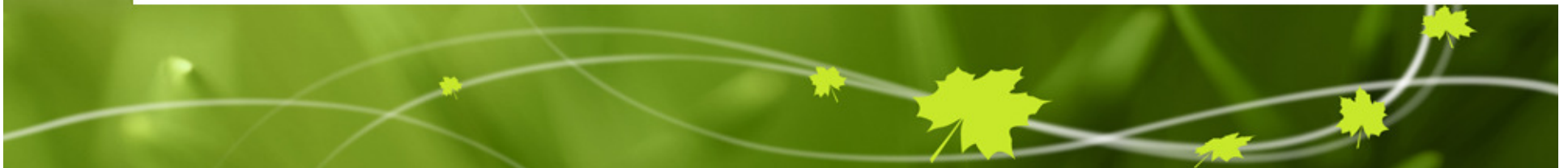# Analysis of tropical cyclone activity in 3 recent versions of the Canadian global NWP system

A. Zadra[1], B. Dugas[1], A.-M. Leduc[2],

R. McTaggart-Cowan[1], M. Roch[1], P. Vaillancourt[1]

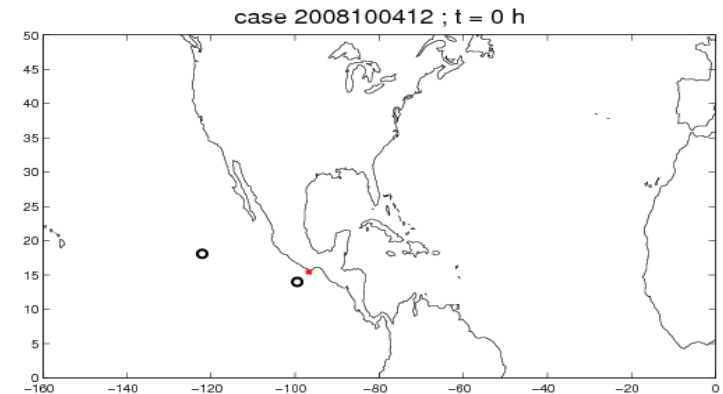**[1]RPN-A – Environment Canada**
[2]CMDN – Environment Canada

TC Tracking and Verification

> **Main conditions used to identify and track tropical storms [based on Walsh (2007)]:**

1) Minimum central SLP must be < 1012 mb
2) Relative vorticity at the center must be > 1e-5 s-1
3) Maximum near-surface wind > 22 kt within a 170 km radius
4) Distance between independent storms > 400 km
5) 850 mb vorticity > 250 mb vorticity within radius of 170 km

> **Verification against best track data**

1) for a **hit**: distance between observed and predicted storm must be < 600 km
2) **contingency tables** (hits, misses and false alarms) as a function of lead time for separate basins

case 2008100412 ; t = 0 h

black: best track data
color: tracks from different versions of the model

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Example of tracking output

```
Storm# Point# i   j   date        time   lat    lon     vort       pres        wind
    1    1 424 415 2008100800    84    34.35 -169.65   0.00024   1006.39172   36.31882
    1    2 427 416 2008100806    90    34.65 -168.30   0.00031   1003.41284   40.96595
    1    3 431 416 2008100812    96    34.65 -166.50   0.00028   1001.40710   37.94922
    1    4 435 421 2008100818   102    36.15 -164.70   0.00026   1000.51678   38.36294
    1    5 439 423 2008100900   108    36.75 -162.90   0.00022    998.91016   37.01458
    1    6 445 426 2008100906   114    37.65 -160.20   0.00026    999.48328   39.13258
    1    7 450 431 2008100912   120    39.15 -157.95   0.00023    999.67926   37.87506
    2    1 606 332 2008100612    48     9.45  -87.75   0.00036   1007.53851   22.39978
    2    2 606 331 2008100618    54     9.15  -87.75   0.00037   1007.77246   28.02093
    2    3 608 330 2008100700    60     8.85  -86.85   0.00042   1006.43024   29.09504
    2    4 608 331 2008100706    66     9.15  -86.85   0.00035   1007.10114   26.94382
```
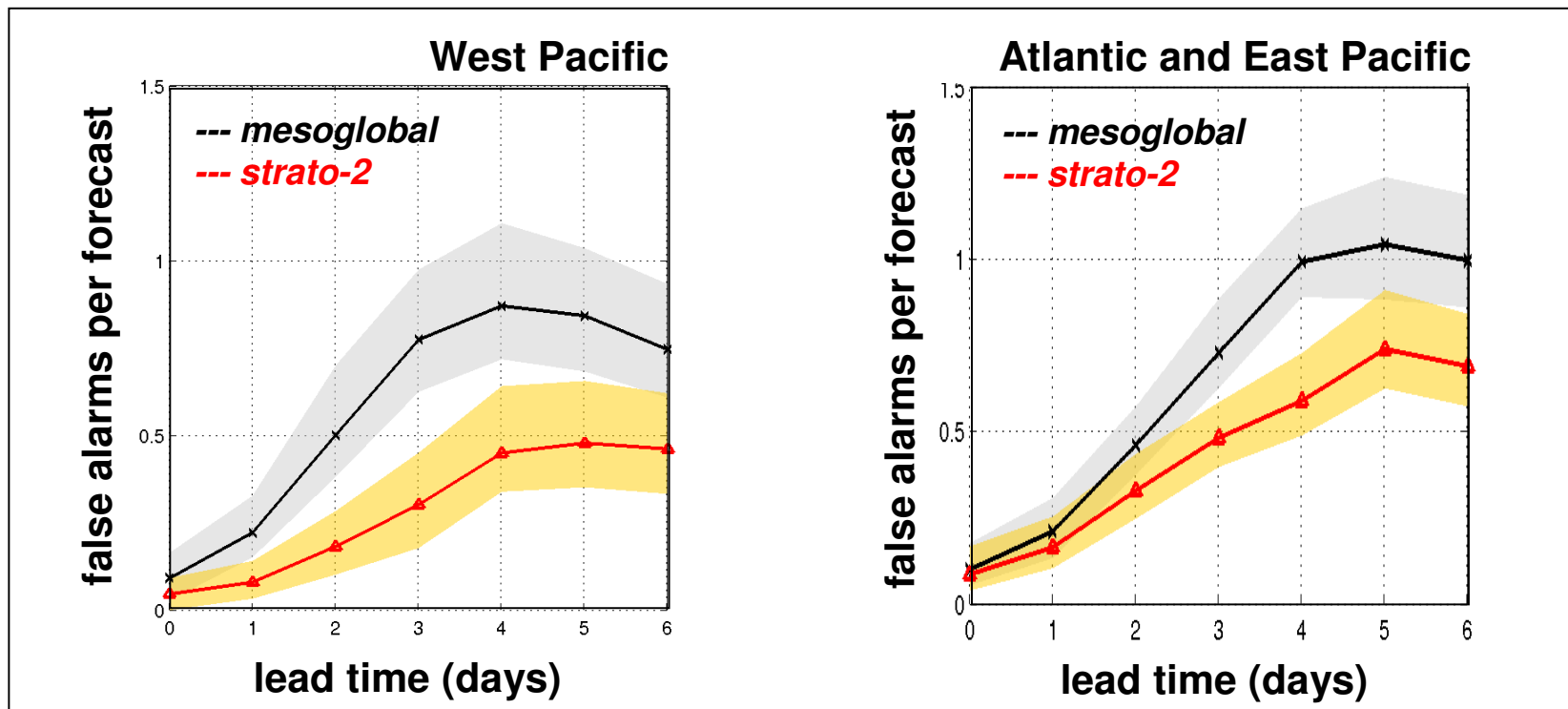
NOTE: Similar data are available from TC best-track data (e.g. NHC) for observed storms.

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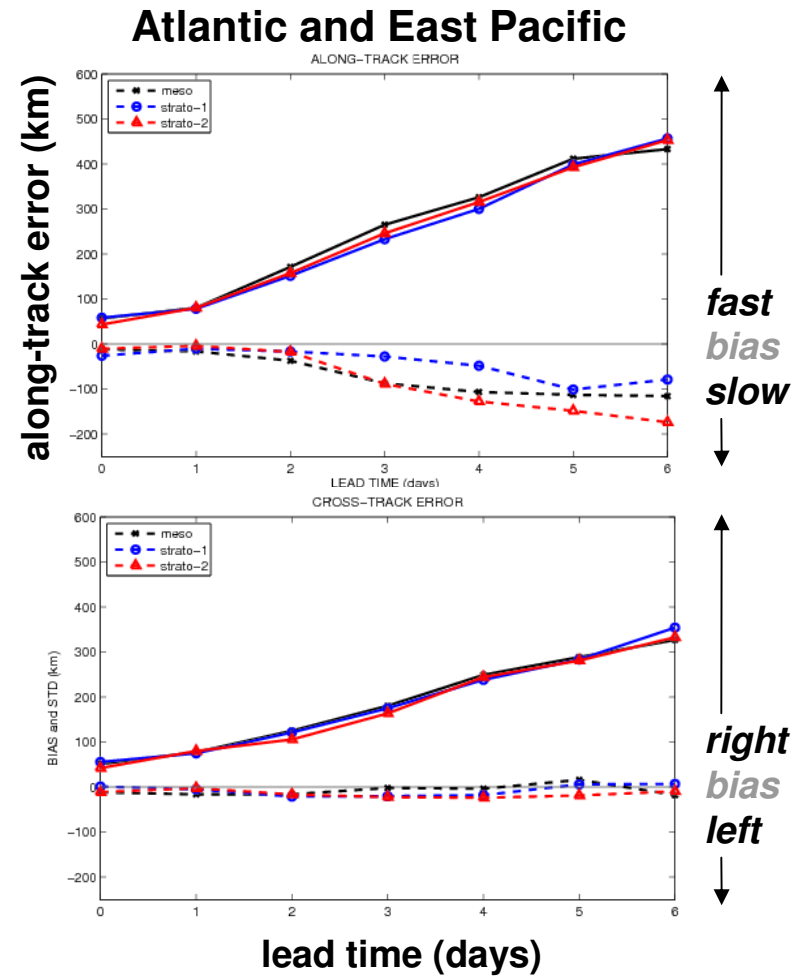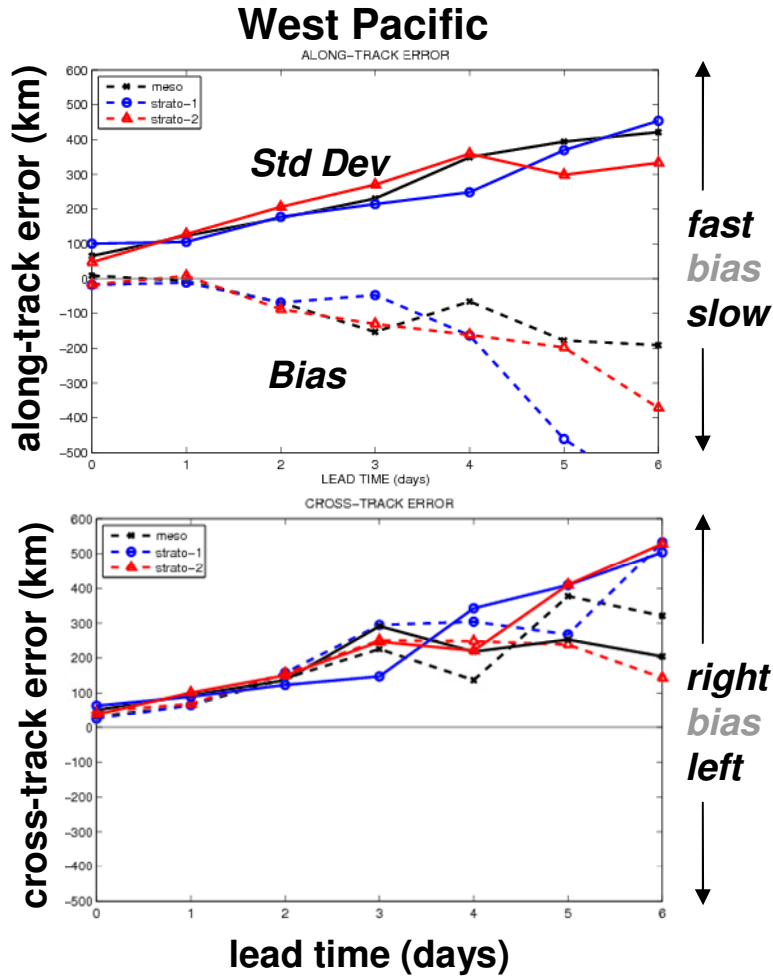
TC False Alarm Statistics

> **2008 season (70 global 6-day forecasts: 03-Jul to 15-Oct, every 36h)**

> **verification against HURDAT and JMA**

False alarms per forecast as a function of lead time between the 2008 implementation of the Canadian global model (black) and the upcoming Strato-2 release (red). The 5-95% confidence interval is computed using a bootstrapping technique and is shown by shading in the plots.

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Canada

TC Track Error Statistics

2008 season

West Pacific

Atlantic and East Pacific

Track errors (solid) and biases (dashed) for forecast days 1-6 in the along-track (top) and cross-track (bottom) directions.

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TC Intensity Error Statistics

- **Mesoglobal** and **strato-1** exhibit similar intensity (SLP and wind speed) errors

- Changes in the CPS in **strato-2** reduce the over-deepening of TCs, so an increase in intensity biases is expected

- Continued intensification over the course of the integration suggest that the model/analysis system is not perfectly balanced:
  - Model "climate" may be too unstable
  - Analysis increments (~160 km) may weaken initial structures

Atlantic and East Pacific 2008 season
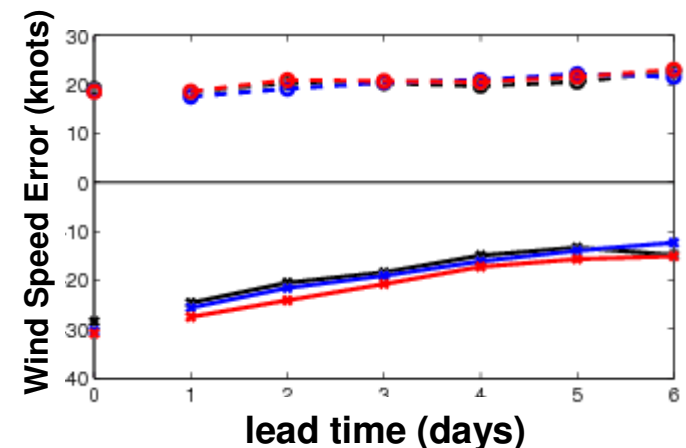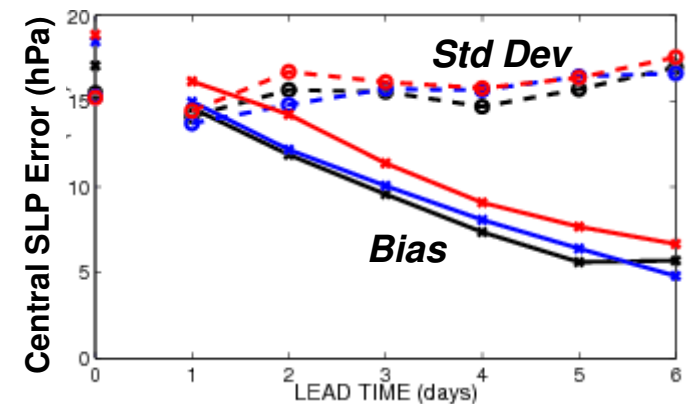
Errors (dashed) and biases (solid) for forecast days 1-6 in central SLP (top) and mean near-surface wind speed (bottom).

Conclusions

- Two ways to adapt this approach for ensembles:
  - Provide distributions (pr scattered plots) instead of single points for biases
  - Calculate standard deviations including individual members