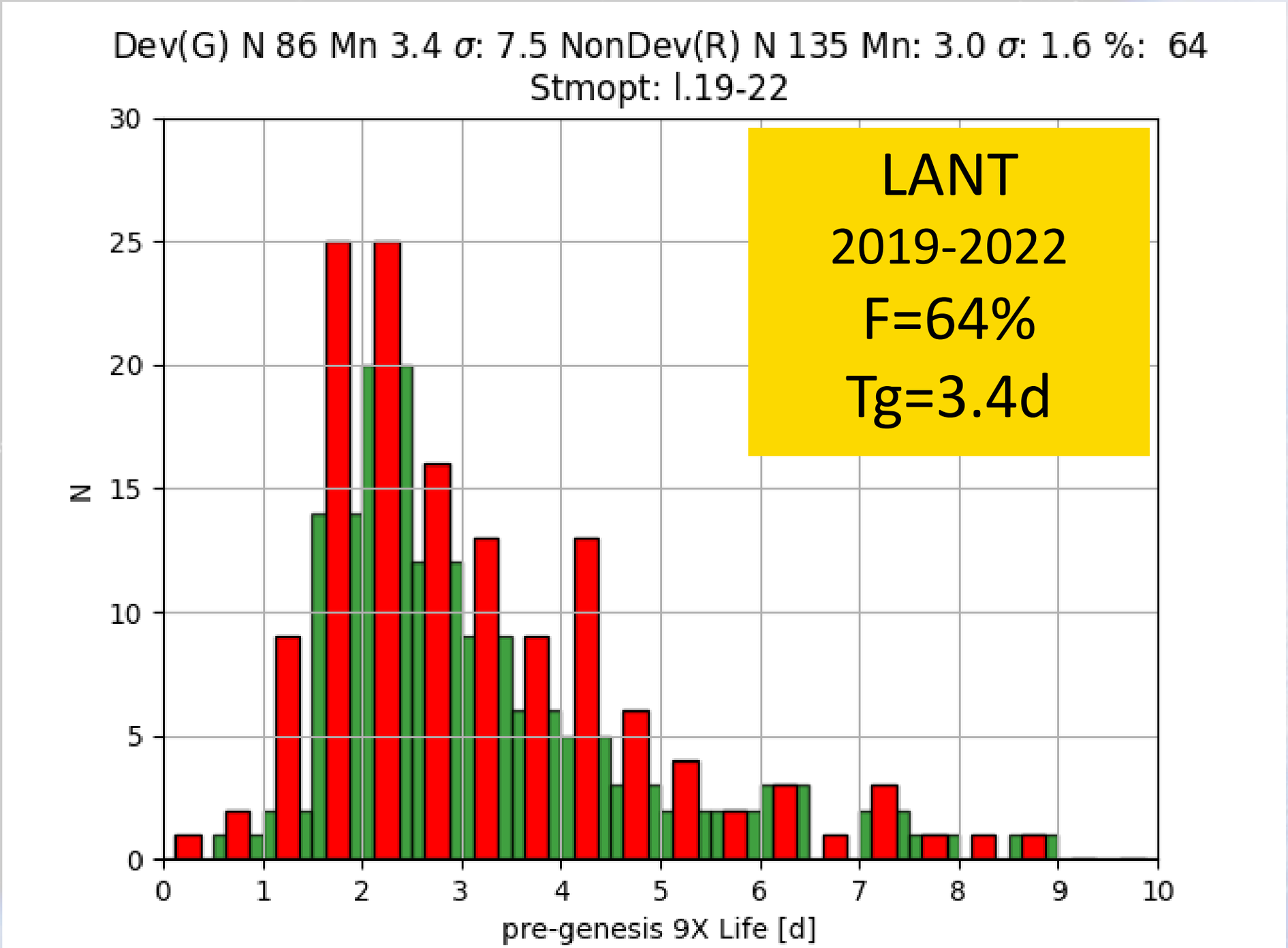
LANT 2007-2022 (15 y)

Seasonal ***Formation*** Rate (#TC/#pTCs) & ***time to genesis*** (from pTC →TC)



LANT 2007-2022 (15 y)

Seasonal ***Formation*** Rate (#TC/#pTCs) & ***time to genesis*** (from pTC →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 → 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 – CAT1-5)
- 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**

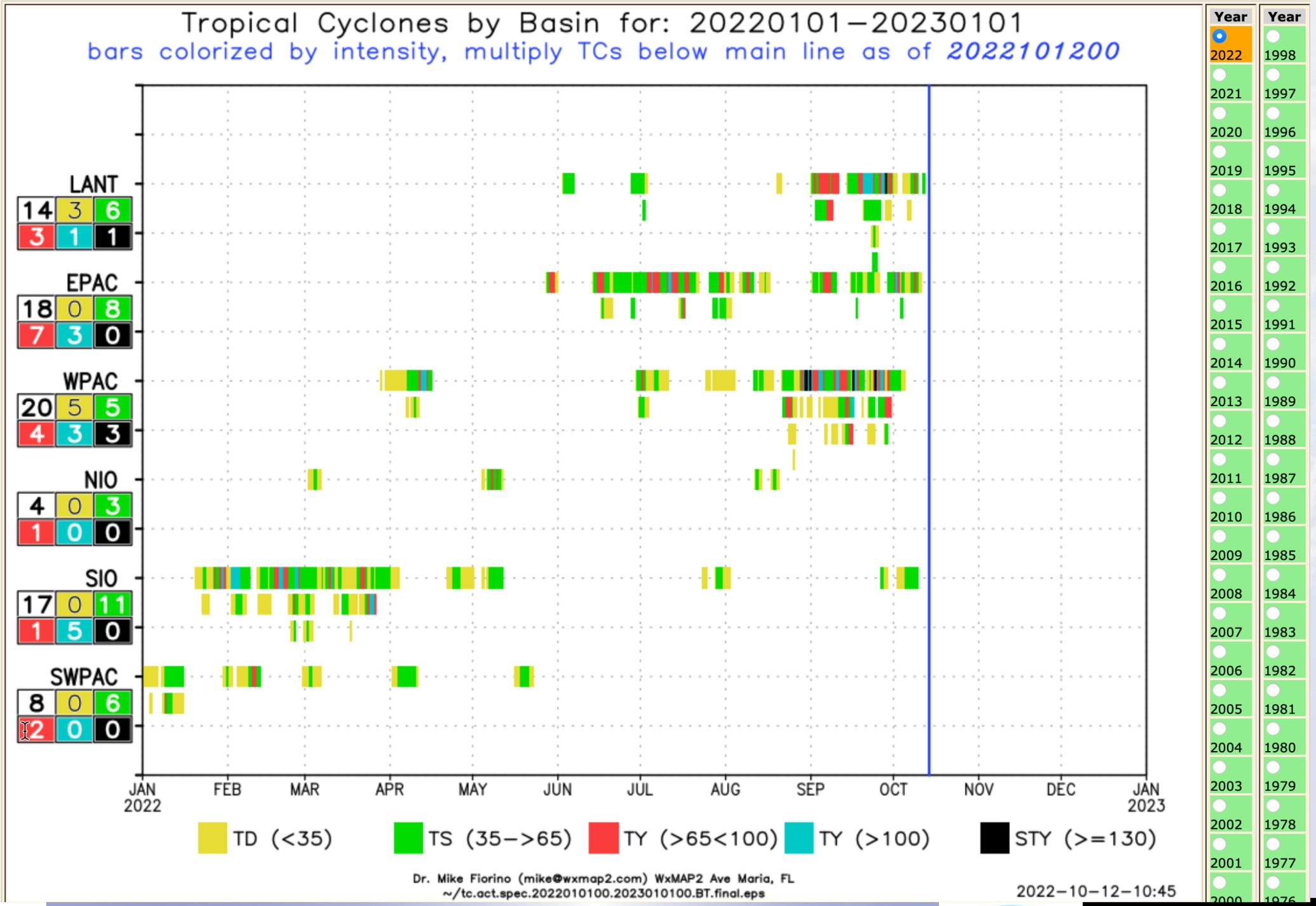
Global TC activity variability – *depends on accuracy of best track done by humans*

1. ***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 → surface wind center
2. ***Intensity = Vmax != Pmin***
   - no physical relationship between Pmin and Vmax!!!

https://tcact.wxmap2.com

spectograph

TCact SPEC -- NHEM 2022 Spectrograph as of: 20221012 (main doc)



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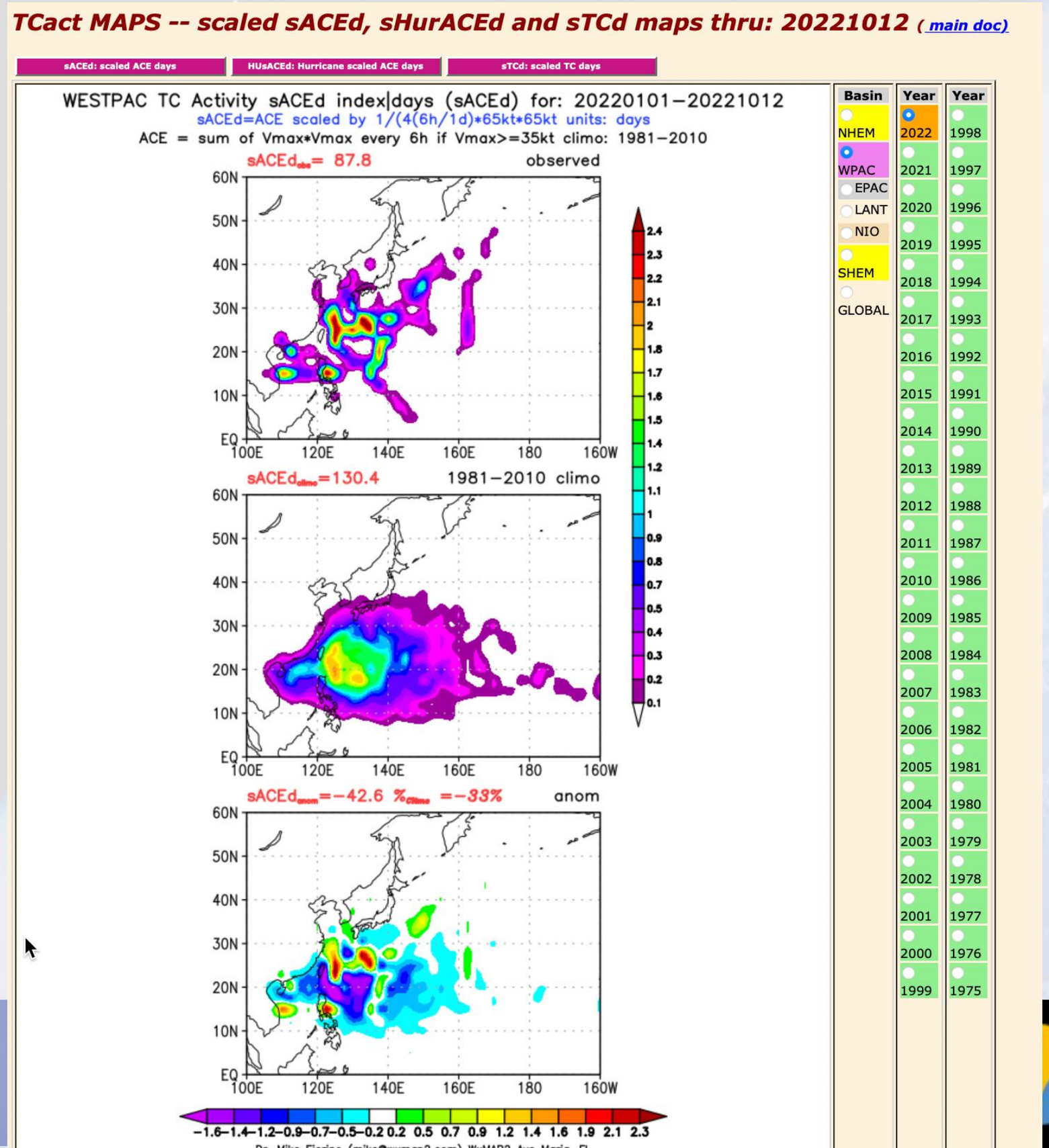
maps



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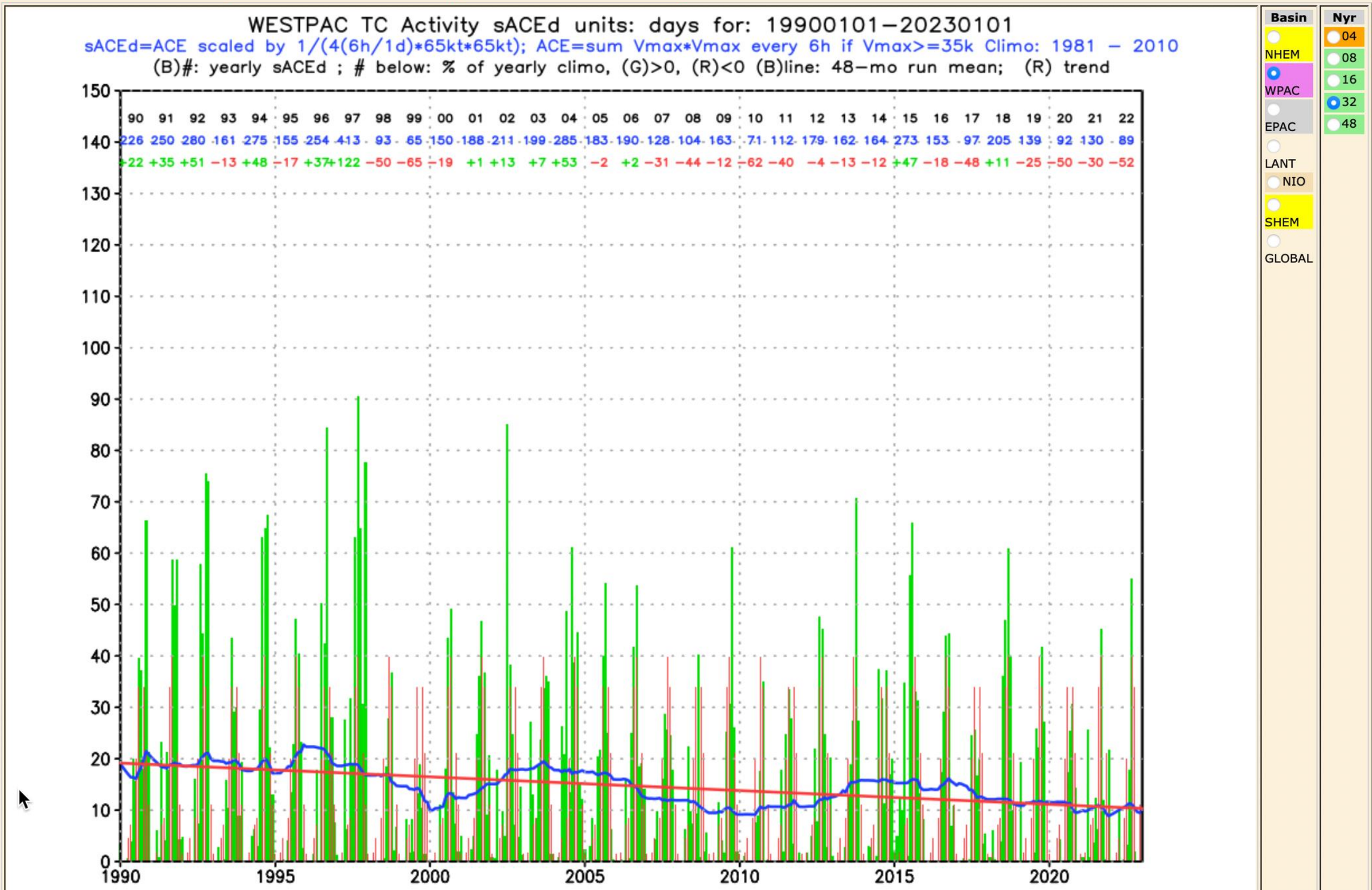
time series

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

sTCd: scaled TC days | sACEd: scaled ACE days | HUsACEd: Hurricane scaled ACE days



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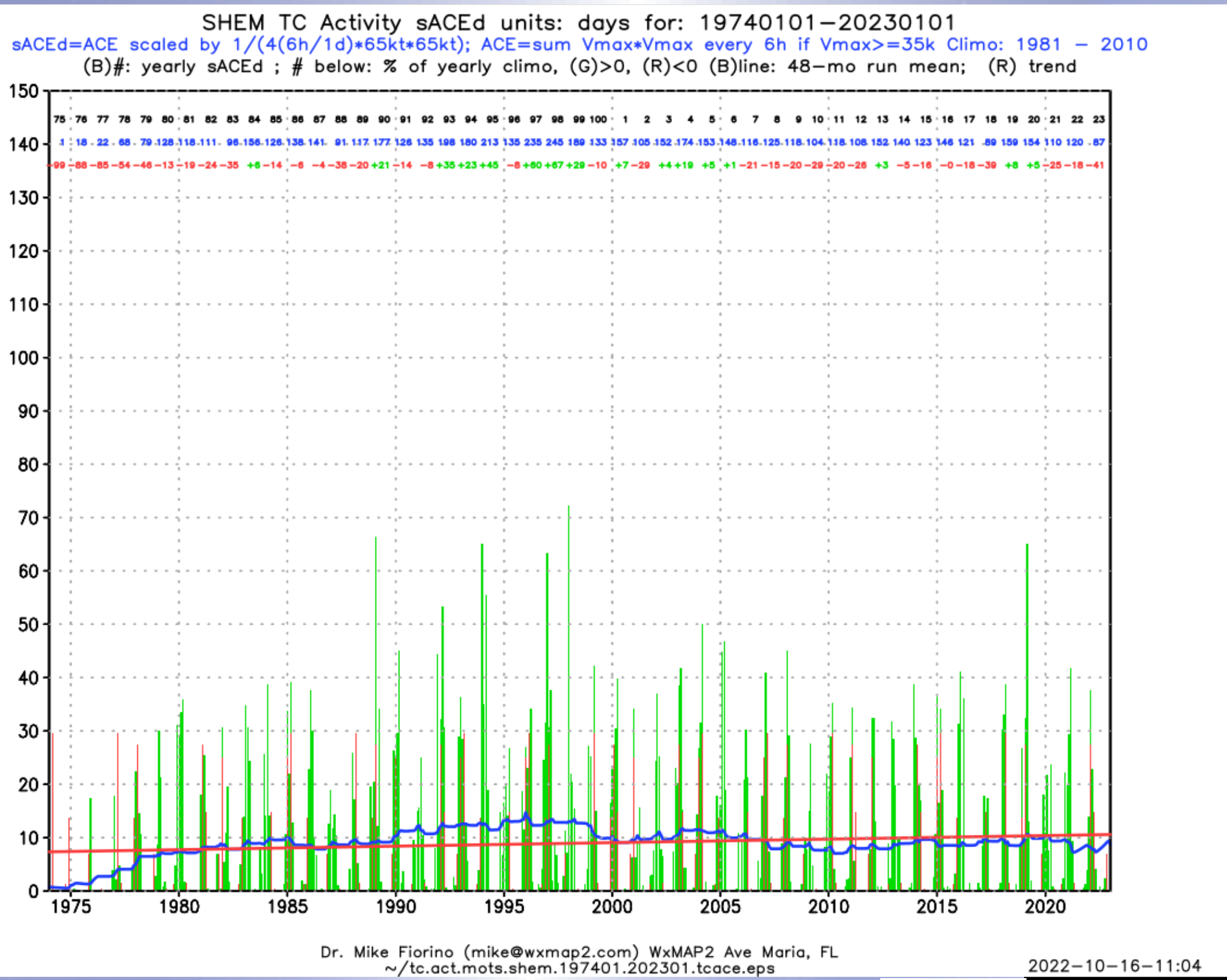

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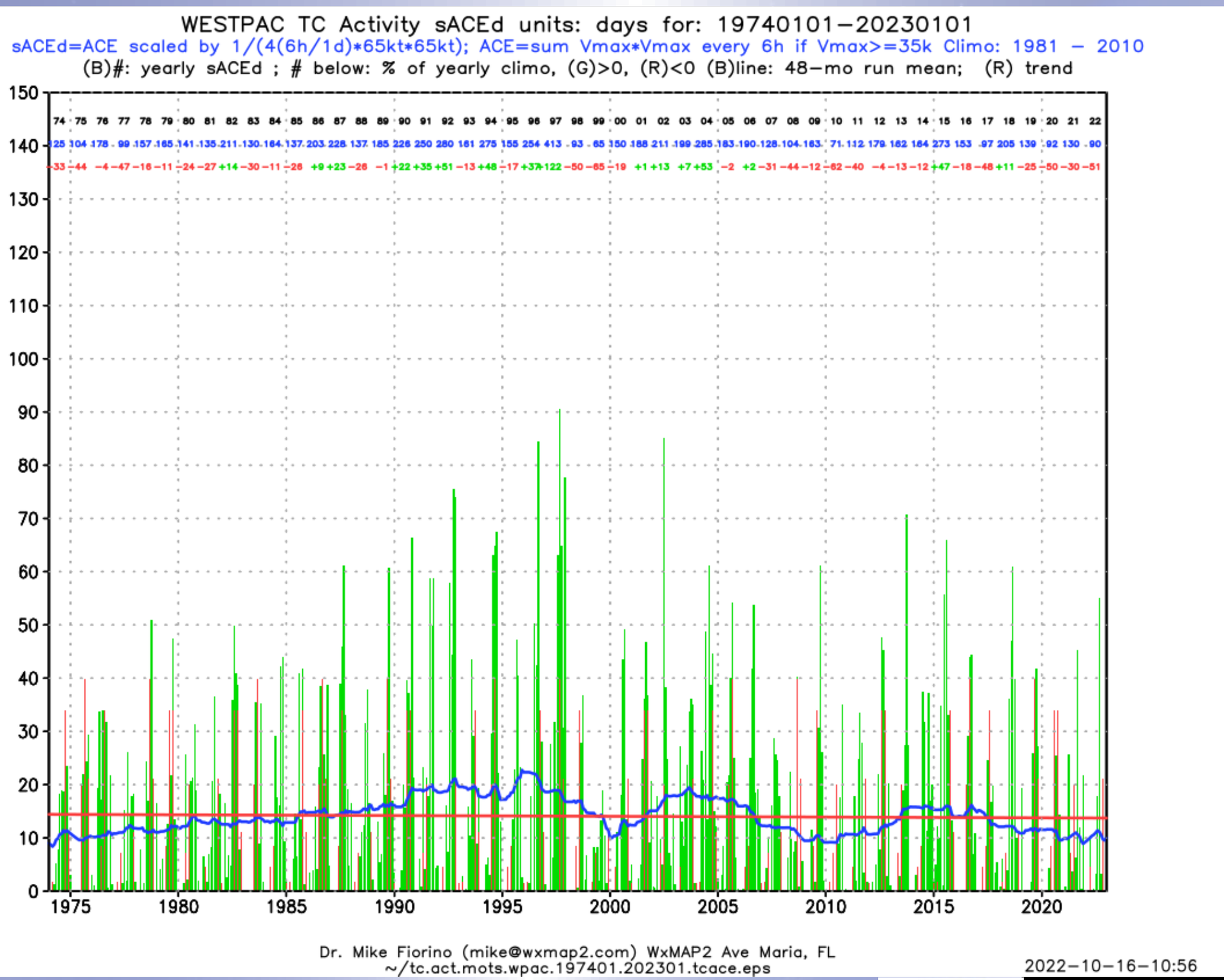

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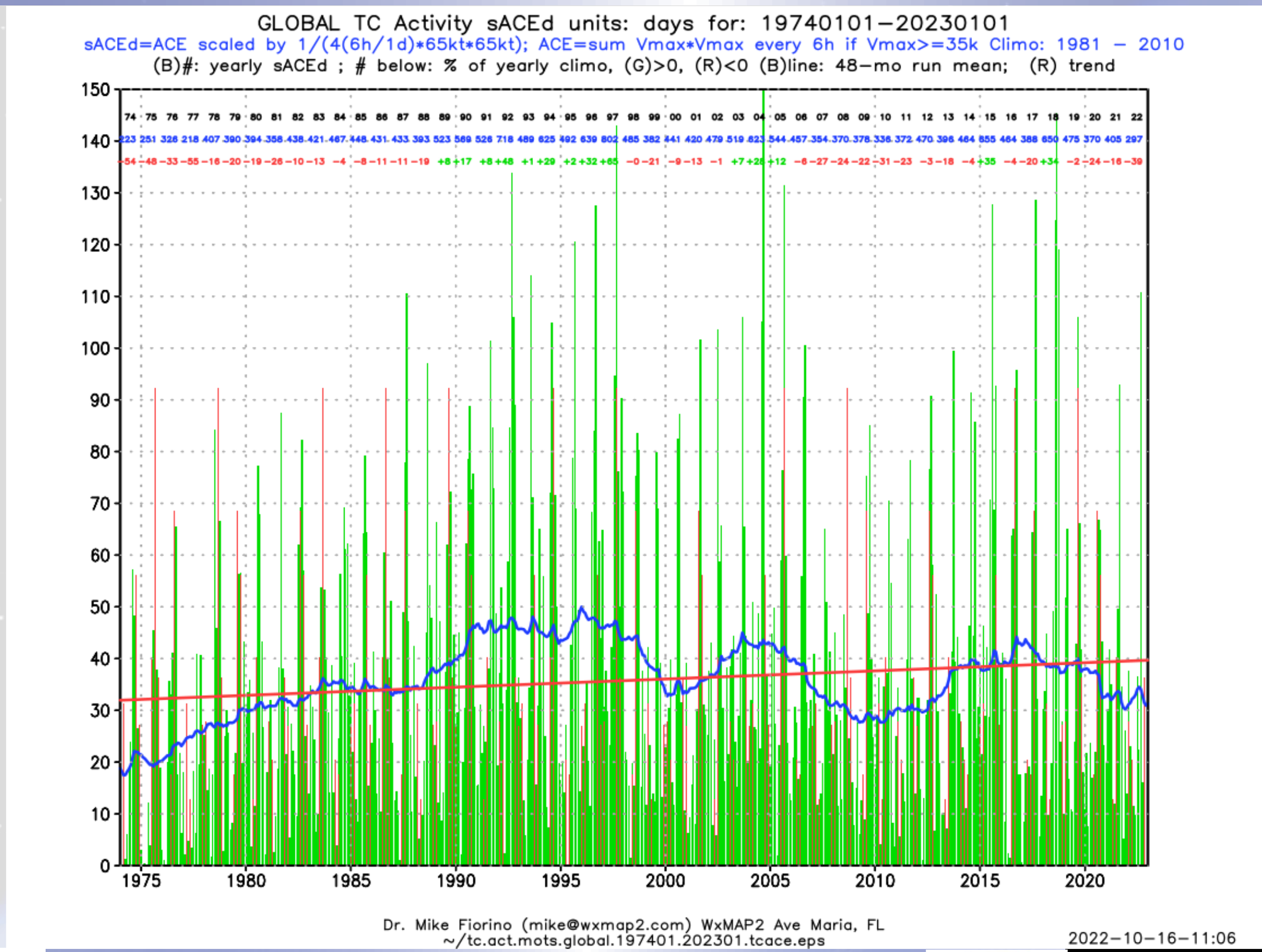

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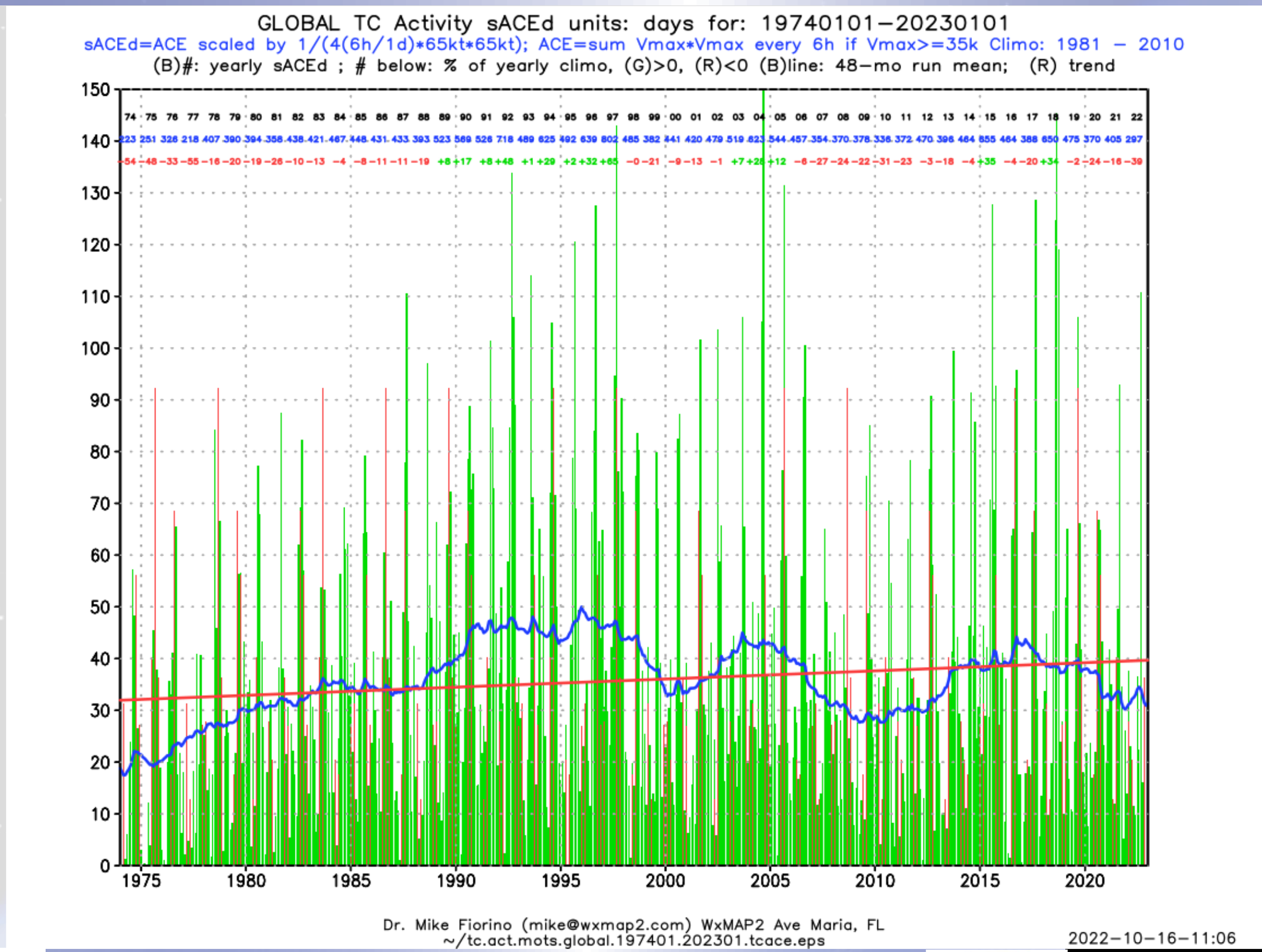

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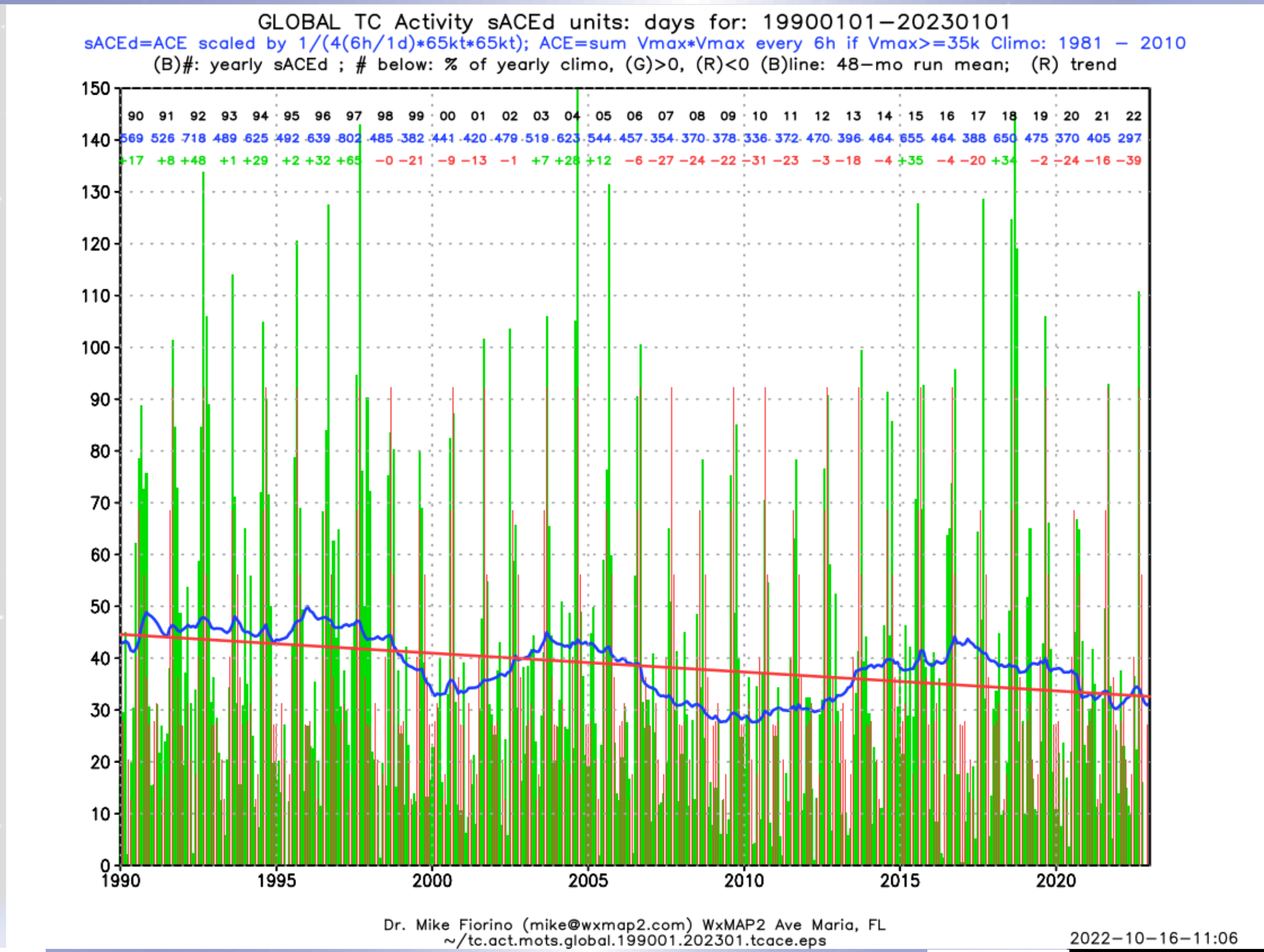

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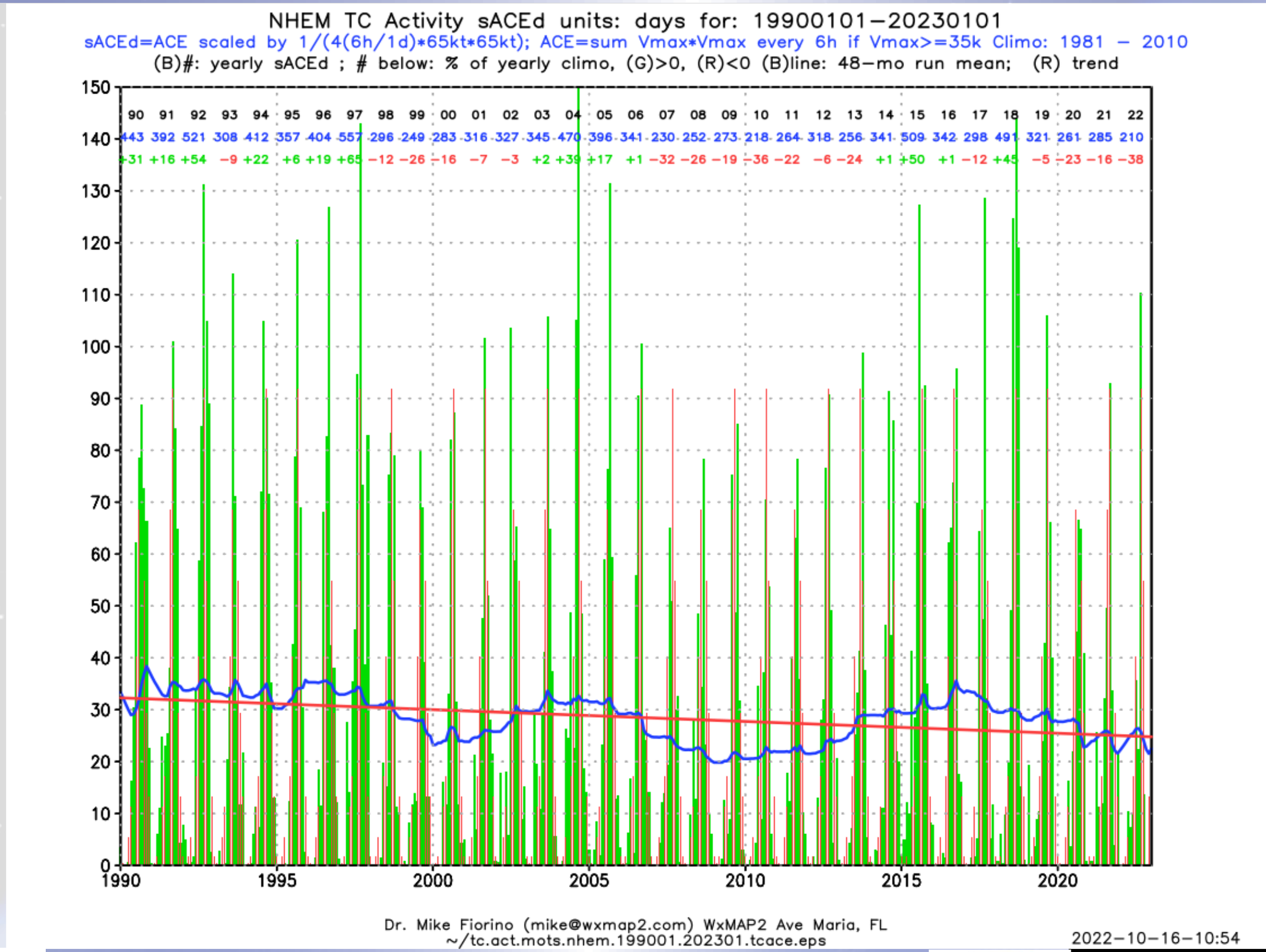

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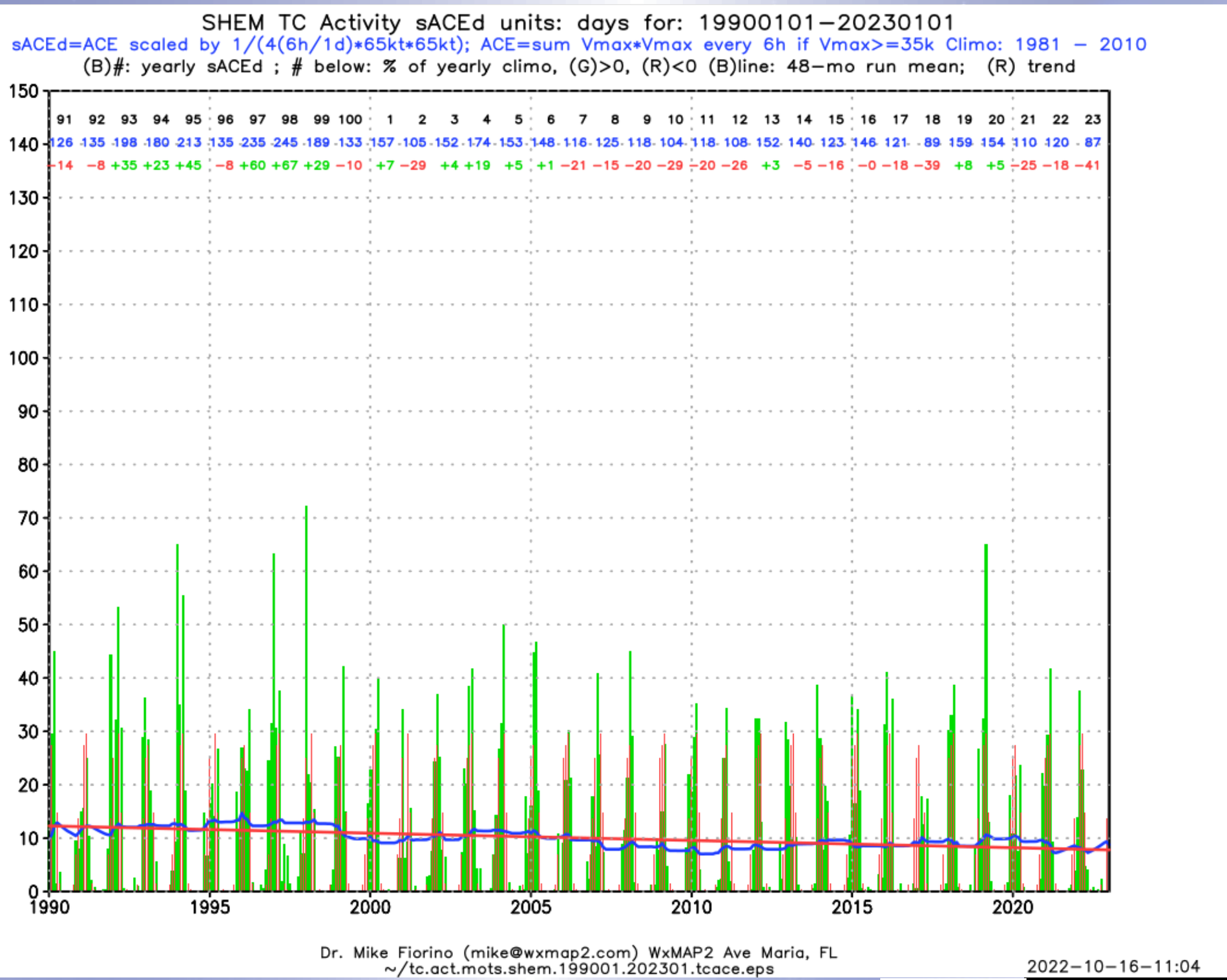

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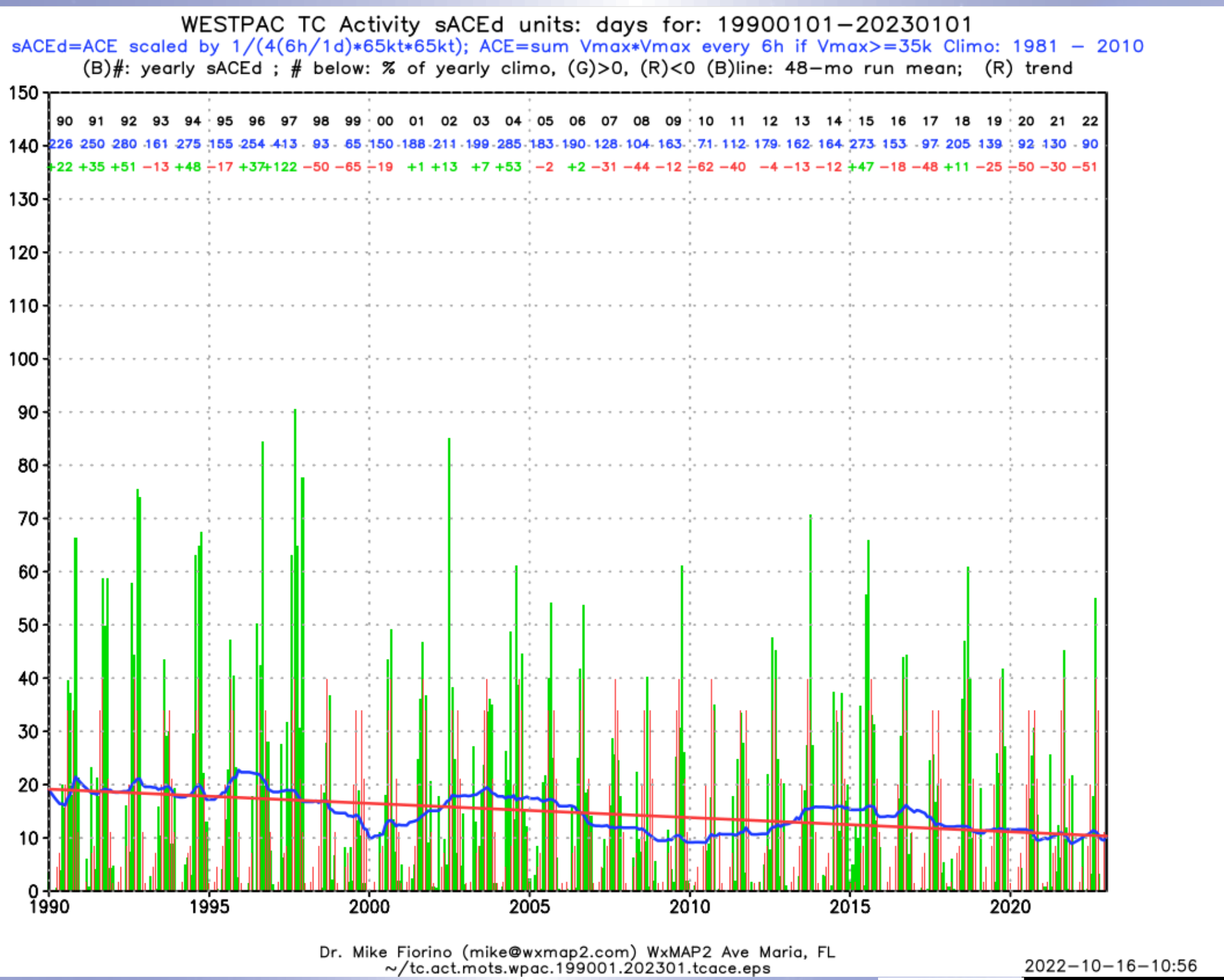

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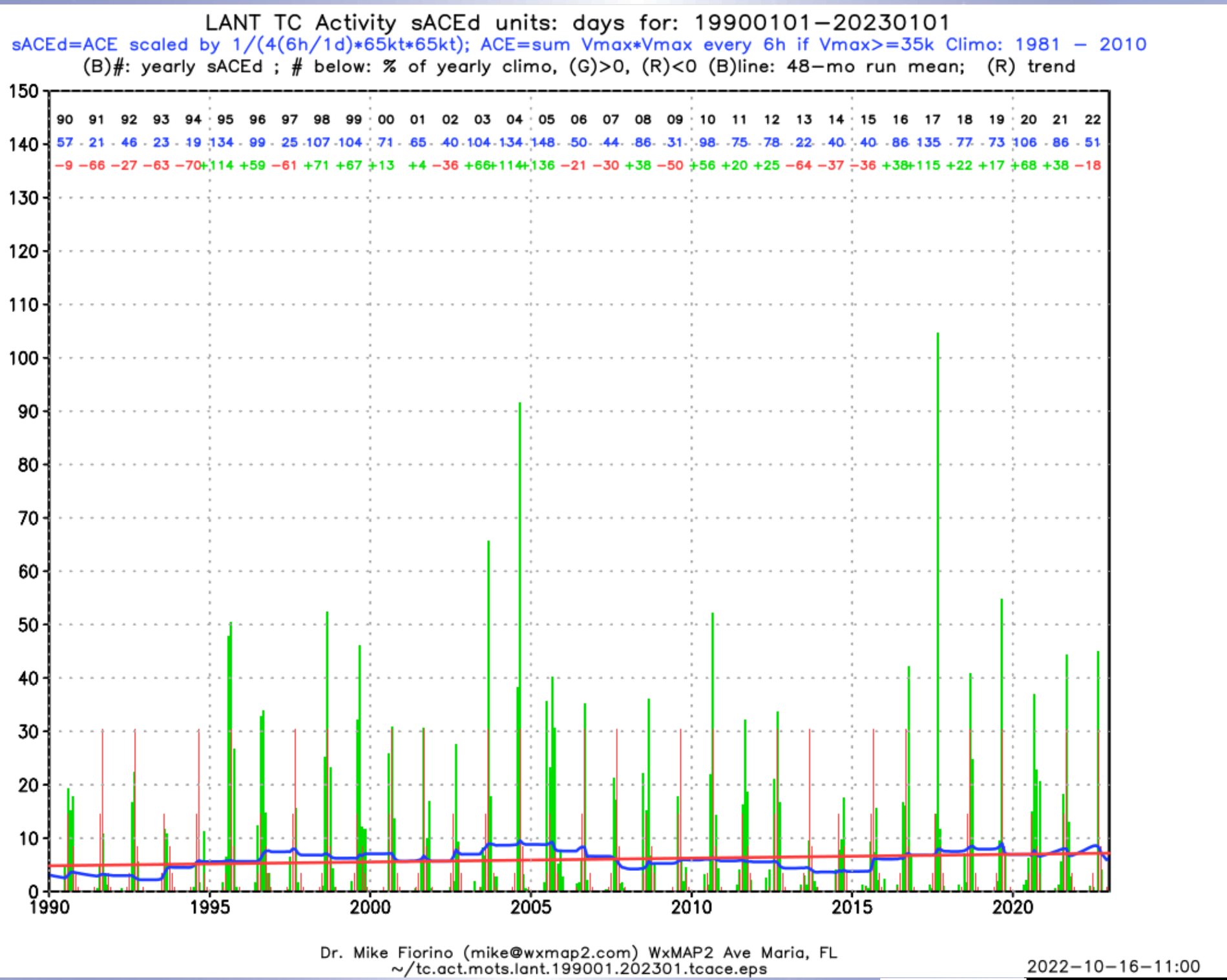

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Summary of pTC→TC and TC activity

- ***15 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 R1

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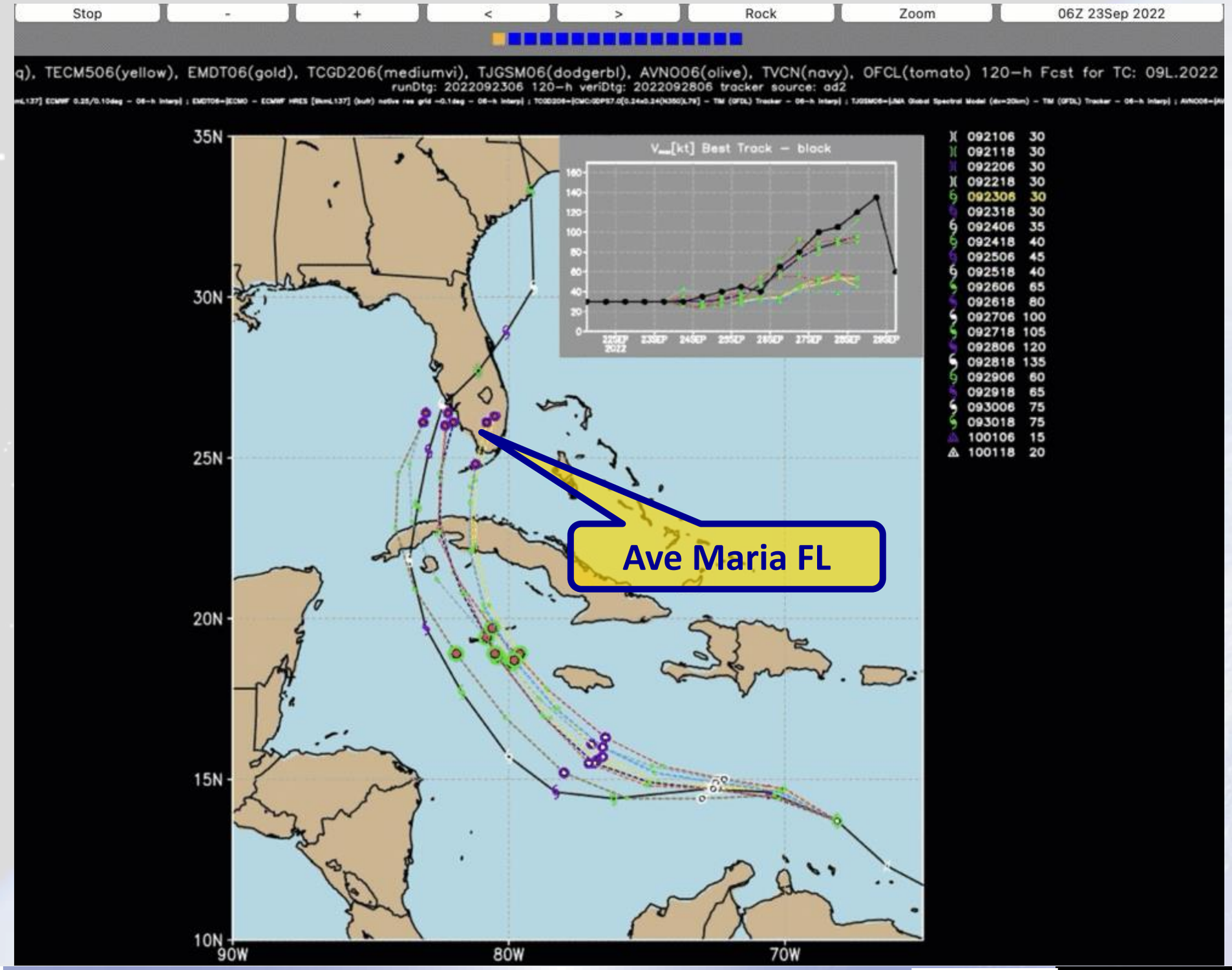
NWP – hurricane IAN
https://tctrkveri.wxmap2.com



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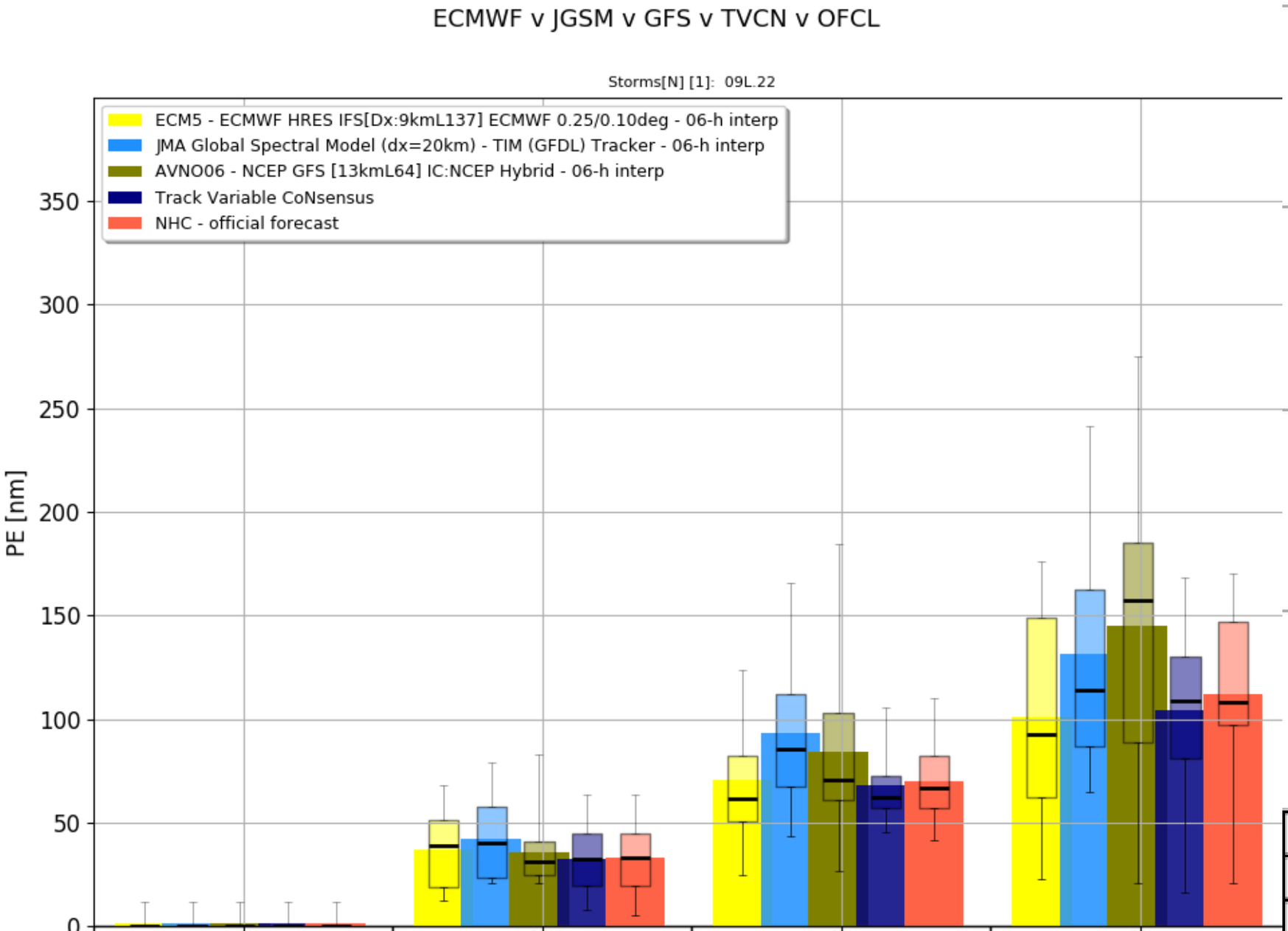
NWP – hurricane IAN

verification – mean position error (PE)



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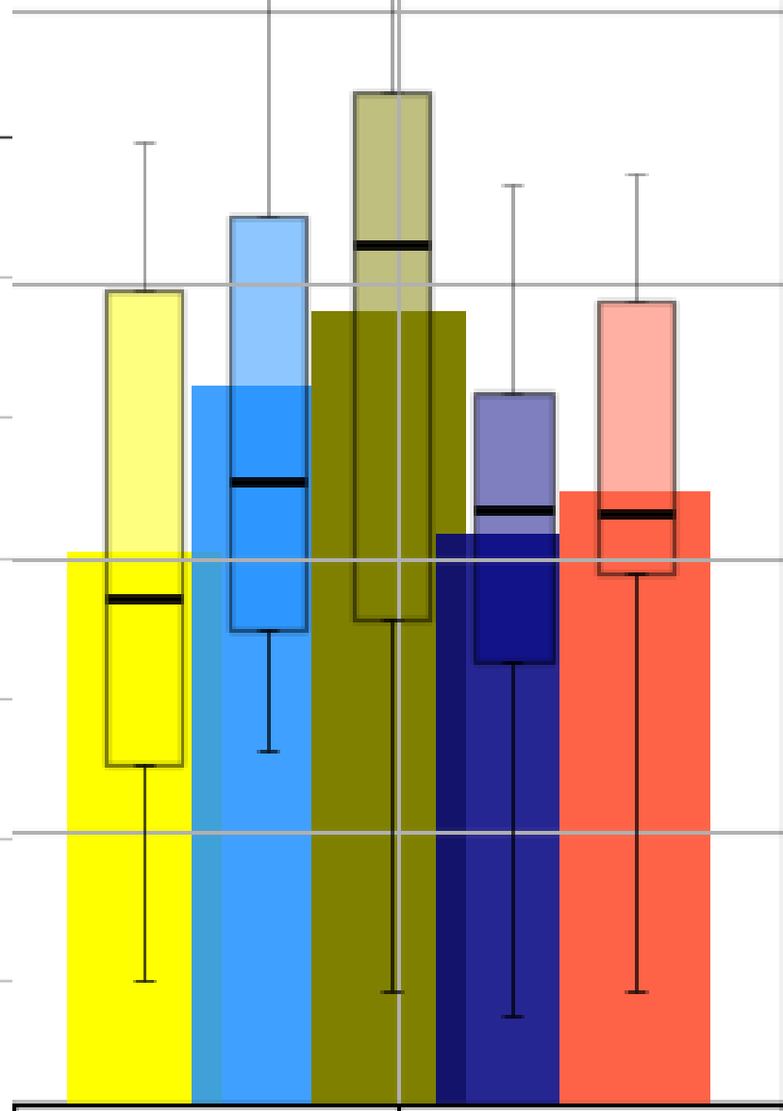
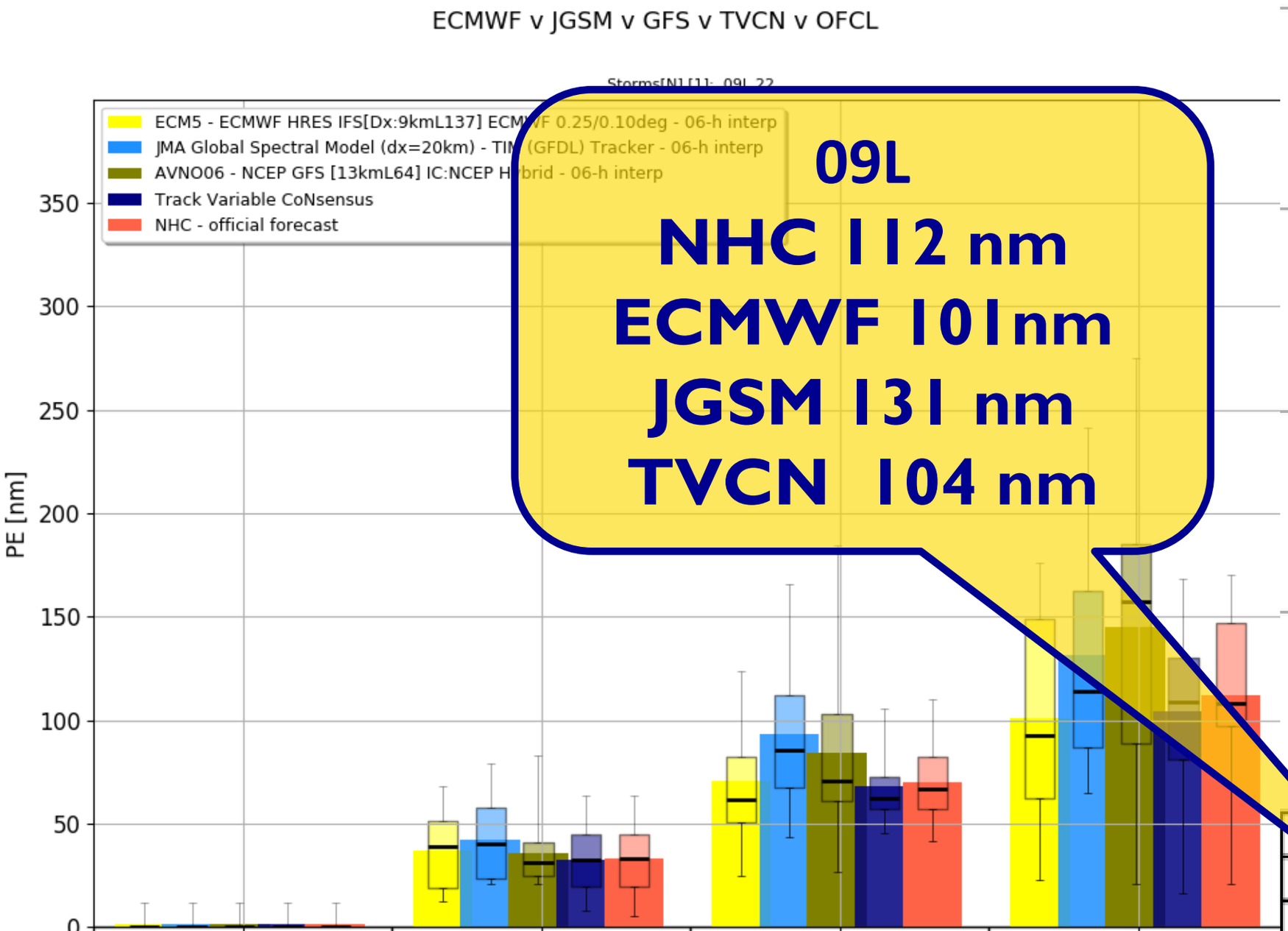
TECM506	1[16]	37[14]	70[12]	101[10]
TJGSM06	1[16]	42[14]	93[12]	131[10]
AVNO06	2[15]	36[14]	84[12]	145[10]
TVCN	2[15]	33[14]	68[12]	104[10]
OFCL	2[15]	33[14]	70[12]	112[10]



72h
101[10]
131[10]
145[10]
104[10]
112[10]

NWP – hurricane IAN

verification – mean position error (PE)



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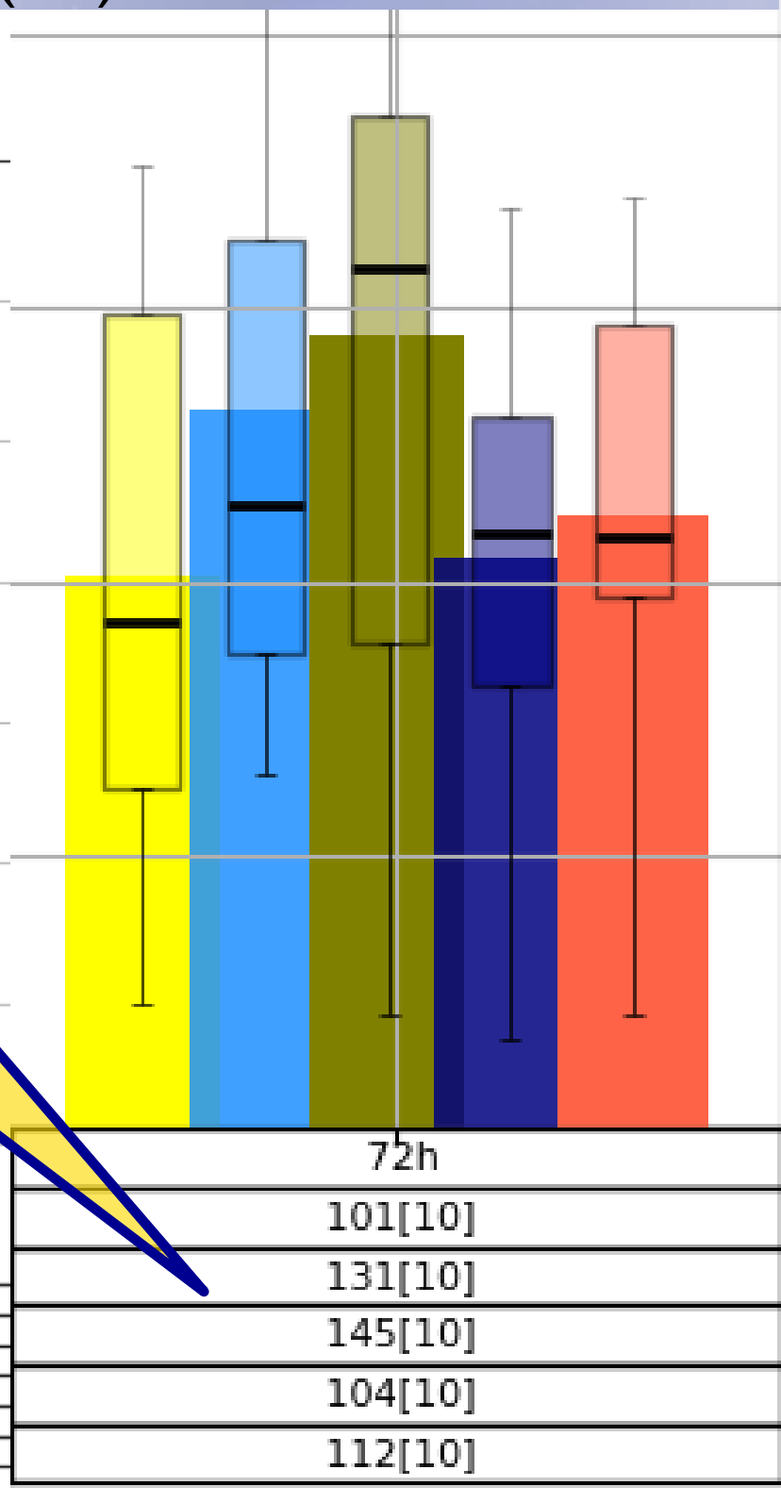
09L

NHC 112 nm

ECMWF 101nm

JGSM 131 nm

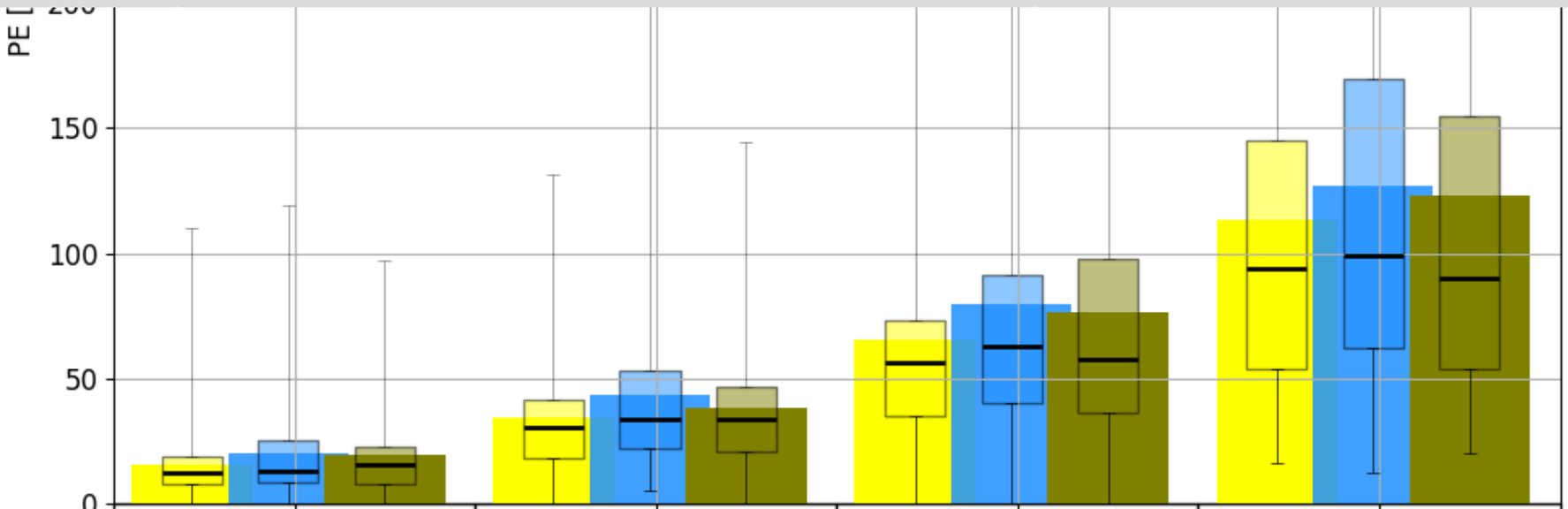
TVCN 104 nm



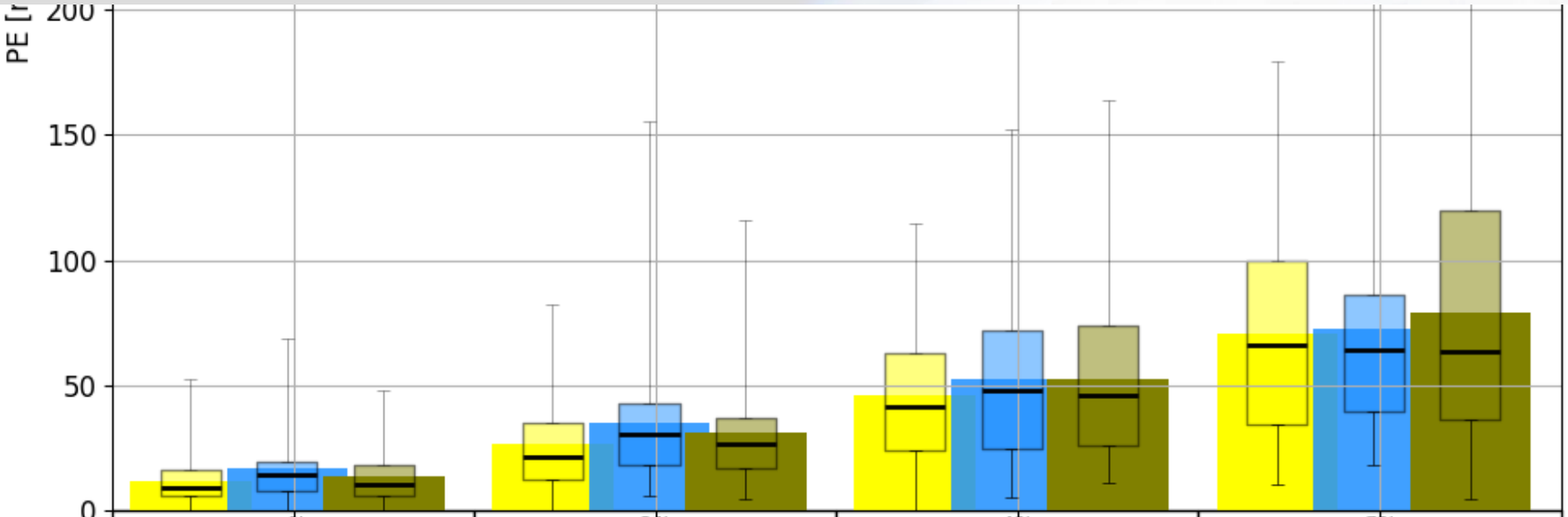
72h
101[10]
131[10]
145[10]
104[10]
112[10]

NWP – WPAC & LANT 2022

verification – mean position error (PE)



	0h	24h	48h	72h
TECM5	16[183]	35[142]	66[104]	113[76]
TJGSM	20[185]	44[142]	80[105]	127[76]
AVNO	20[178]	38[140]	76[105]	123[76]



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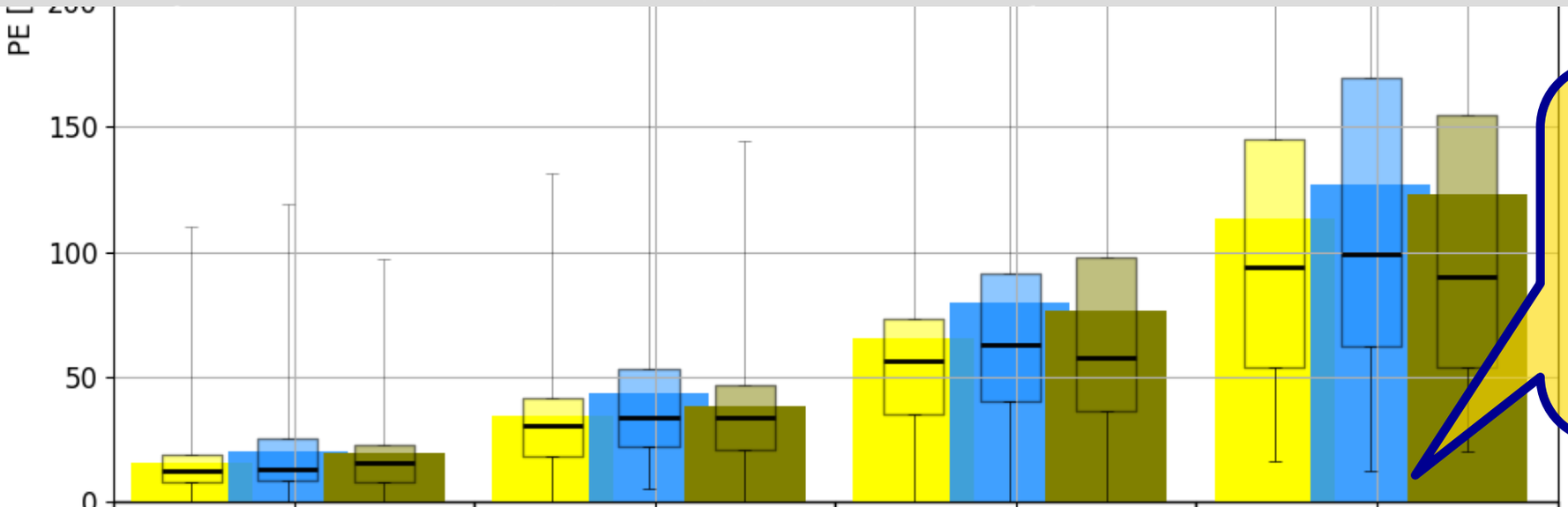
TECM5	12[106]	26[80]	46[60]	71[47]
TJGSM	17[107]	35[81]	52[61]	73[47]
AVNO	13[100]	31[80]	53[61]	79[47]

NWP – WPAC & LANT 2022

verification – mean position error (PE)



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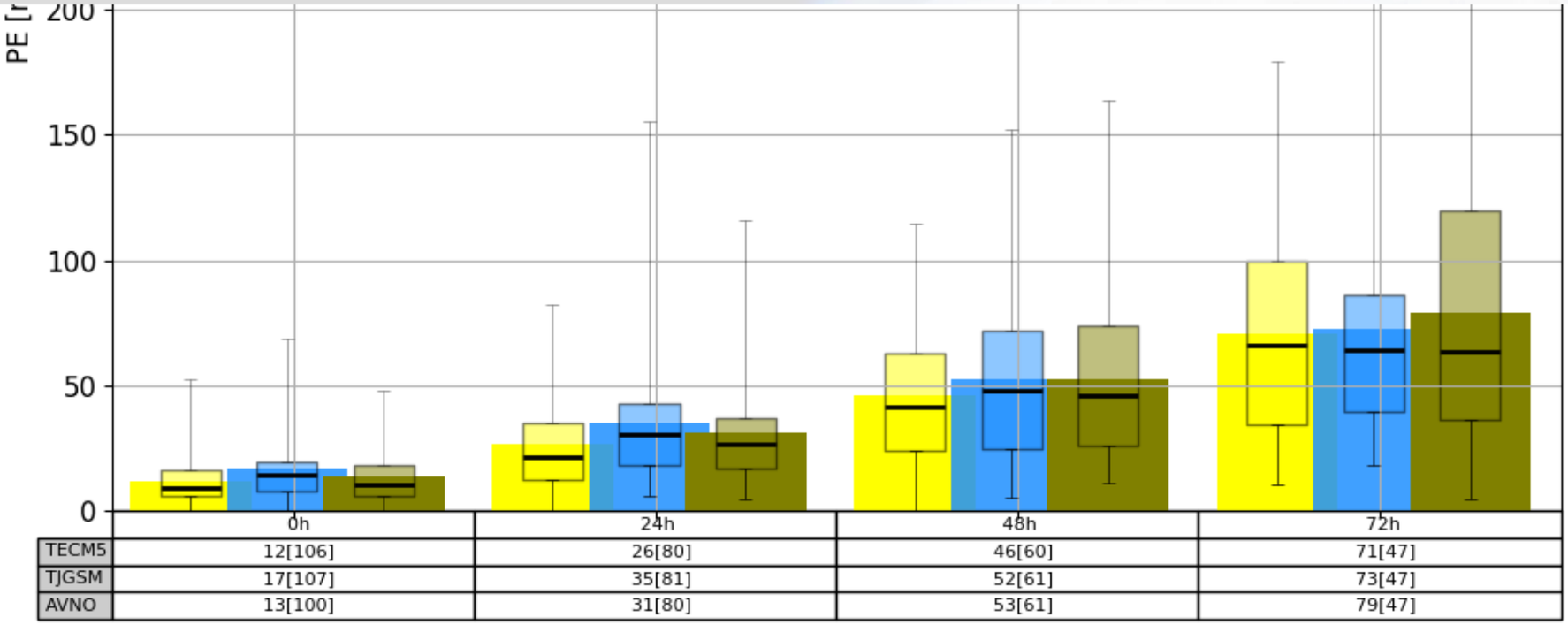
TJGSM	20[185]	44[142]	80[105]	127[76]
AVNO	20[178]	38[140]	76[105]	123[76]

WPAC~120nm

ECMWF 113 nm

JGSM 127 nm

GFS 123 nm



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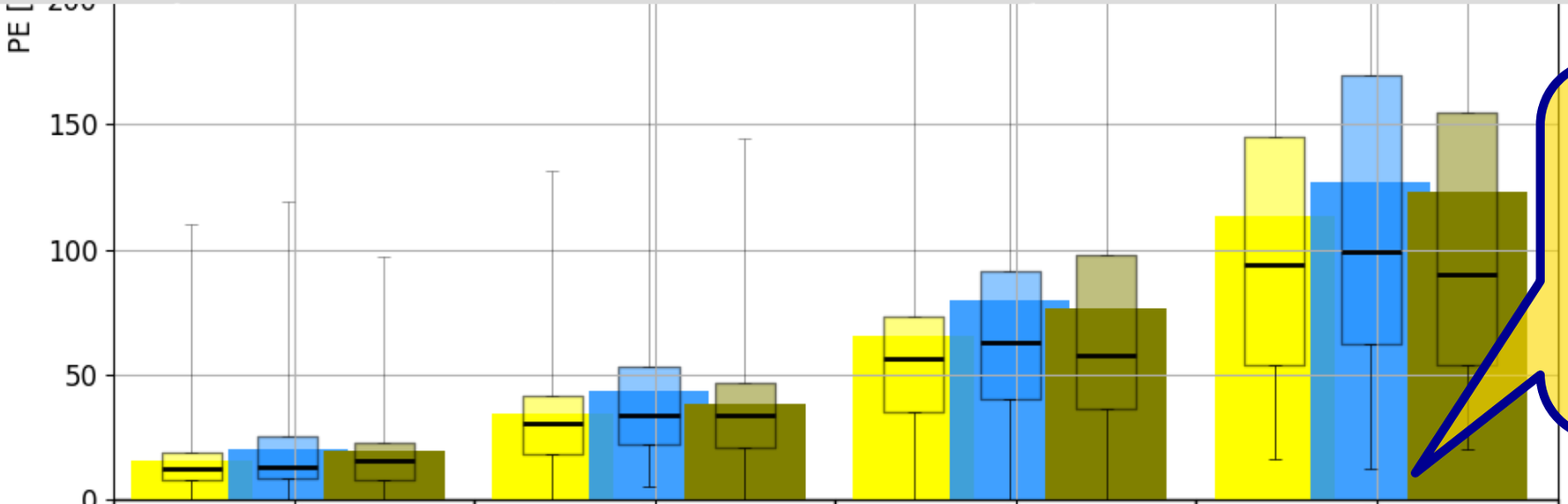
TJGSM	17[107]	35[81]	52[61]	73[47]
AVNO	13[100]	31[80]	53[61]	79[47]

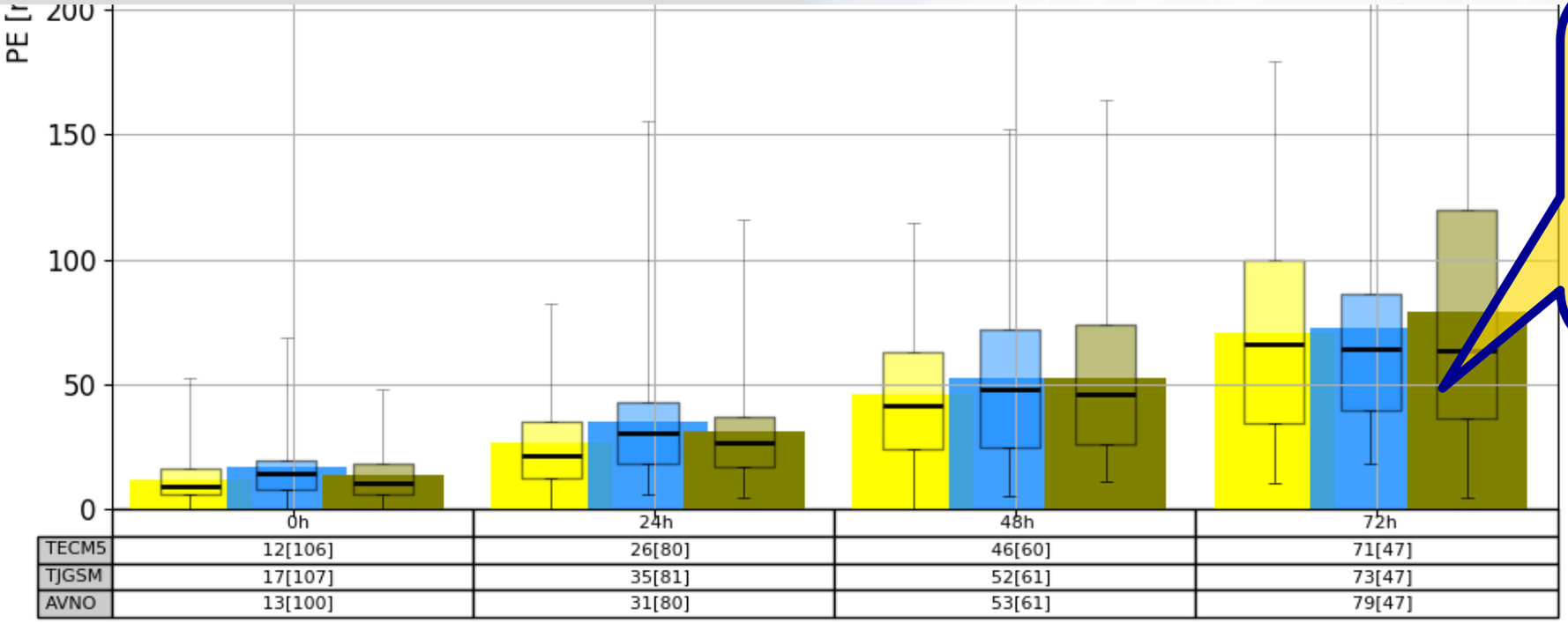
NWP – WPAC & LANT 2022

verification – mean position error (PE)



	0h	24h	48h	72h
TECM5	16[183]	35[142]	66[104]	113[76]
TJGSM	20[185]	44[142]	80[105]	127[76]
AVNO	20[178]	38[140]	76[105]	123[76]

WPAC~120nm
ECMWF 113 nm
JGSM 127 nm
GFS 123 nm



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TECM5	12[106]	26[80]	46[60]	71[47]
TJGSM	17[107]	35[81]	52[61]	73[47]
AVNO	13[100]	31[80]	53[61]	79[47]

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

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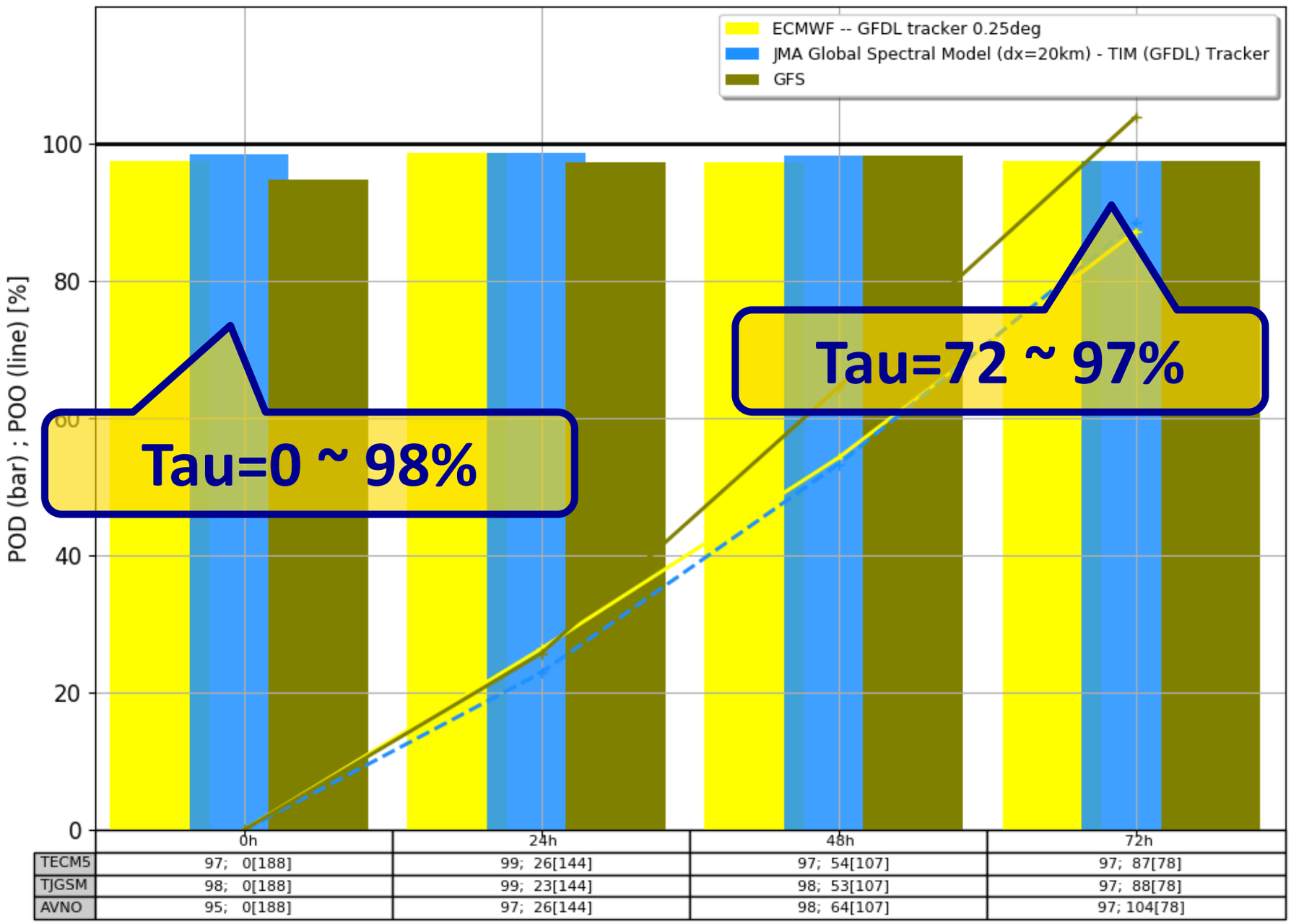
NWP PoD – Probability of Detection

WPAC 2022

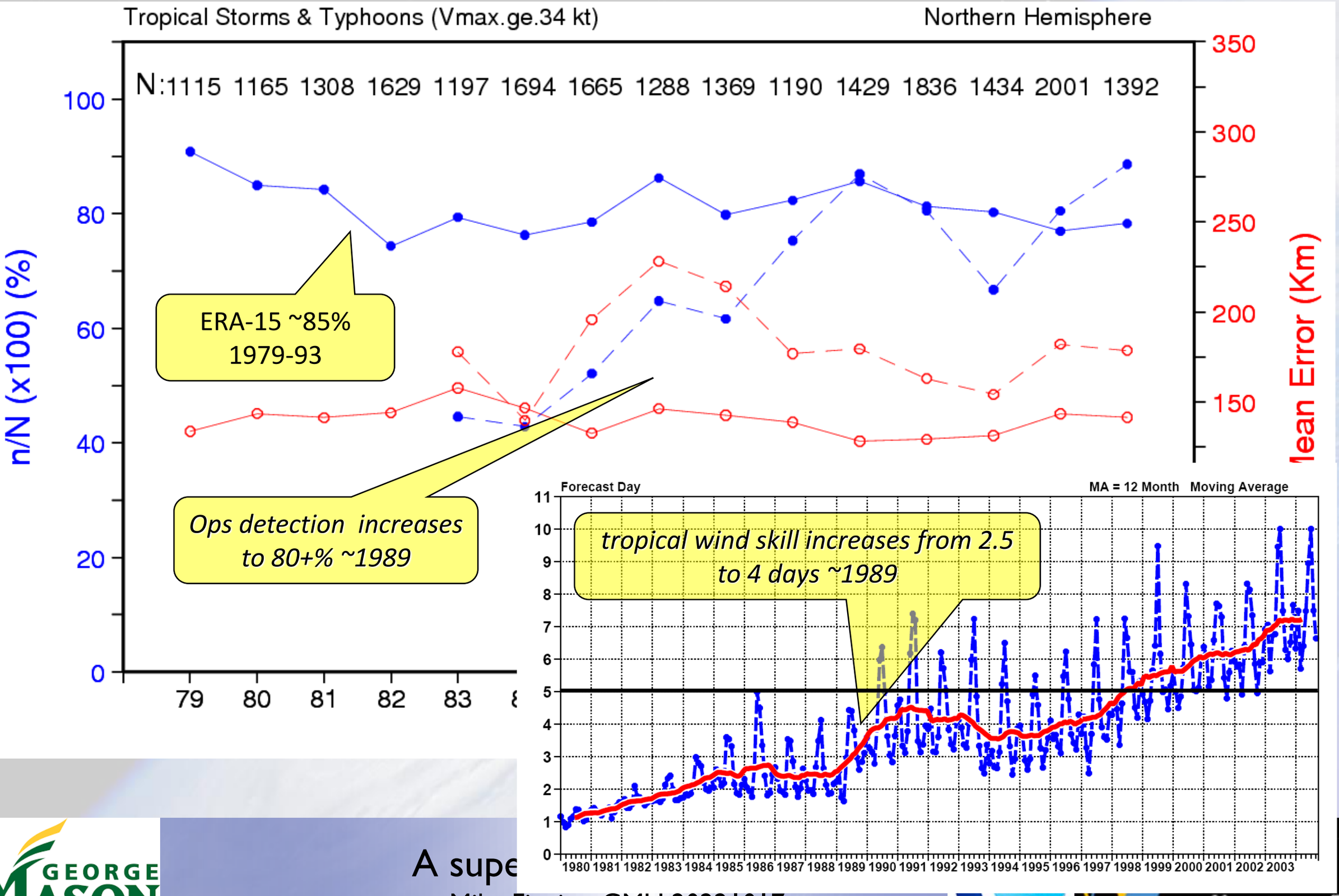


	0h	24h	48h	72h
TECM5	97; 0[188]	99; 26[144]	97; 54[107]	97; 87[78]
TJGSM	98; 0[188]	99; 23[144]	98; 53[107]	97; 88[78]
AVNO	95; 0[188]	97; 26[144]	98; 64[107]	97; 104[78]

NWP metrics 2022

- Good 72 mean PE → 100 nm
  - ~ 120 nm in WPAC
  - ~ 100 nm in LANT
- Good PoD → 95-100%
  - tau 0 (initial) ~ 98%
  - tau 72 (72-h forecast) ~ 95%
- How does ERA5 compare to ERA15/40?

TC Detection in ERA-15 v ECMWF ops



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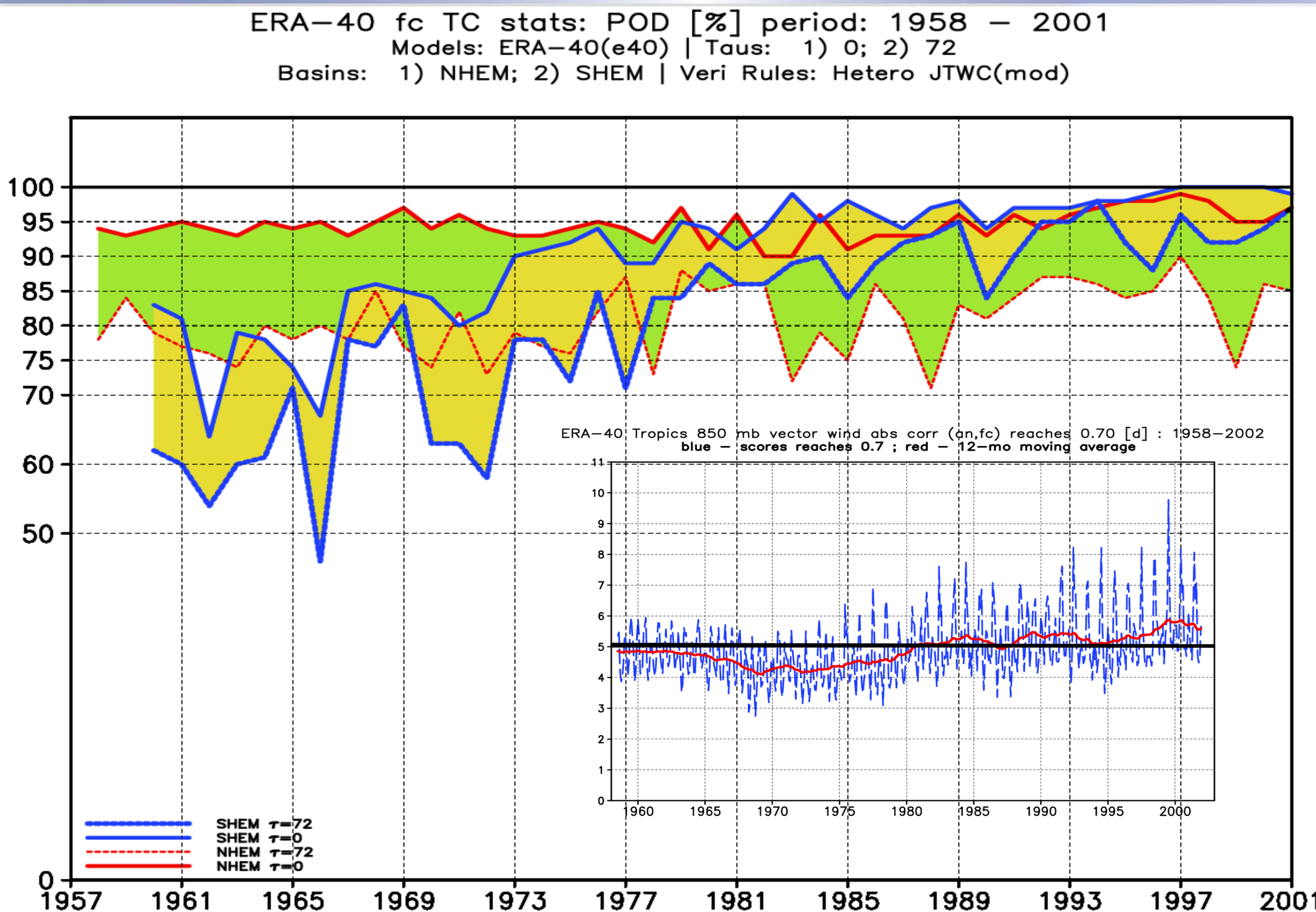
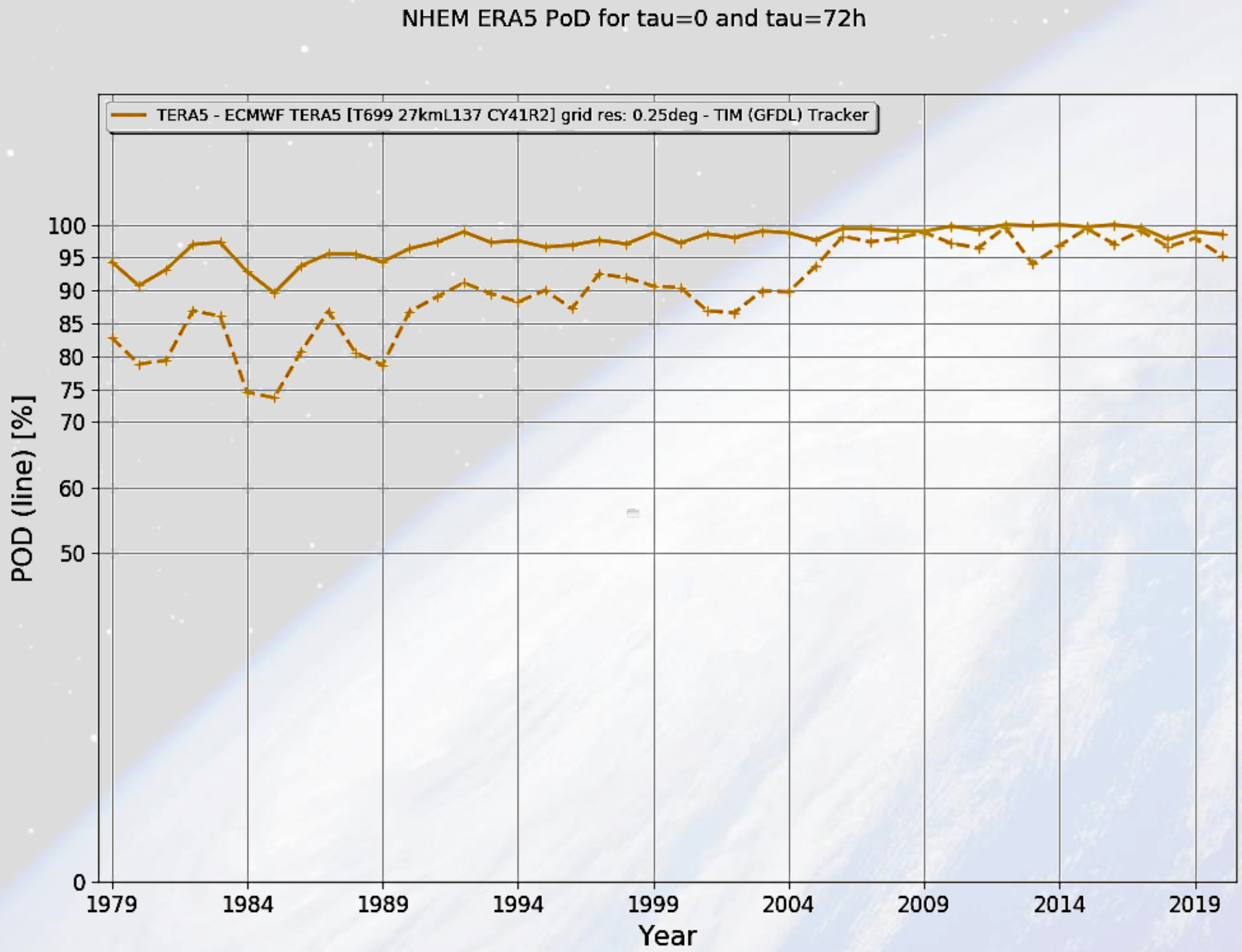
ERA-40 TC detection v tropical wind score

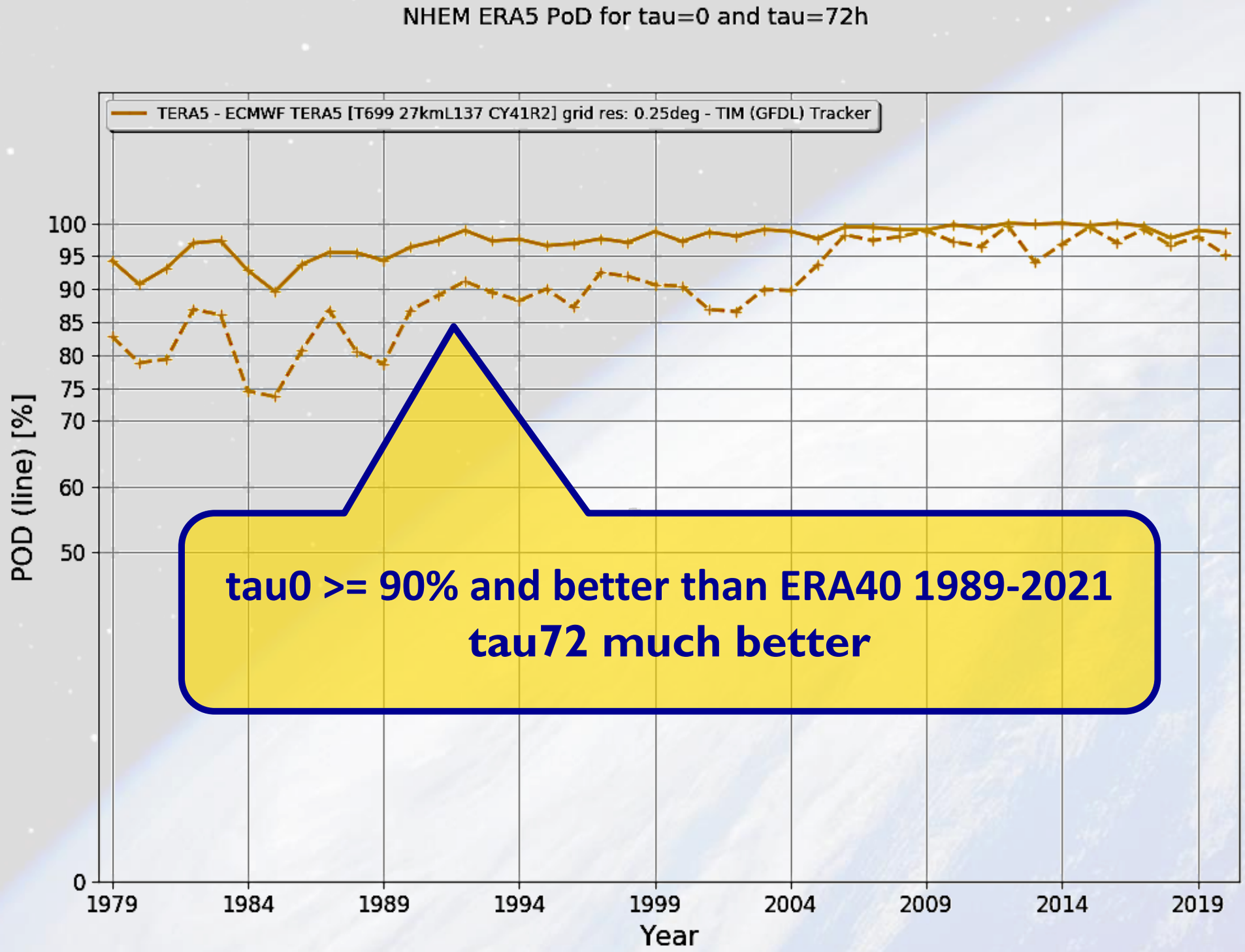
SHEM v NHEM ; tau=0 v tau=72 h



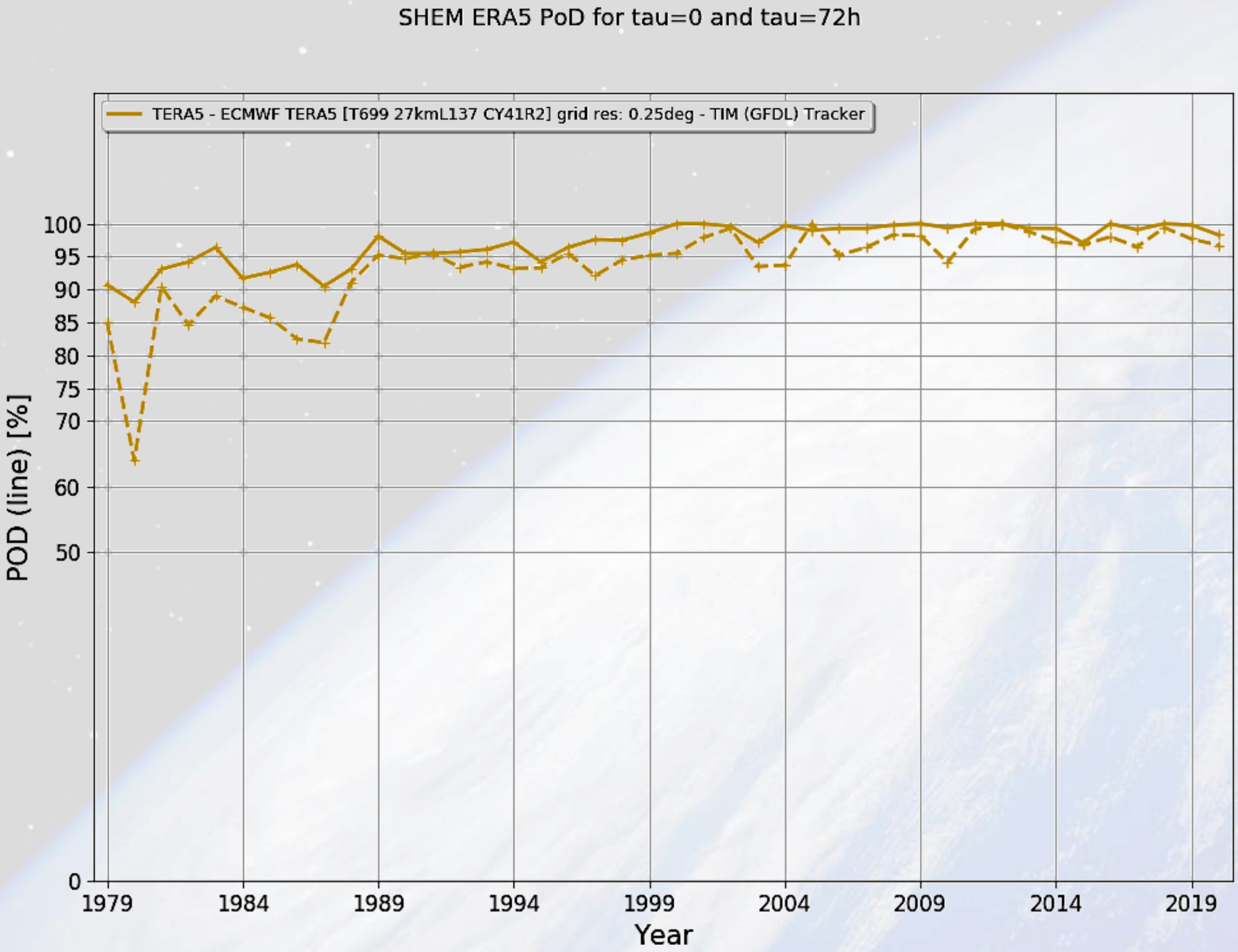
NHEM ERA5 PoD at tau=0 and 72 h



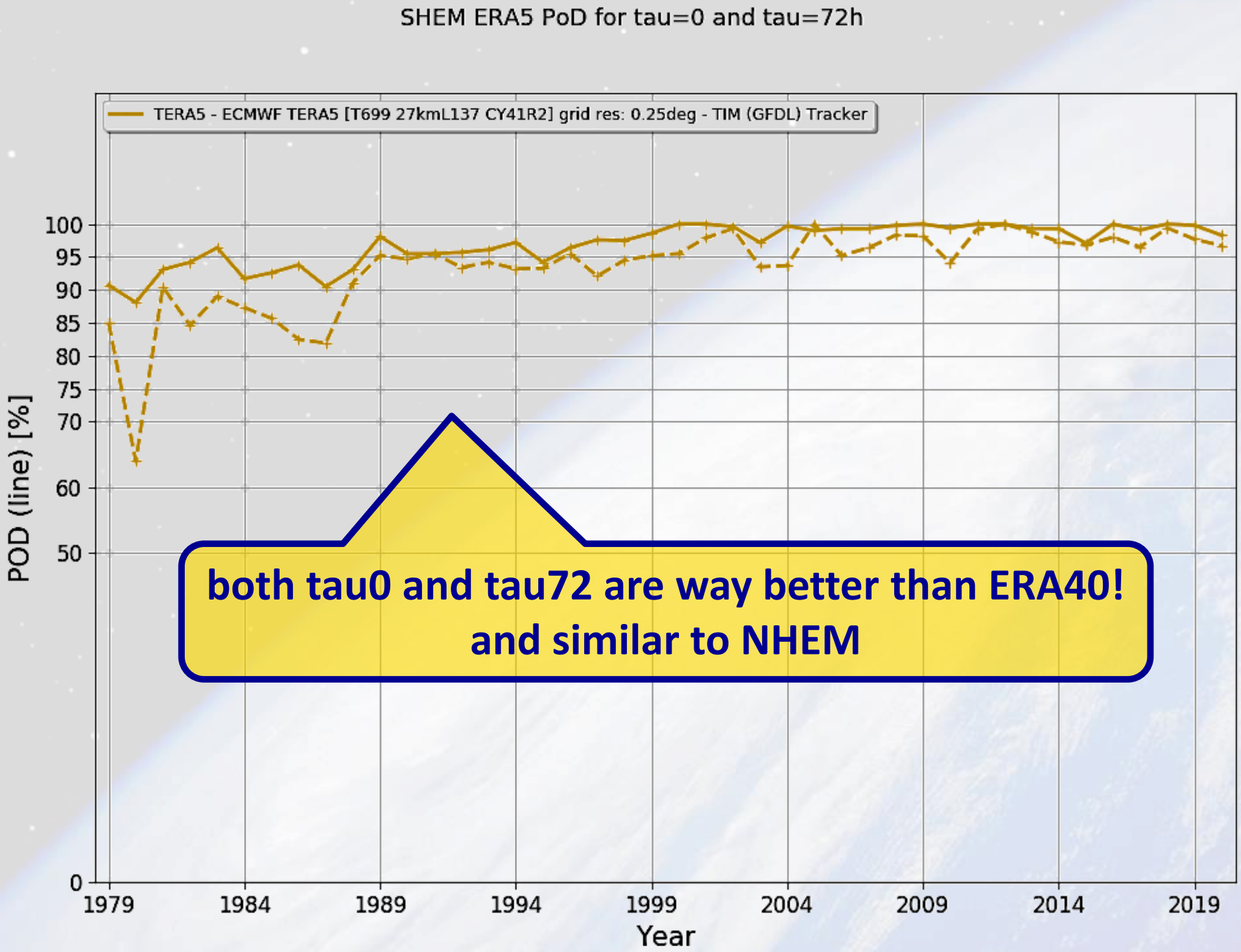
NHEM ERA5 PoD at tau=0 and 72 h



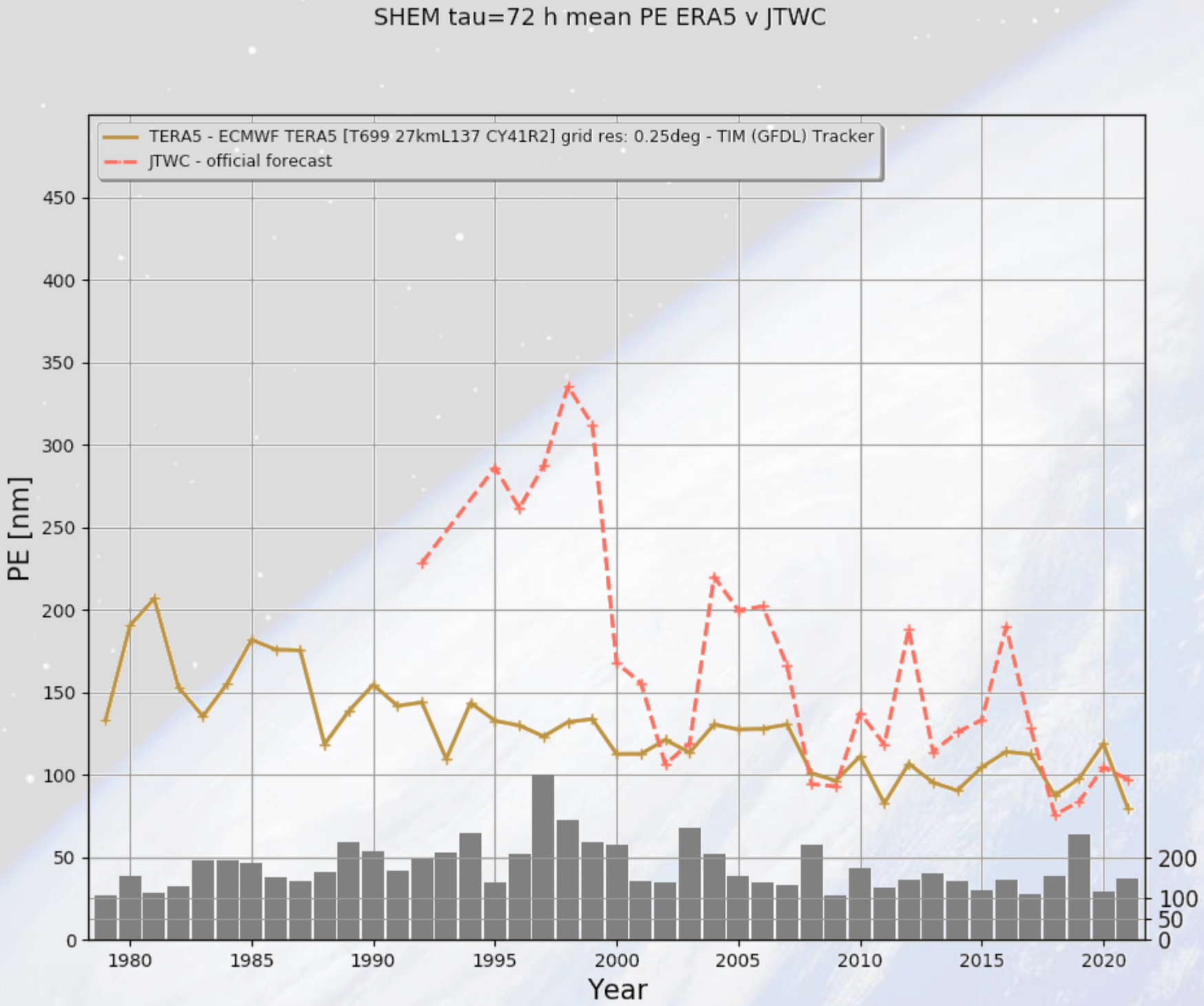
SHEM ERA5 PoD at tau=0 and 72 h



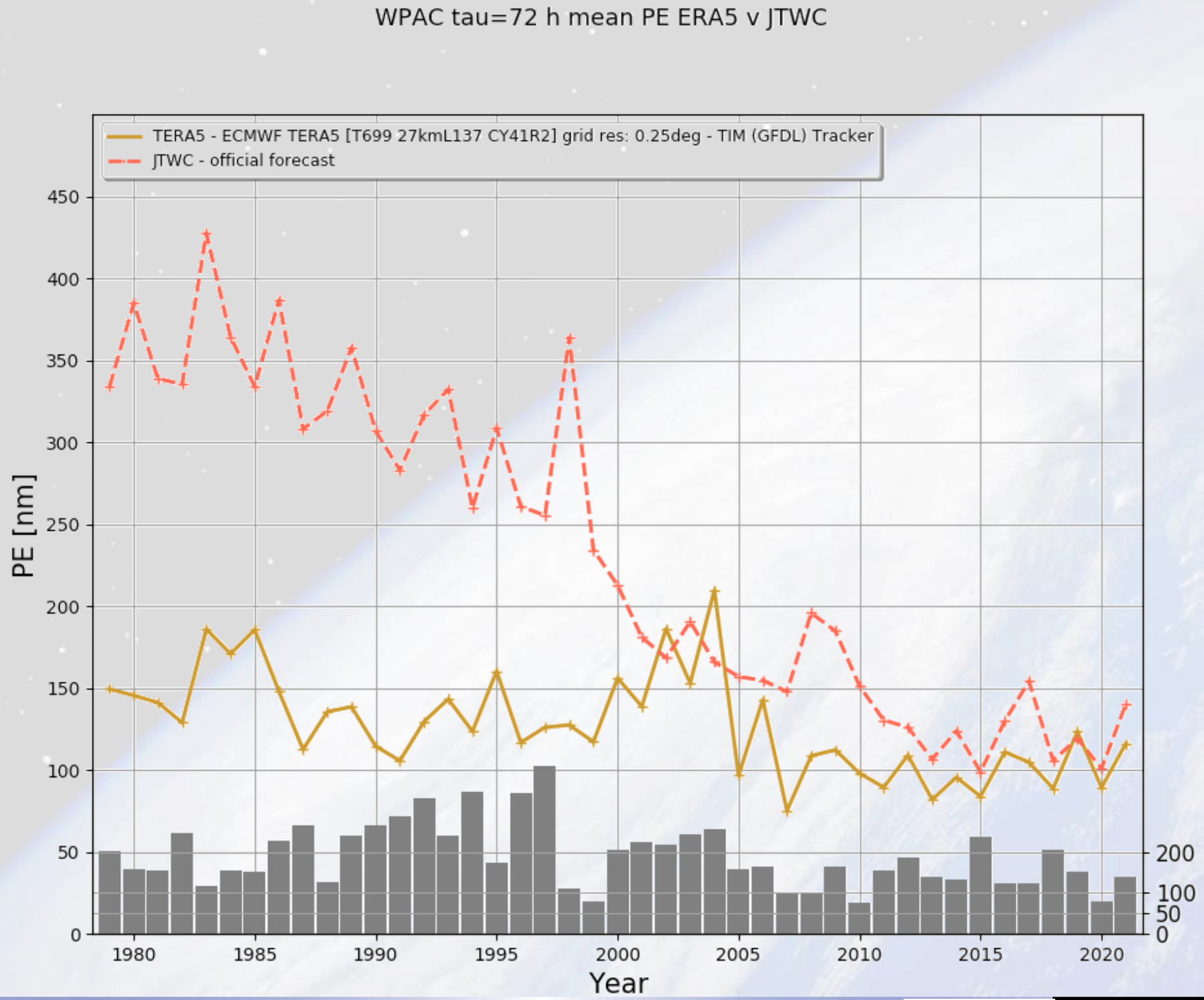
SHEM ERA5 PoD at tau=0 and 72 h



SHEM ERA5 v JTWC mean 72-h PE



WPAC ERA5 v JTWC mean 72-h PE



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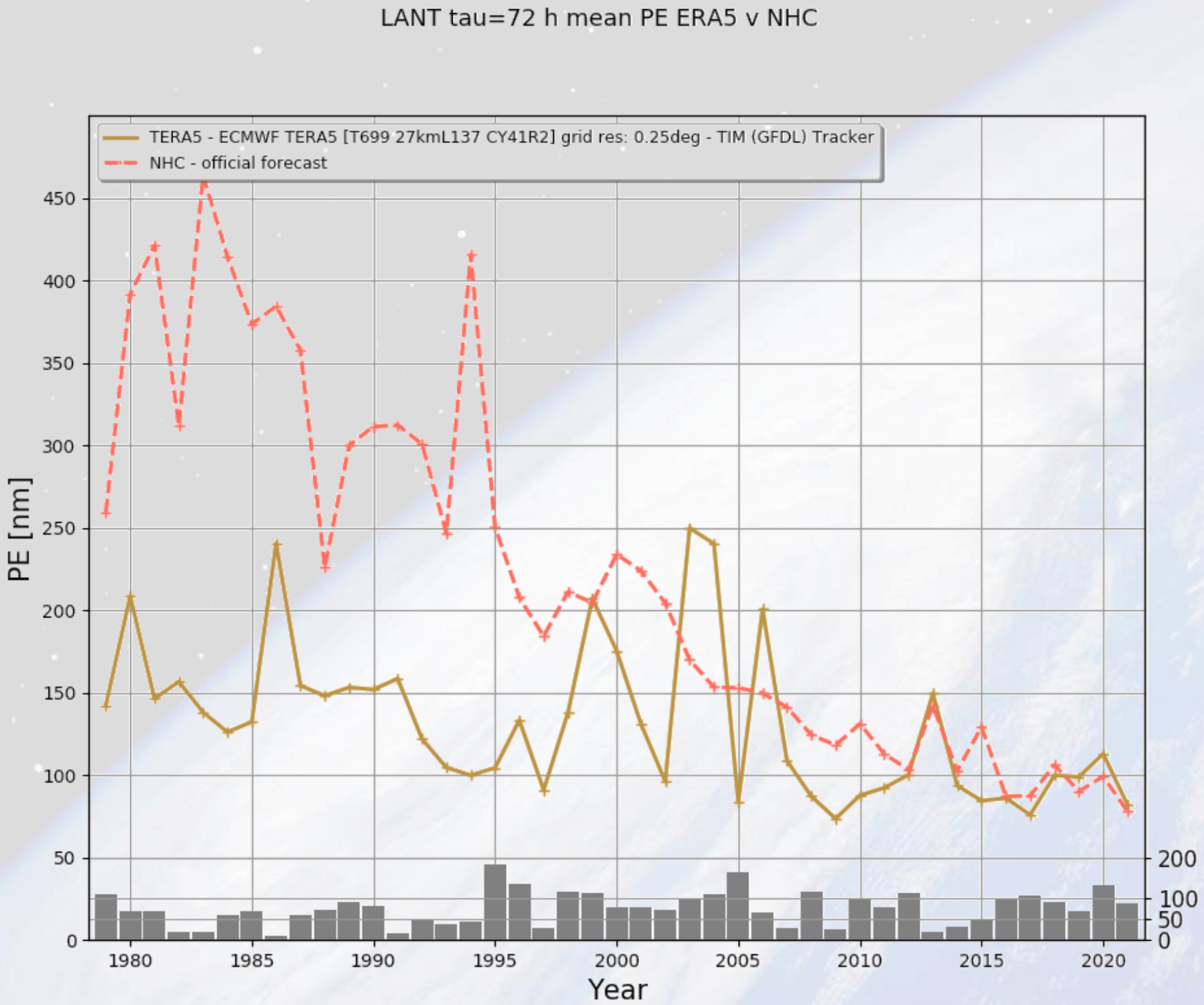
LANT ERA5 v NHC mean 72-h PE



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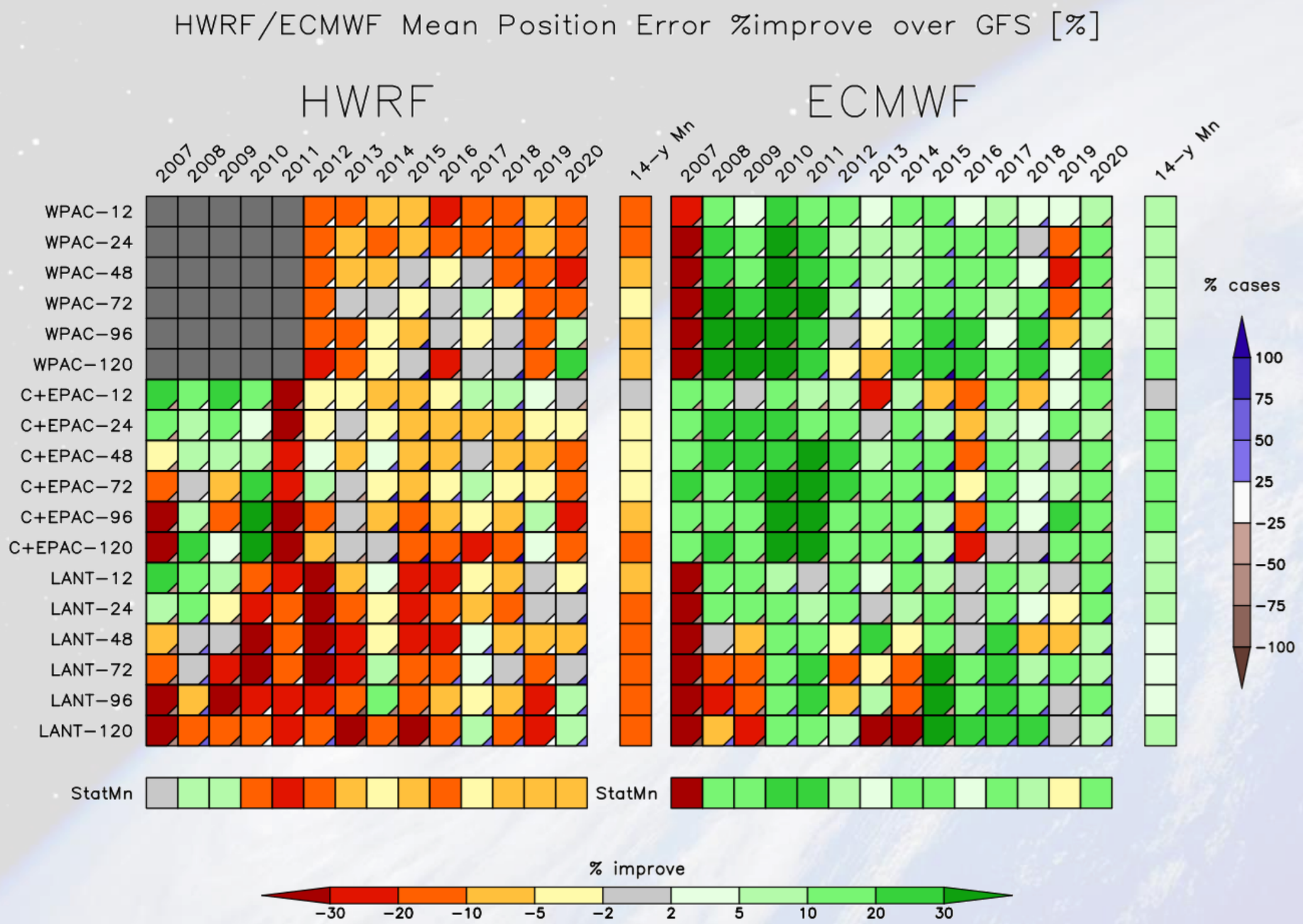
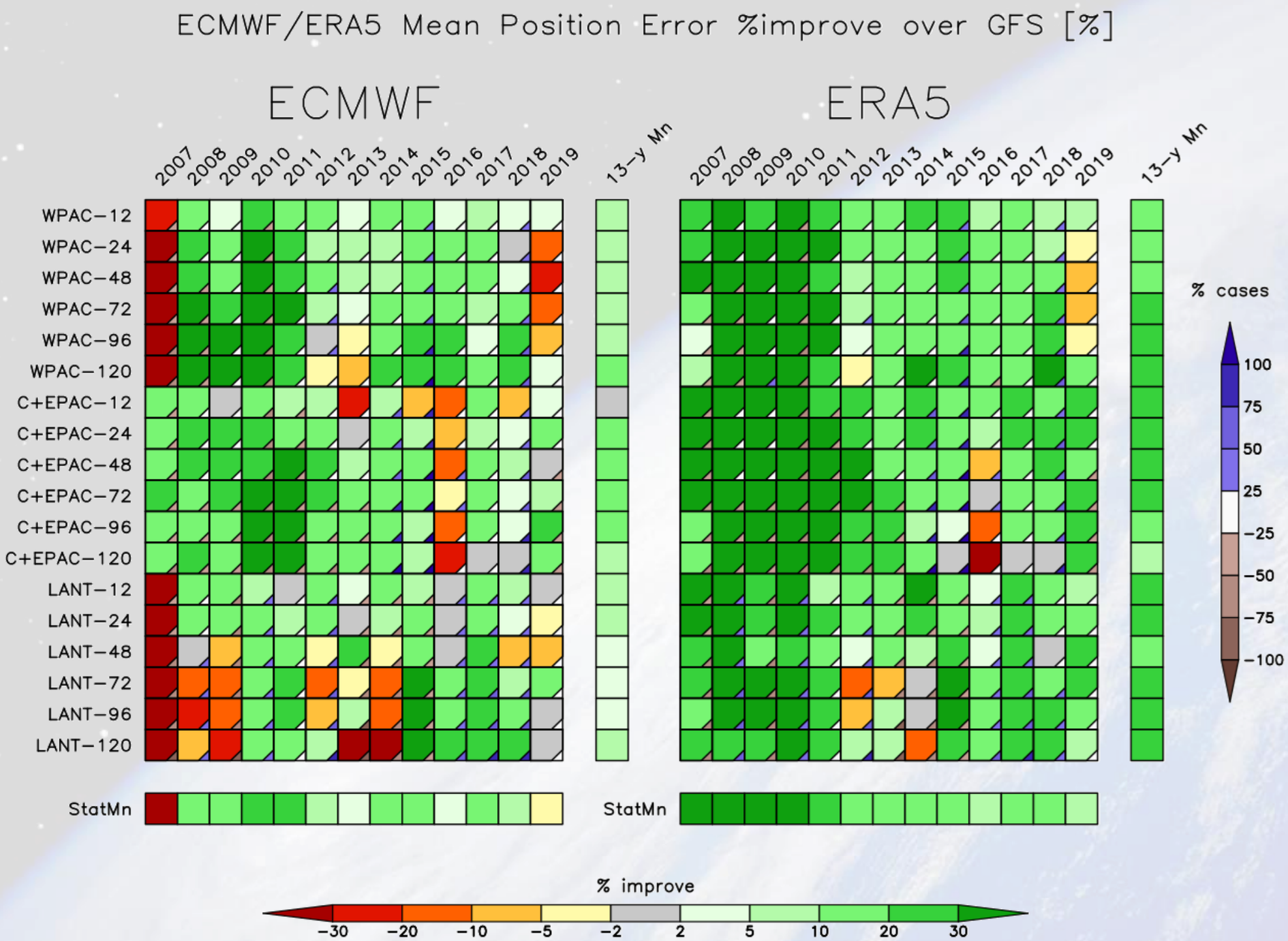
HWRF v ECMWF v GFS 2007-2020

% improve (lower) mean PE relative to GFS as a baseline



ECMWF v ERA5 v GFS 2007-2019

% improve (lower) mean PE relative to GFS as a baseline



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Takeaways or **BLOB**
Bottom **L**ine **O**n the **B**ackend

- 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
  - lat/lon/Vmax/speed/direction
  - distance from coast
  - R34/POCI
  - ERA5 rain
  - CMORPH (GSMaP) rain

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