

Do ensemble typhoon forecasts capture true uncertainty of the forecasts?

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Overview of the past discussions

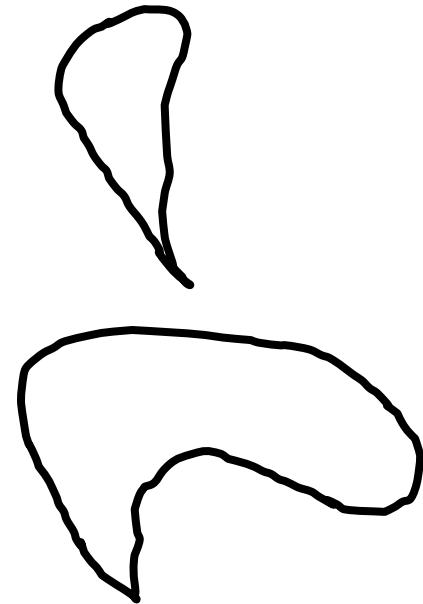
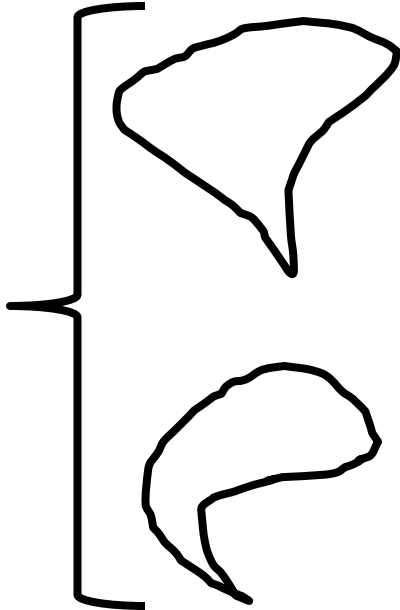
1. We looked into the vertical and horizontal profiles of ensemble initial perturbations by operational NWP centers including ECMWF, NCEP, CMC and JMA and found the huge differences in the profiles and also amplitudes of the perturbations. This result is based on a case study for Typhoon Sinlaku.
2. Using data from ECMWF and NCEP, we looked into how the perturbations change the structures of Typhoon Sinlaku in terms of the size and the advection flow. We found that the size does not change a lot and that the advection flow changes by about 1m/s independent of the stage of Typhoon Sinlaku such as before- amid- and after-recurvature.

Motivation

“True” ensemble spread (uncertainty)
of tracks that only the God knows

Ensemble spread of tracks in
numerical model

The spread
changes
depending on
initial time
and TCs



1. How well does the spread in numerical model represent true one?
2. What determines the spread in numerical model?
3. What can we do in order to improve the expression of spread in numerical model from a perspective of ensemble initial perturbations?

Motivation 2

1. How well does the spread in numerical model represent true one?

This is Today's topic.

I will show the relationship between spread and position error of control forecast.

2. What determines the spread in numerical model?

In the case of Typhoon Sinlaku, the change in the advection flow would play an important role in determining the spread of tracks.

What is next to do? Energy growth of the perturbations?

3. What can we do in order to improve the expression of spread in numerical model from a perspective of ensemble initial perturbations?

future work

What I did

I evaluated the spread of tracks, using TIGGE data from ECMWF and NCEP.

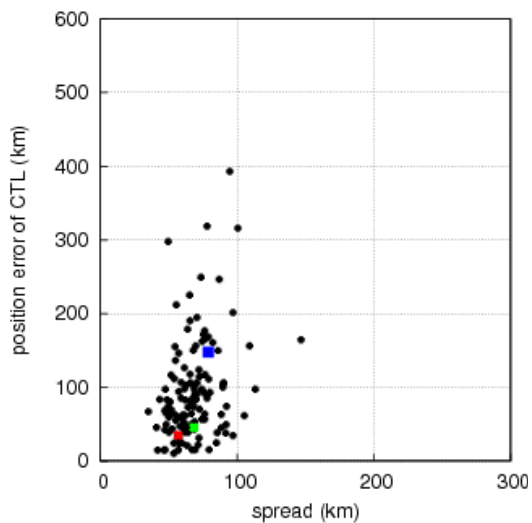
1. Download PSEA data of ECMWF and NCEP in 2008.
2. Track all TCs (tropical storm or more) in 2008 by using the track algorithm of JMA, which tracks the minimum PSEA.
3. Plot figures showing a relationship between spread and position error of control forecast at each forecast time: 24, 48, 72, 96 and 120h.

Note that Sinlaku's cases we looked into are plotted in red(9/10; before recurv.), green(9/15; amid recurv.) and blue(9/18; after recurv.).

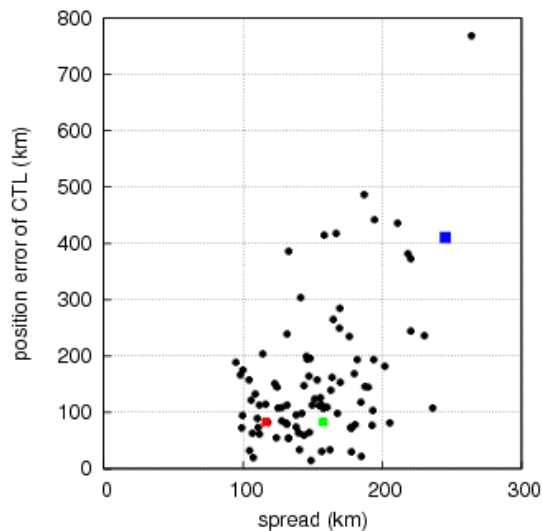
4. Plot figures showing a relationship between position errors of ECMWF and NCEP at each forecast time.
5. Plot figures showing a relationship between spreads of ECMWF and NCEP at each forecast time.

ECMWF 2008

ECMWF 2008 FT=024

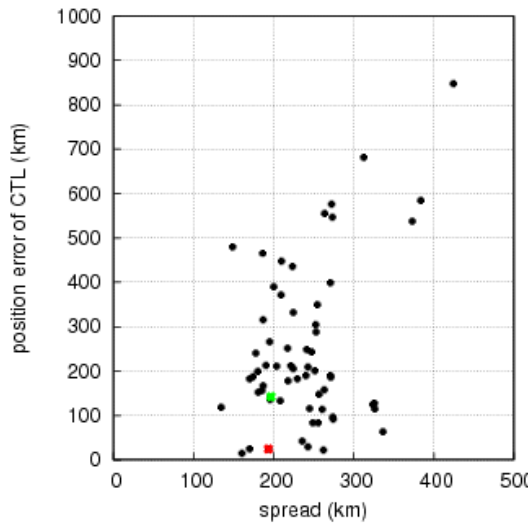


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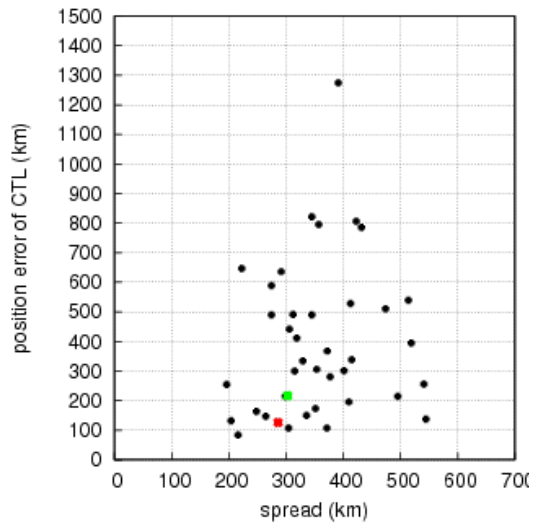


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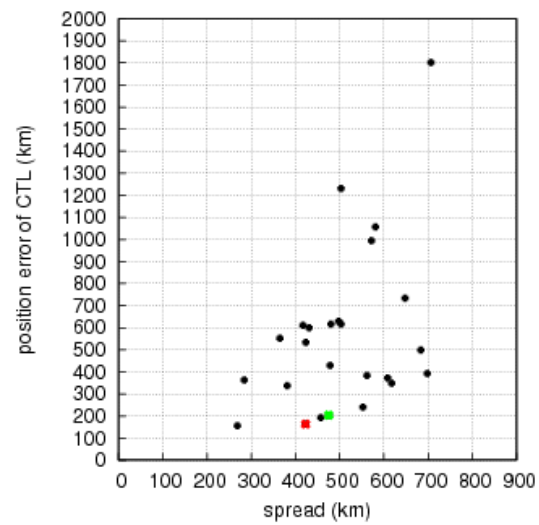
ECMWF 2008 FT=072



ECMWF 2008 FT=096



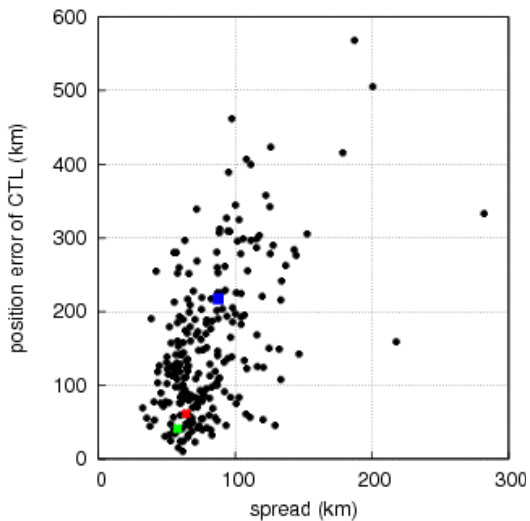
ECMWF 2008 FT=120



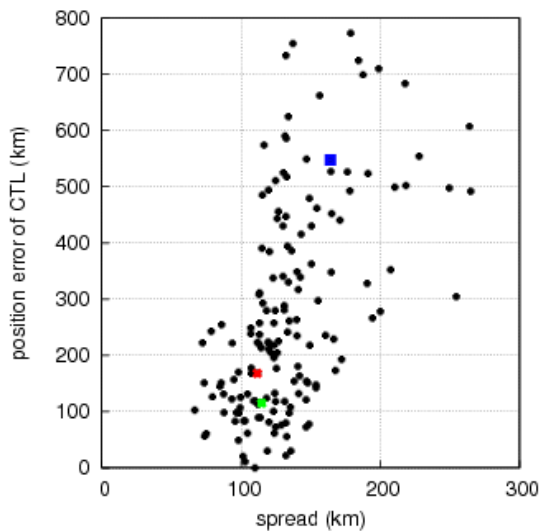
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NCEP 2008

NCEP 2008 FT=024



NCEP 2008 FT=048



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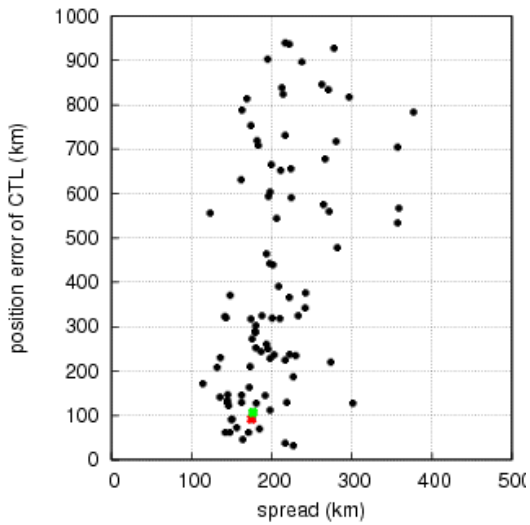
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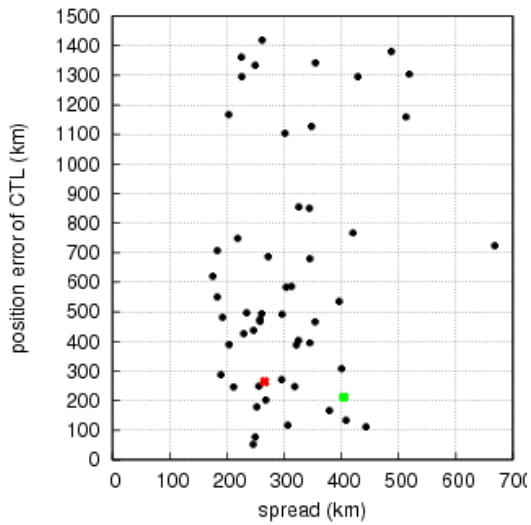
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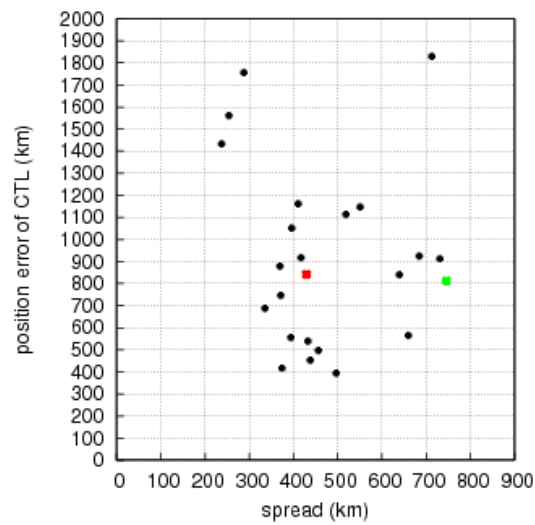
NCEP 2008 FT=072



NCEP 2008 FT=096



NCEP 2008 FT=120



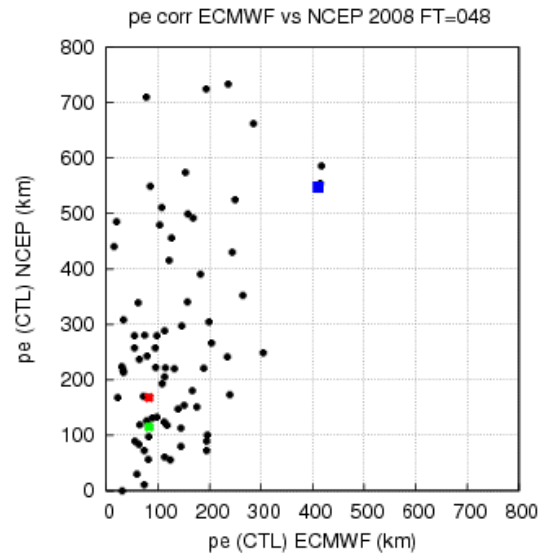
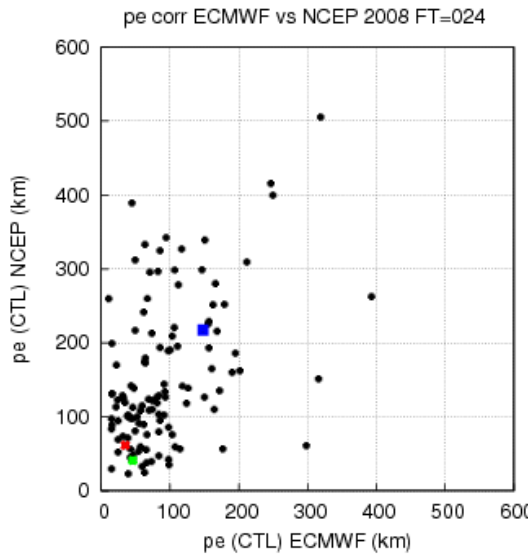
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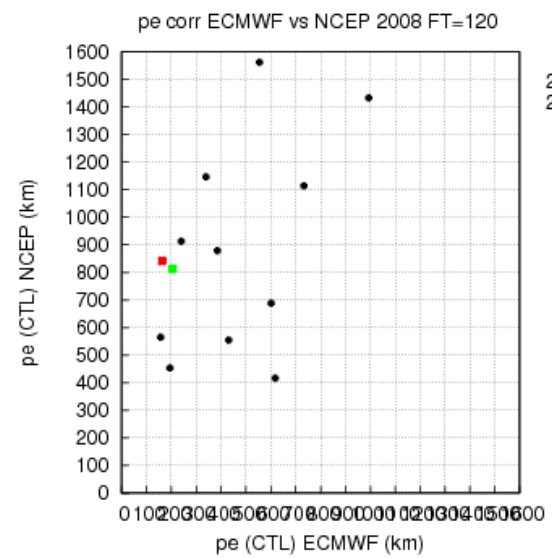
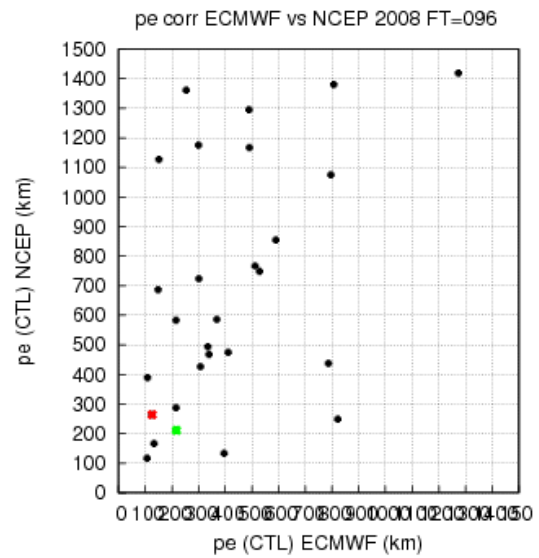
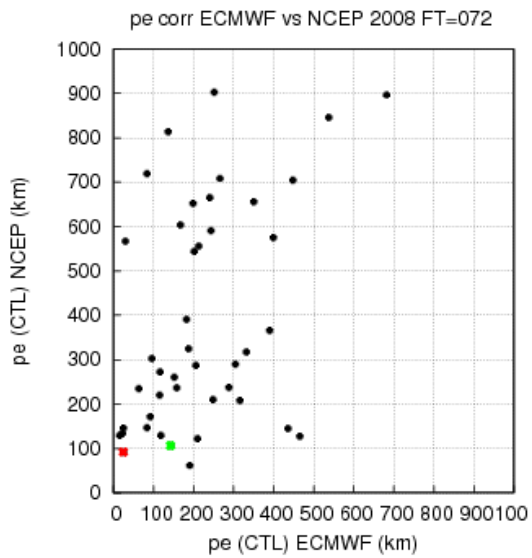
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Position Error Correlation; ECMWF vs NCEP 2008

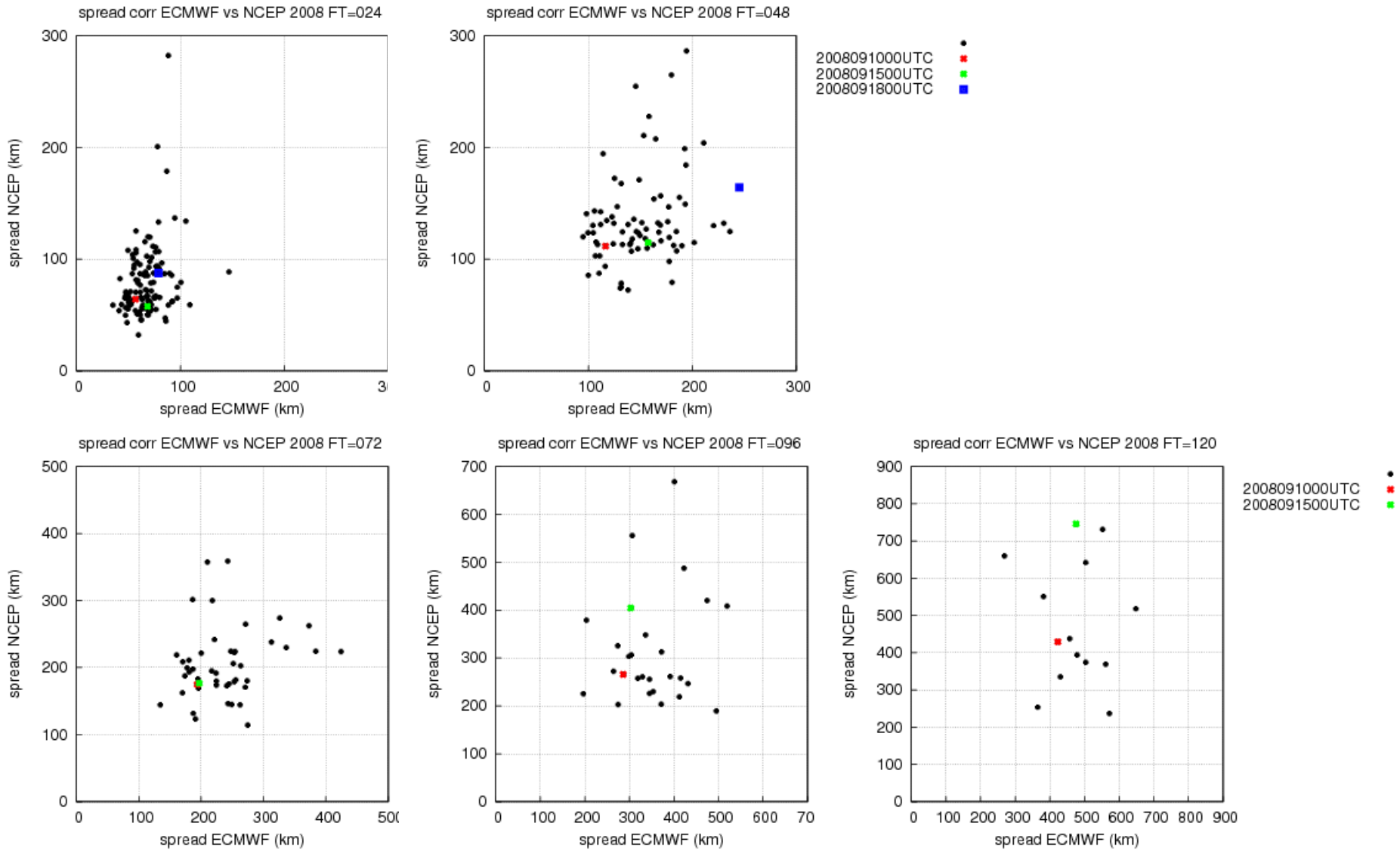


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Spread Correlation; ECMWF vs NCEP 2008



Summary

Correlation between spread and position error is not so high in both ECMWF and NCEP, especially after 3 day forecasts.

Correlation between ECMWF's position error and NCEP's position error is not high, implying that the amount of spread is kind of model-dependent.

We thought during the T-PARC operation that uncertainty of track forecast at 00UCT of 9/10 is large. However it is found that the uncertainty is relatively small with respect to other cases.

Question

The spread is an appropriate variable to estimate the uncertainty of track forecasts? What else?

What is our next step? Looking into the growth of perturbations?

What can we learn from the growth of perturbations?

How can we define the growth of perturbations?