1) Introduction:

- MSC is running a 20 member GEPS (0.45x0.45L40) up to Day 16 operationally (32 days on Thursdays at 002). This system is using an Ensemble Kalman Filter as a data assimilation scheme (Houtekamer et al. 2014) to generate the initial conditions for the medium-range ensemble forecasts. The forecast perturbations are coming from set a multi-physical parameterizations as well as two stochastic approaches (physical tendencies perturbations and the stochastic energy back-scattering scheme).

- Context: In preparation of the arrival a new supercomputer and the associated opportunity to increase model resolution, an evaluation of the different perturbations methods of the MSC Global Ensemble Prediction System is performed.

- Goal of the study: review the source of spread in the system.

- Method: several experiments with individual source removed incrementally

2) Forecast error and spread in the operational GEPS (January 2015):

   a) 500 hPa geopotential heights
   b) 250 hPa zonal wind
   c) 850 hPa temperature
   d) 850 hPa dew-point depression
   e) MSL pressure
   f) 2-m temperature

Remarks:

- Upper air:
  - in general the current GEPS is well balanced in NH.
  - Too much spread is noticed in the Tropics for temperature, dew-point depression and winds.

- Near surface:
  - A clear lack of spread is noticed for T2m as well as the ES 2m and the 10-m wind speed (not shown) in Northern Hemisphere as well as in the Tropics.

3) Where this spread is coming from?

Let’s look, experiments methodology:

- We have run 120 hour forecasts for 30 cases in January 2015 with:
  1) Reference: quasi-Operational system with EnKF analyses (OPS)
  2) minus initial conditions perturbations: identical analysis for all members (-I.C.)
  3) minus Multi-physics: identical physics for all members (-multi-ph)
  4) minus PTP (-PTP)

4) Individual impacts on the forecast spread:

   a) 500 hPa geopotential heights
   b) 250 hPa zonal wind
   c) 850 hPa temperature
   d) 850 hPa dew-point depression
   e) MSL pressure
   f) 2-m temperature

5) Conclusions:

- The most important contributor to the spread are the initial conditions at day 1 (obviously) and PTP scheme is second. That scheme is important at day 5.
- The multi-physics contribution is usually small specially at day 5 but can be significant at day 1.
- SKEB contribution is marginal at day 1 but more significant at day 5.
- Above 250 hPa, the initial conditions are the main contributor.