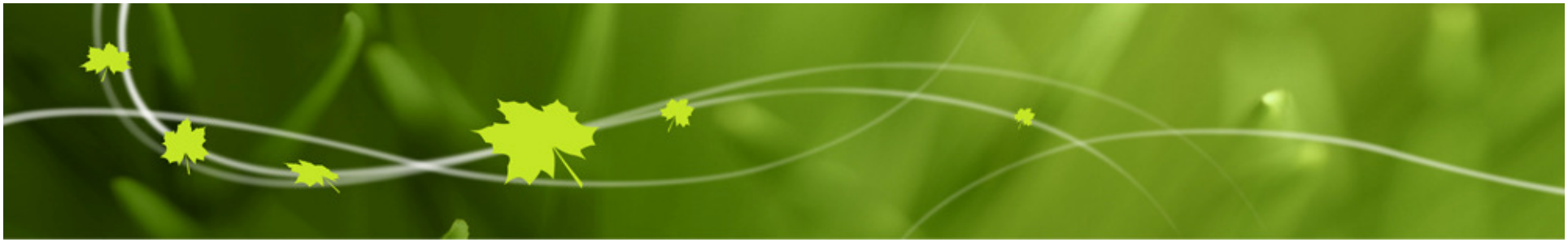


# The day 6 and 7 adventure at MSC

**B. Archambault, P. Bourgouin, G. Hardy, N. Gagnon**

**Meteorological Service of Canada (MSC)**

# Background (2008)

- At that time, extended public forecasts covered days 3 to 5. MSC wanted to improve the service provided to Canadians by extending the range to day 7.

## Developers' Wishes

- Use the full power of the Global Ensemble Prediction System (GEPS)
  - Confidence intervals
  - Uncertainty information
  - Clustering approach
  - Probabilistic approach

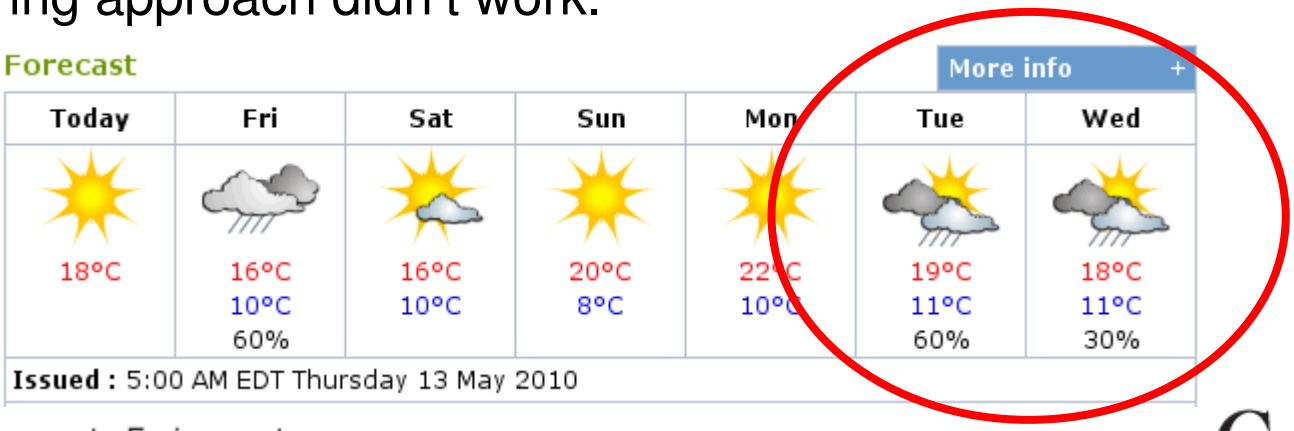
# Background (2008)

## Constraints

- Time and management constraints (fast-track).
- Smooth integration into the current MSC operational system (deterministic).
- Stable forecast system.

## Reality

- Use GEPS as a deterministic model.
- Clustering approach didn't work.



# Forecasts by averaging

- Important forecast parameters (POP6, POP12, temperature, cloud cover) are produced by a Perfect Prog (PP) technique applied on every members.
- The 21 statistical values for each parameters are then averaged to produce single values.
- Precipitation types are based on forecast temperature alone (T≥5C → Rain, T< 0C → Snow, else Rain/Snow).
- Averaging the Direct Model Output for all the others parameters (winds, thickness, vertical movement…)

# Verification periods

3 periods – 00UTC runs

| | | |
|---|---|---|
| - Winter | 22 February to 22 April 2008 | 118 stations |
| - Summer | 1 July to 31 July 2008 | 118 stations |
| -Fall | 1 October to 1 December 2008 | 23 stations |
| -Winter 2010 | 1 December to 28 February | 118 stations |

# Verifications – the various candidates

**ENS**: Forecasts based on GEPS (D1-10, PP)

**GLB**: Forecasts based on Global model using the same post-processing as ENS (D1-10, PP, single model)

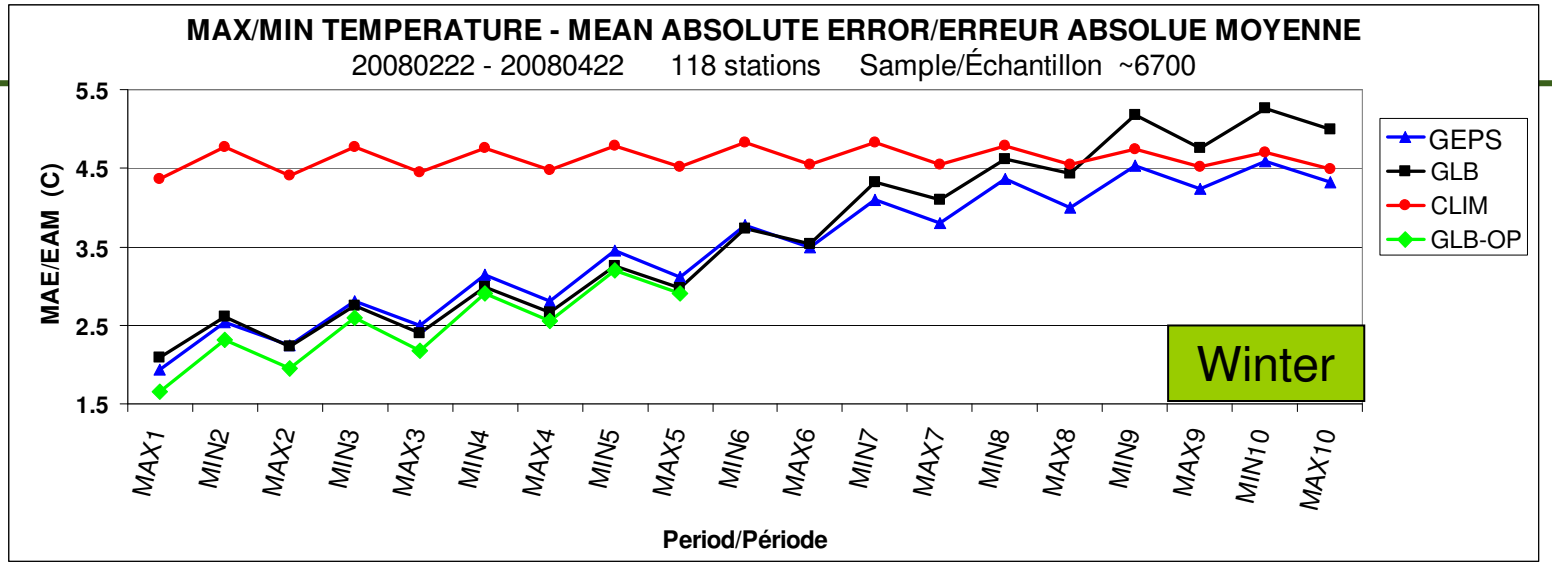
**GLB-OP**: Forecasts based on Global model but using the operational post-processing (UMOS for TT and auto-correction algorithm) (D1-5, single model)

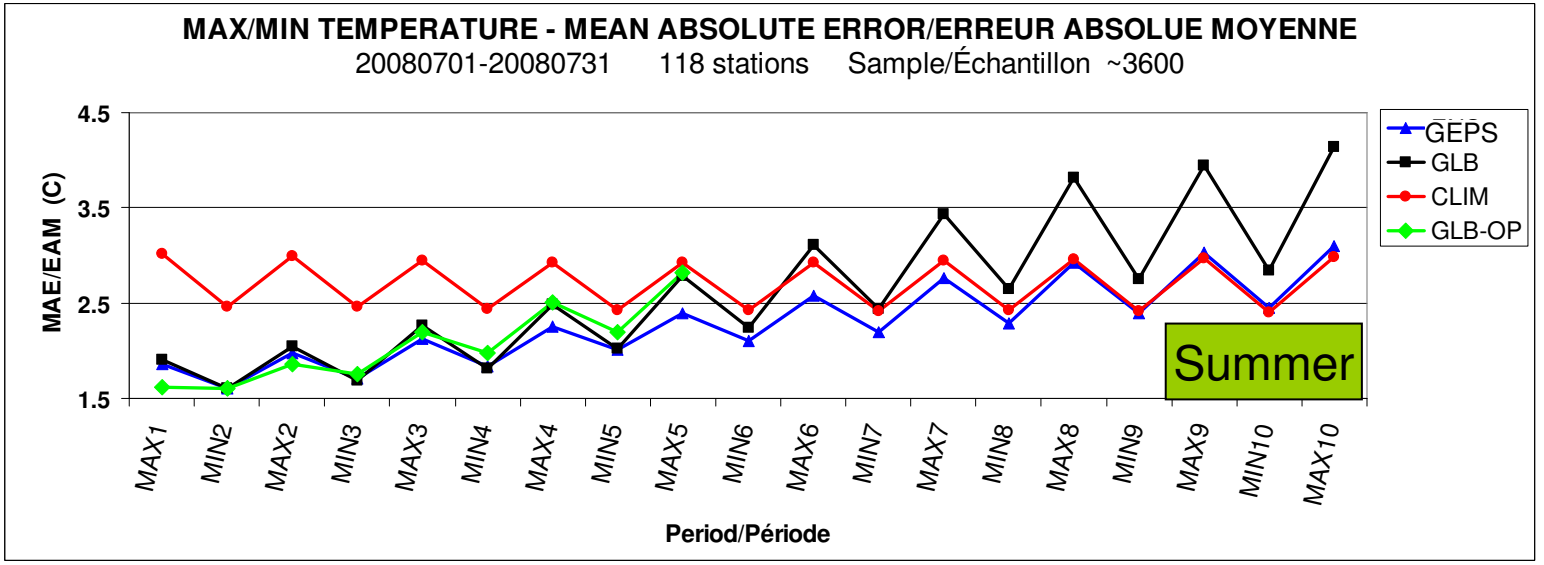
**CLIM**: Forecasts based on the climatological values during the specific period

**Winter (summer, fall):** historical operational forecasts

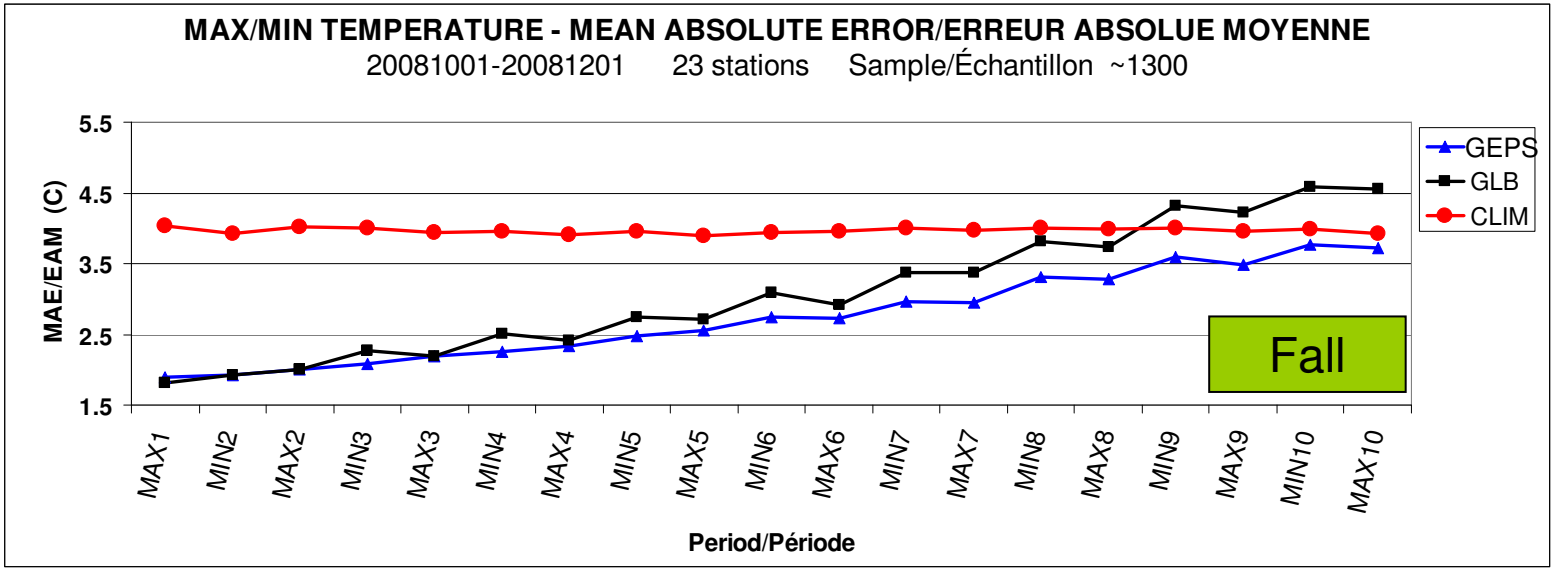
**NAEFS:** Forecasts based on NAEFS (D1-10, PP)

# Temperature (1)

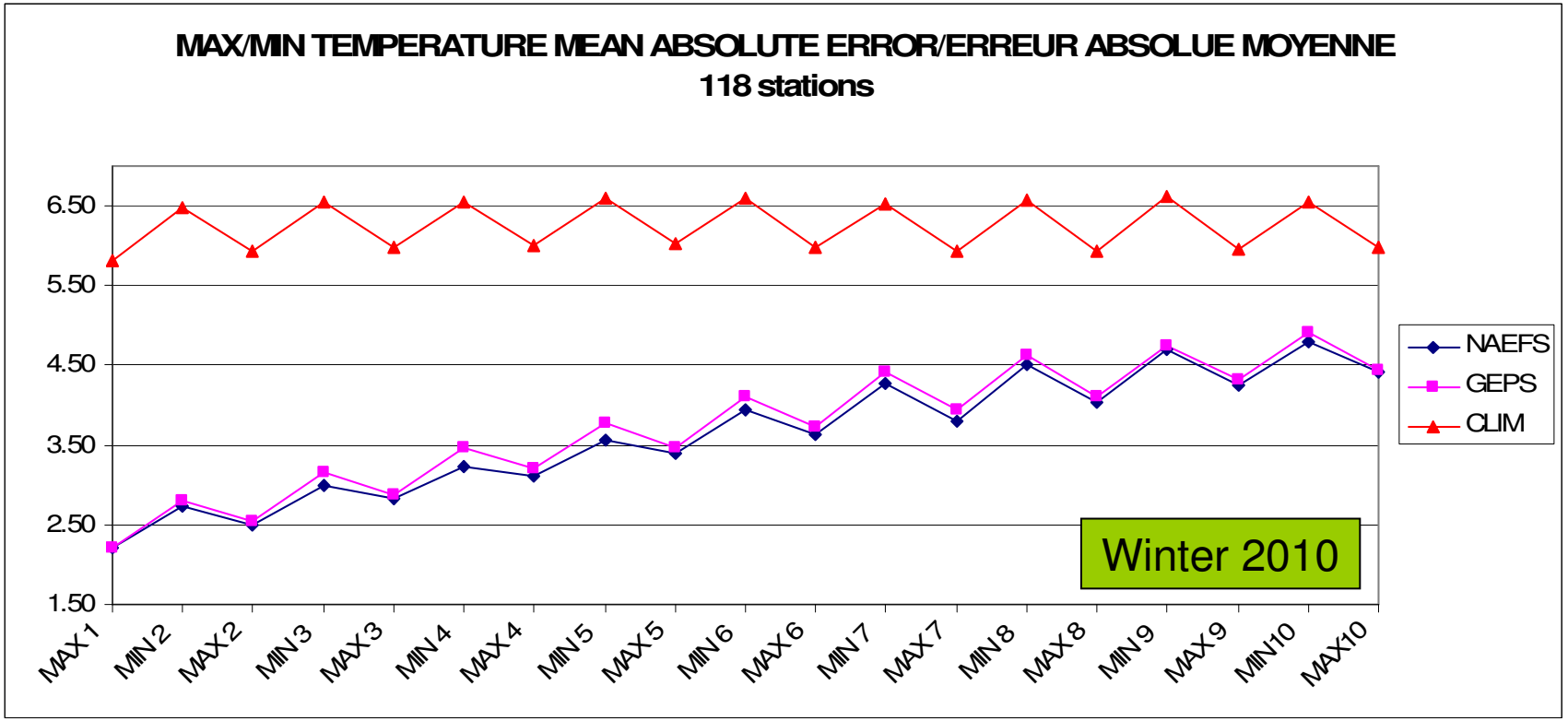


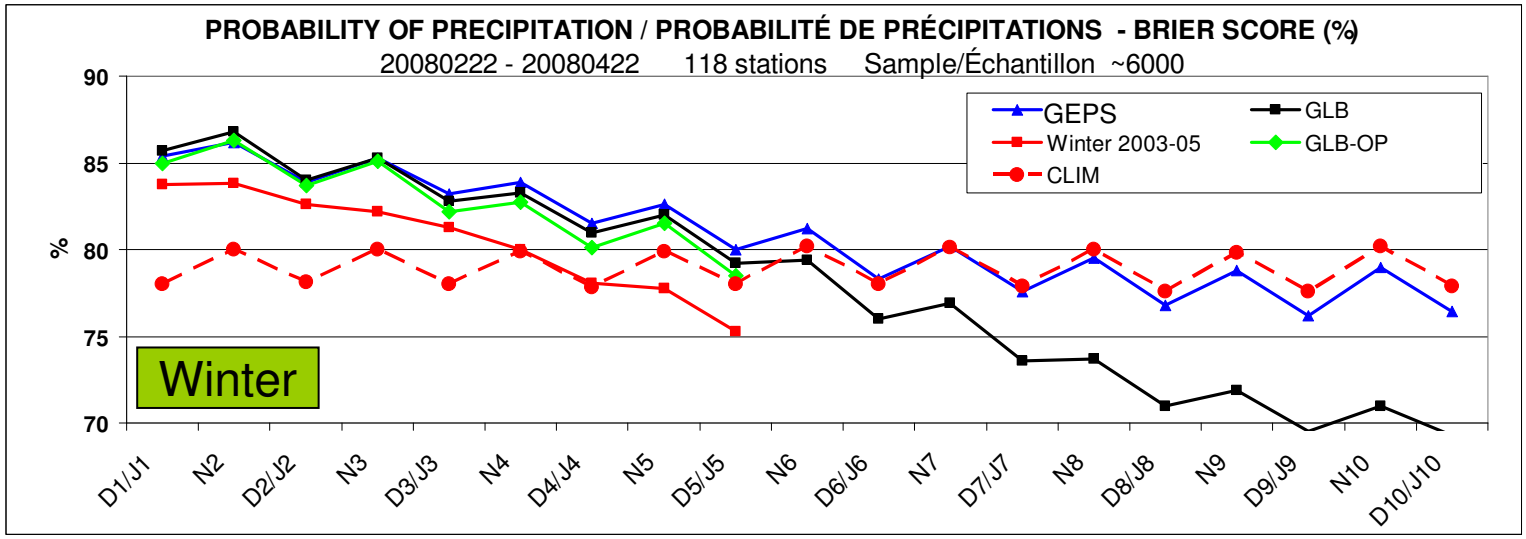
# Temperature (2)



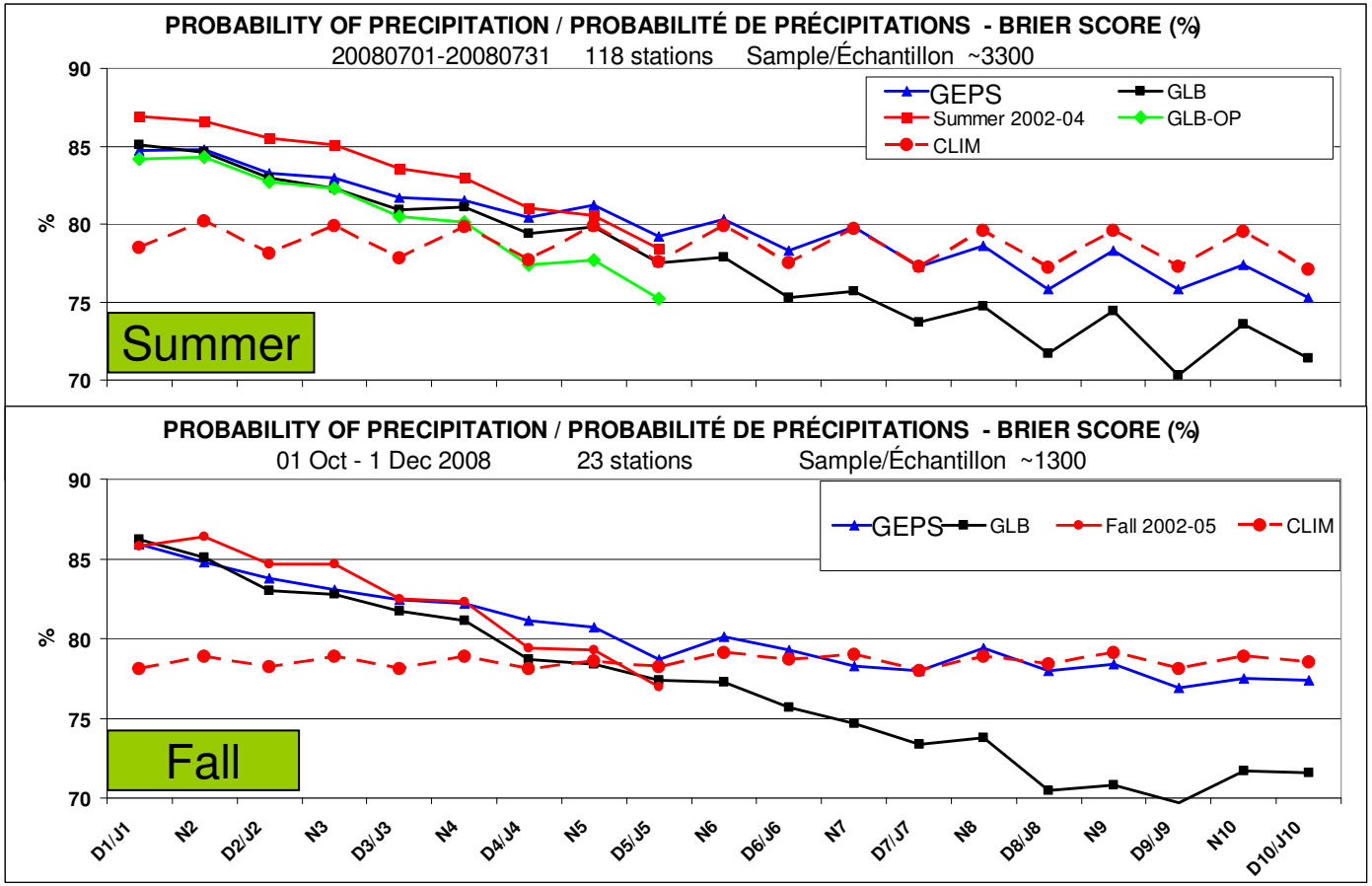
# Temperature NAEFS, CMC and CLIM



# Probability of precipitation – Brier score

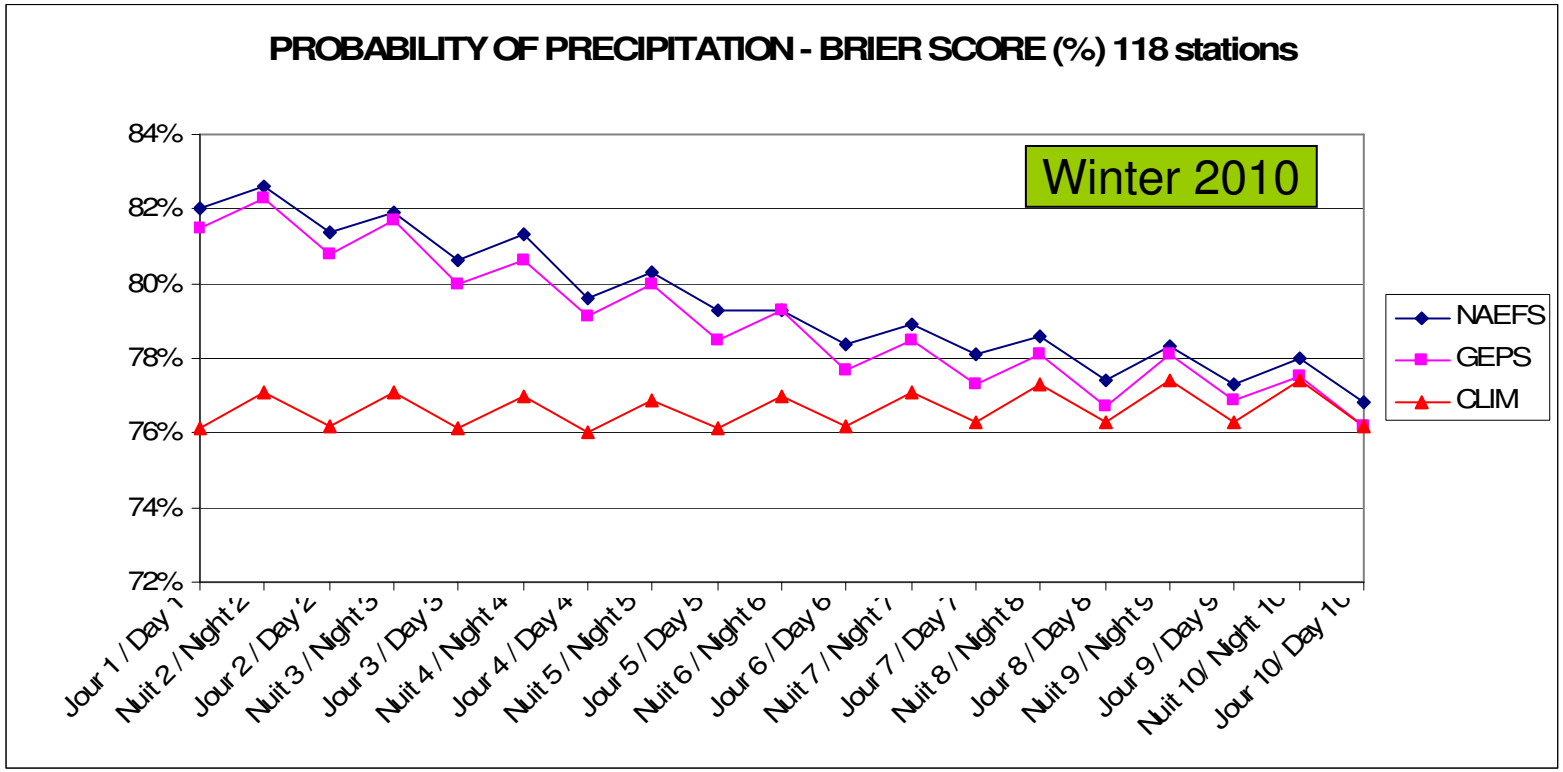


# Probability of precipitation – Brier score




The 0.2mm threshold for precipitation is quite small.

# Probability of precipitation NAEFS and CMC



# Flip-Flop

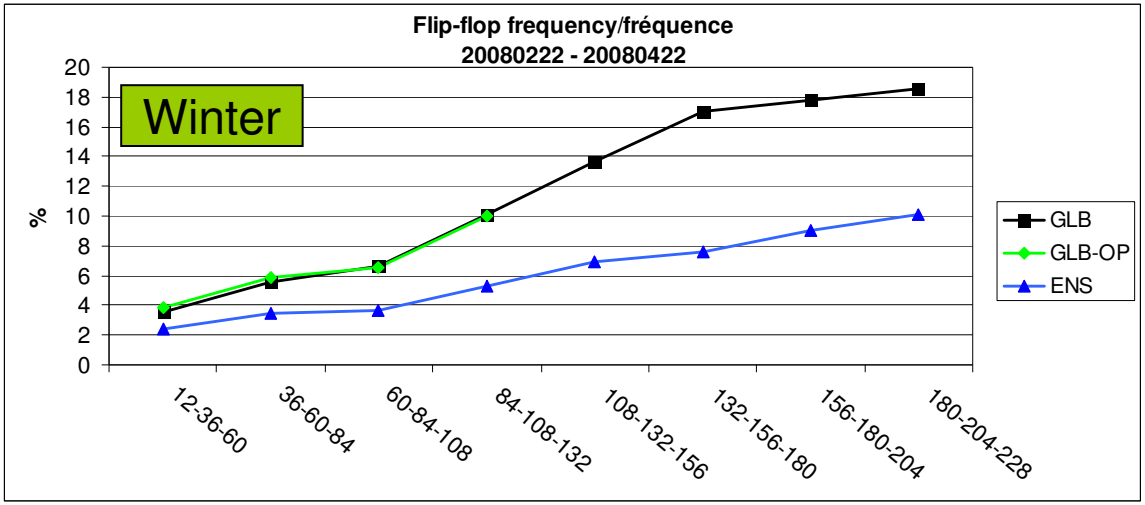
- Common problem for deterministic models
- Sometime, model can produces very different forecast from consecutive runs valid at the same time.

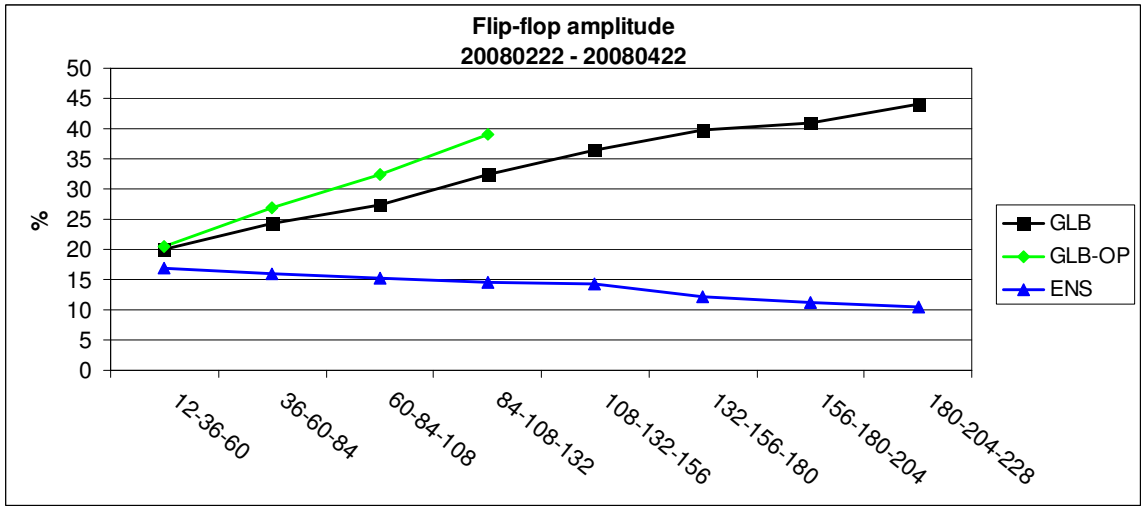
- Most significant parameter for users is precipitation.
- Flip flop here is based on POP

# Flip-Flop Index

- Defined as a significant change in POP12 values from 3 consecutive runs valid at the same time.
- A threshold of 30% is used to discriminate between ‘dry’ and ‘wet’ forecasts.  A flip-flop is detected if successive forecasts crosses the threshold twice.
  - 20% - 40% - 10% → flip-flop
  - 20% - 40% - 35% → no flip-flop
- Flip-flop frequency:
  - F = (number of flip-flop / total number of case) * 100%
- Flip-flop amplitude: mean of the differences between the 3 consecutive values:
  - 20% - 40% - 10% → amplitude = 25
  - 10% - 90% -  0% → amplitude = 85

# FLIP-FLOP Index (2)



# Verification summary

- Useful information, better than climatology.
- GEPS versions perform better than deterministic one.
- GEPS versions less subject to flip-flop.
- NAEFS perform better than GEPS alone.

## Following these results

- System works up to 10 days.
- Public forecast only for days 6 and 7.

# Conclusion

- This is a first step toward the use of GEPS to produce public forecasts.
- GEPS-based systems produce useful information for public forecasts at D6-7,better than deterministic one.
- The averaging approach tend to produce smooth forecasts. Given the uncertainties at this range, it is desirable behavior. The forecasts are less subject to flip-flop than those based on a single model.
- Using NAEFS ensemble add value to the forecast.

# Possible future improvements

- Improve algorithm for precipitation type.
- Produce POP and cloud cover by sampling.
- Use of an higher threshold for POP.
- Investigate possible use of NAEFS ensemble for Canadian public forecast.
- Develop a probabilistic terminology for the public forecast.