Sensitivity of typhoon forecasts to different subsets of targeted dropsonde observations

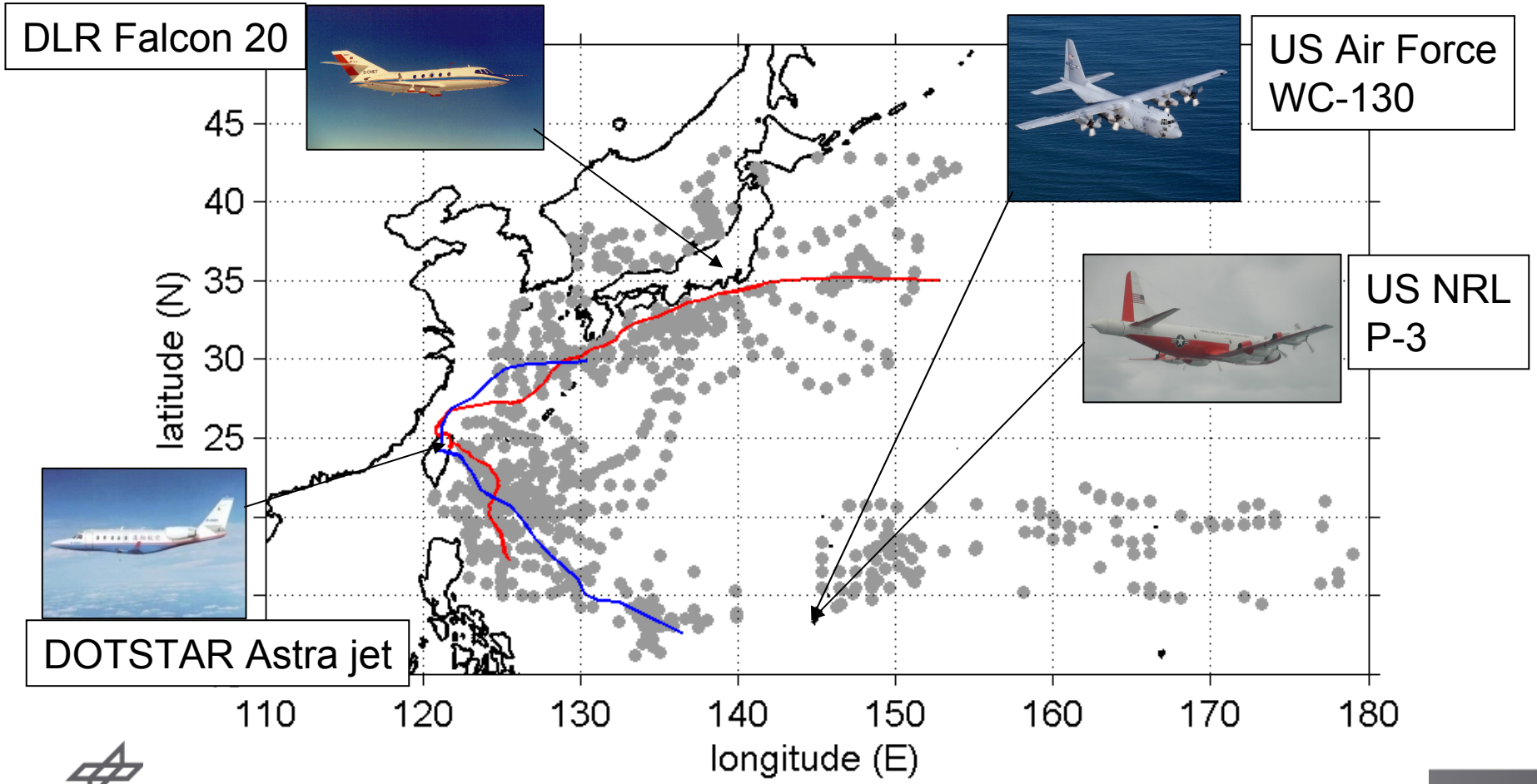
F. Harnisch and M. Weissmann

Deutsches Zentrum für Luft- und Raumfahrt,
Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft

29th Conference on Hurricanes and Tropical Meteorology, 10–14 May 2010, Tucson, AZ

TCS-08 / T-PARC 2008:
High observational coverage of dropsondes

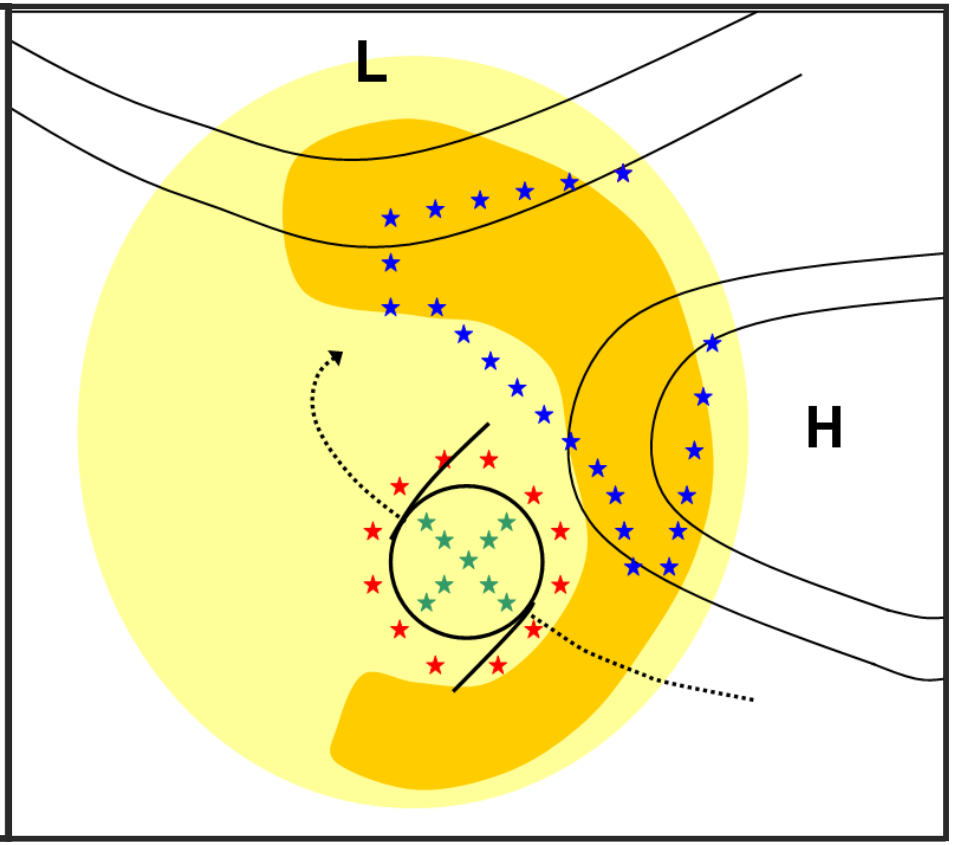


Separation of dropsondes into three different subsets

remote sensitive areas (ReObs)

typhoon vicinity (ViObs)

typhoon center and core (CeObs)



What is the influence on the typhoon track forecast?

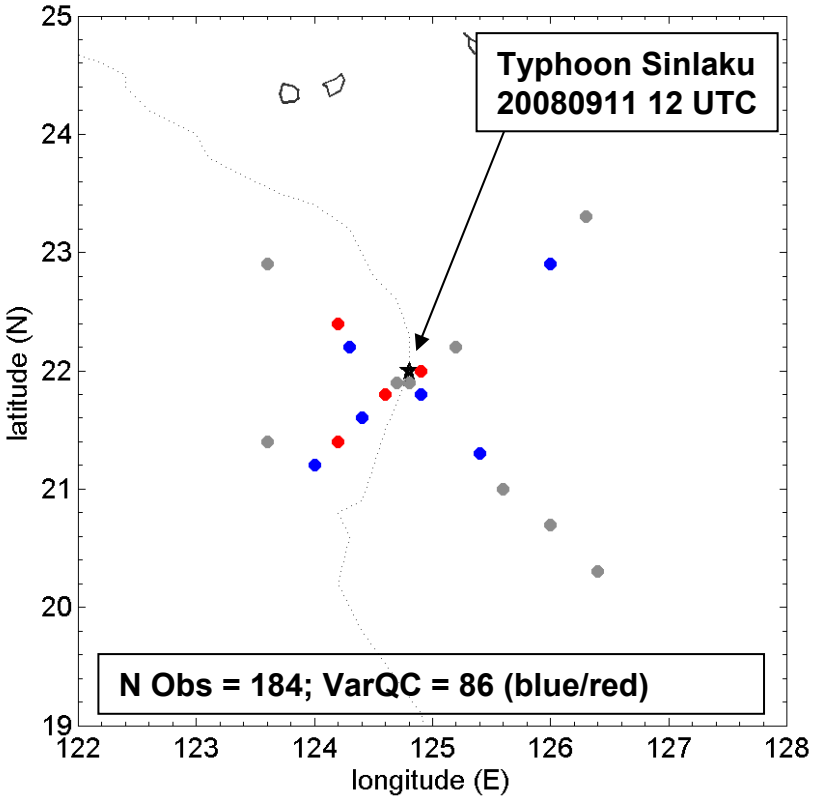
Setup of the ECMWF data denial experiments

ECMWF Integrated Forecast System (IFS)	
resolution	T799 L91
forecast time	240 hours (00 UTC, 12 UTC)

ECMWF global data assimilation	
method	4D-Var
assimilation window	12 hourly (-3 h to +9 h)
resolution inner loop	T95 L91, T159 L91, T255 L91
resolution outer loop	T799 L91

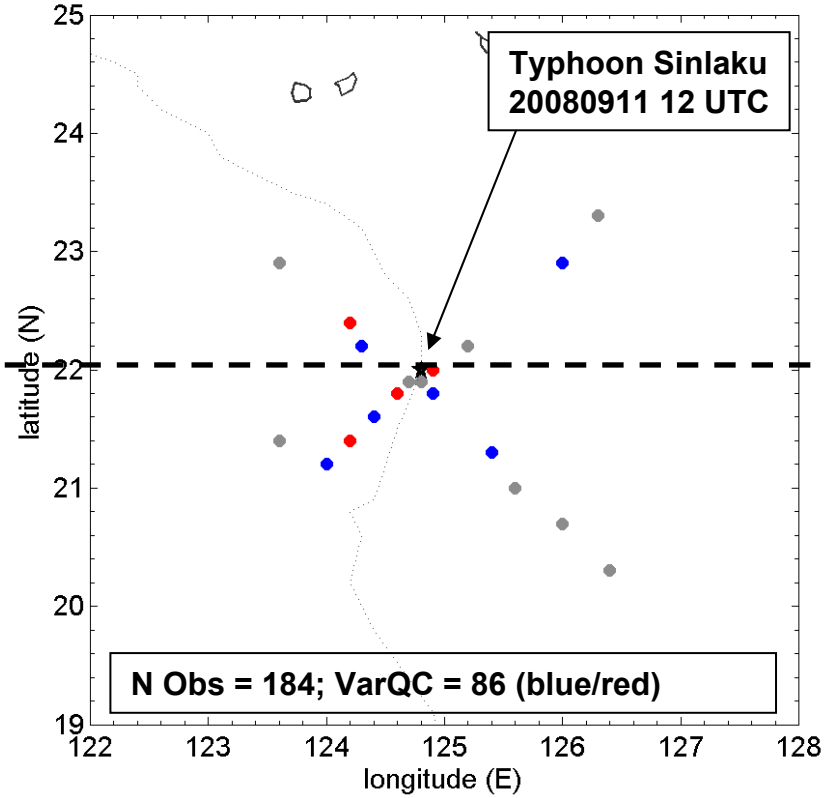
- control experiment with denying all dropsonde observations (NoObs)
- experiments with different subsets of dropsonde observations at 7 cases for Sinlaku and 5 cases for Jangmi

Assimilation of TC center and core observations

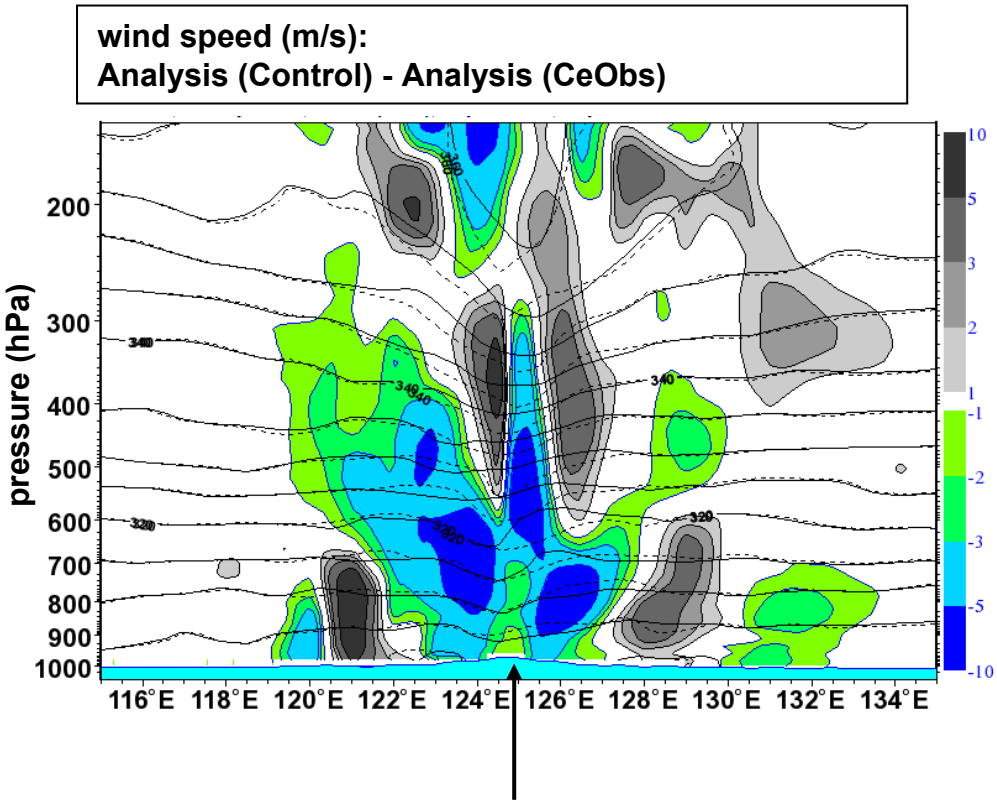


4 dropsonde fully rejected (red)

Assimilation of TC center and core observations

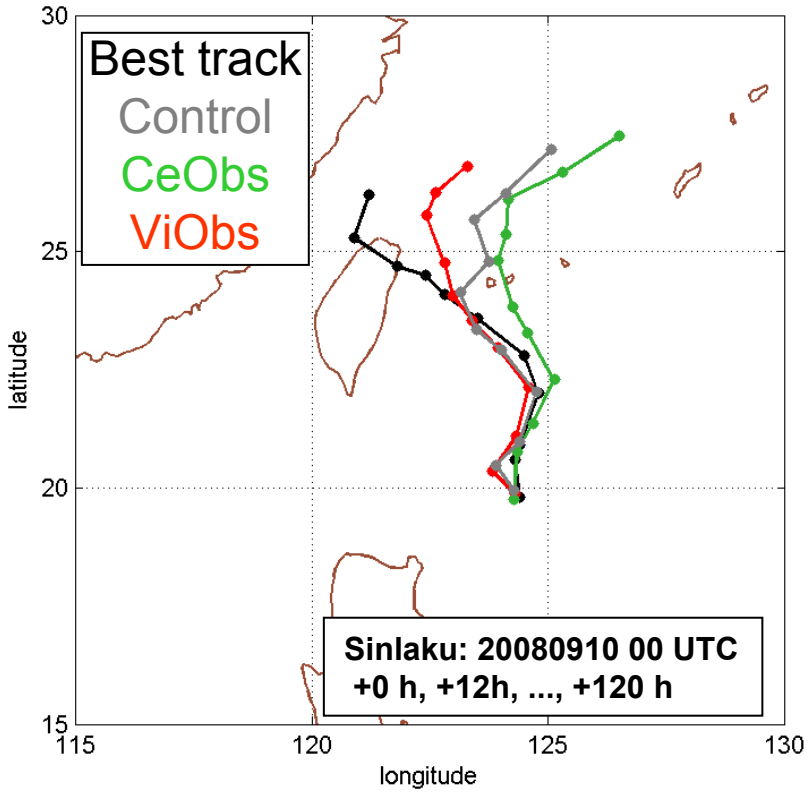


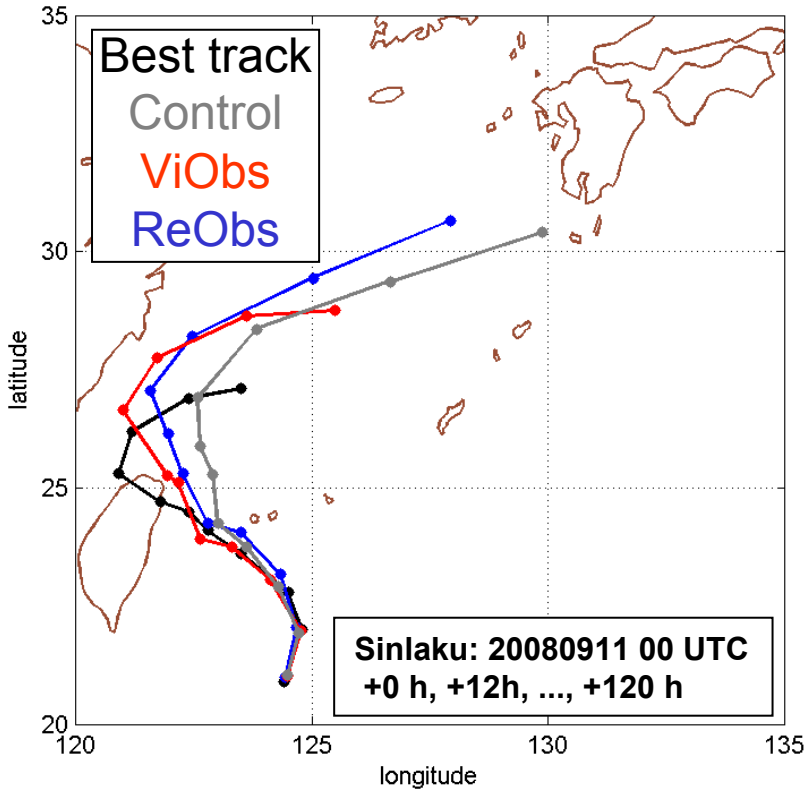
4 dropsonde fully rejected (red)



surface position of Sinlaku

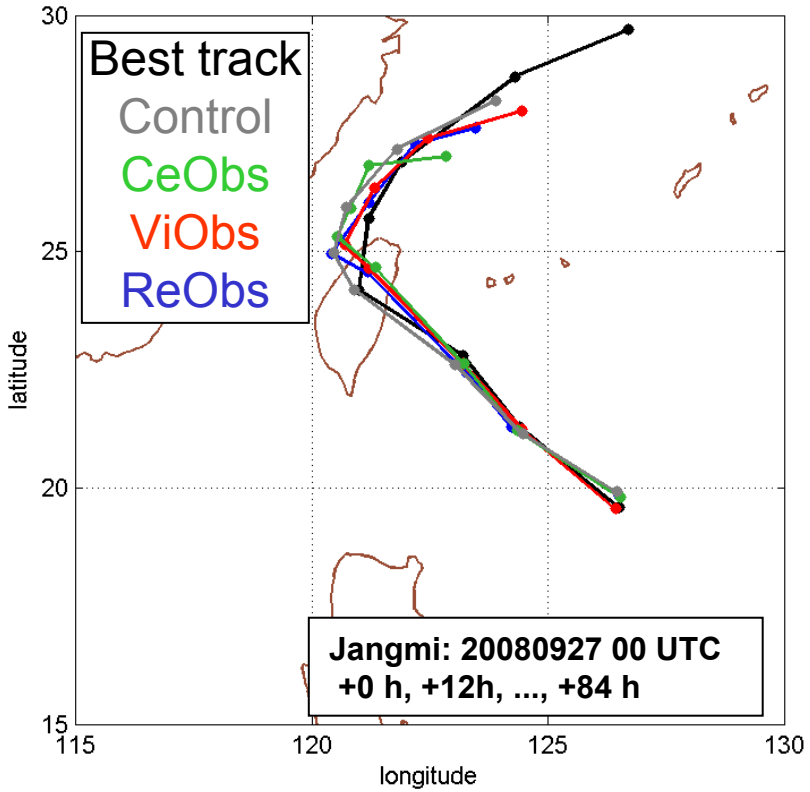
Examples of improved track forecasts

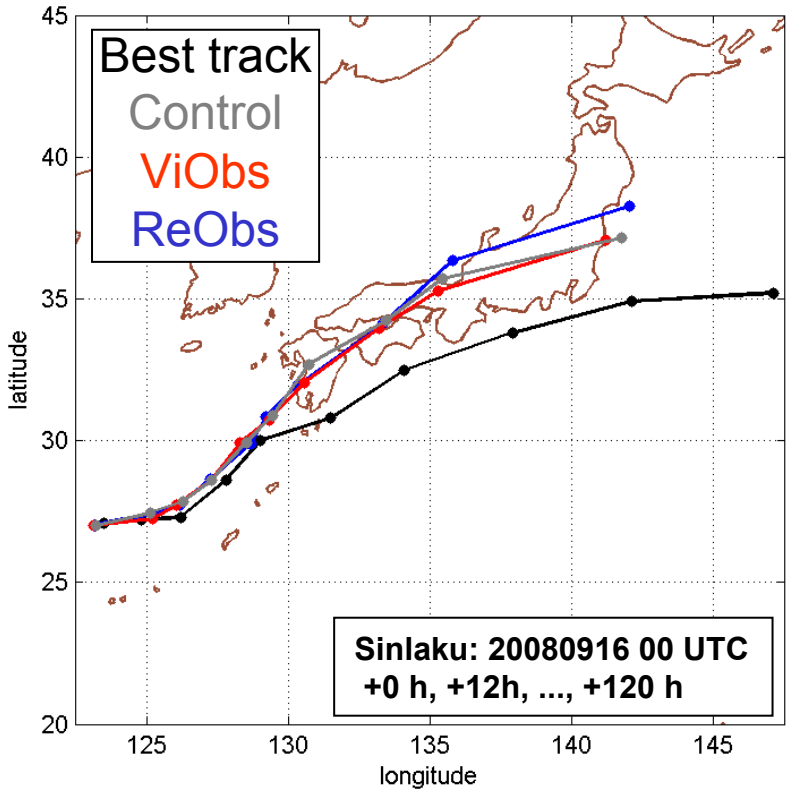




- uncertainty of landfall andrecurvature point → improvement with dropsondes
- largest improvement with ViObs dropsondes (mainly DOTSTAR), degradation with CeObs observations (WC-130) at 00 UTC 10 Sept 2008

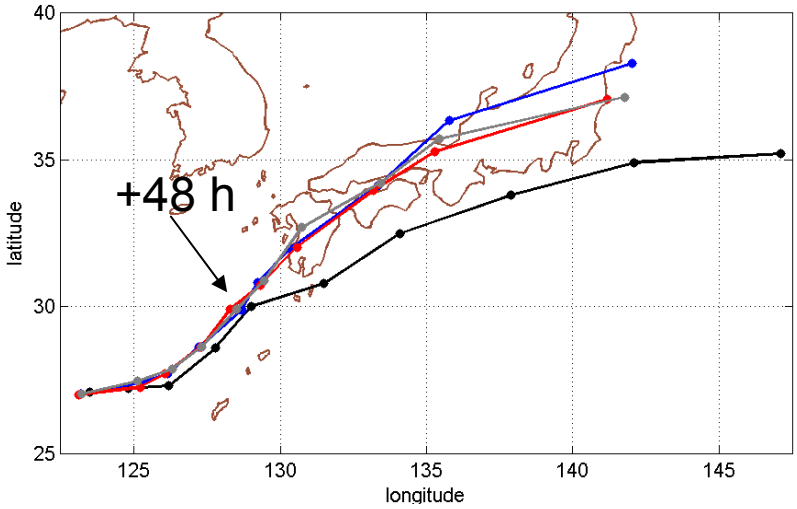
Examples of neutral to slightly deteriorating track forecasts





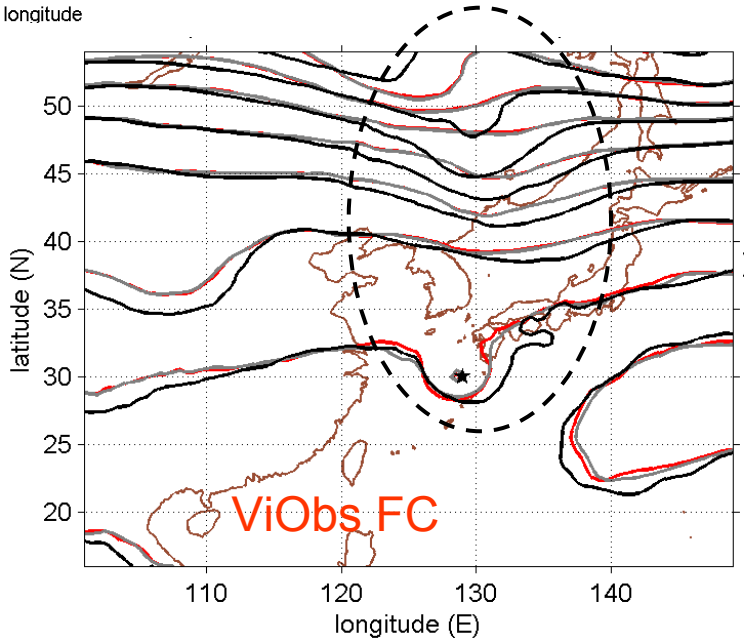
- very good forecasts
- remaining errors are rather connected to other model shortcomings (e.g., land interaction, upstream development) than initial condition errors in the typhoon environment

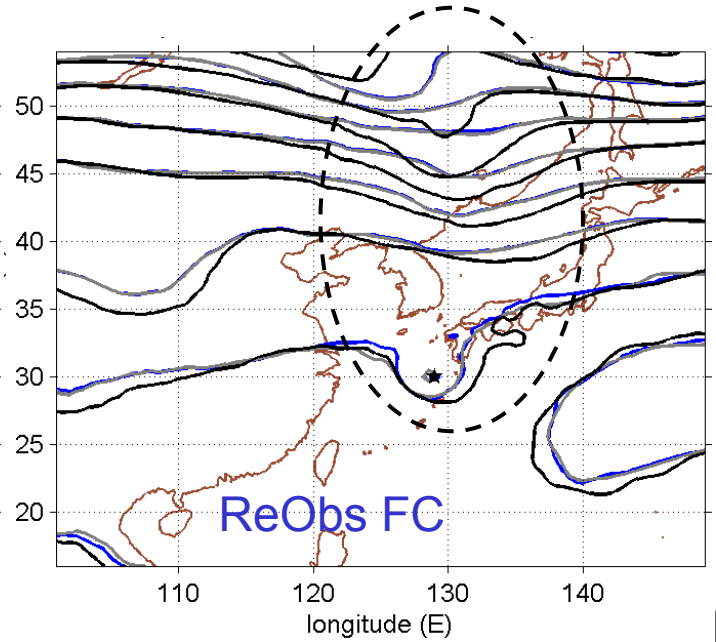
Influence of upstream flow: 00 UTC 16 Sept 2008



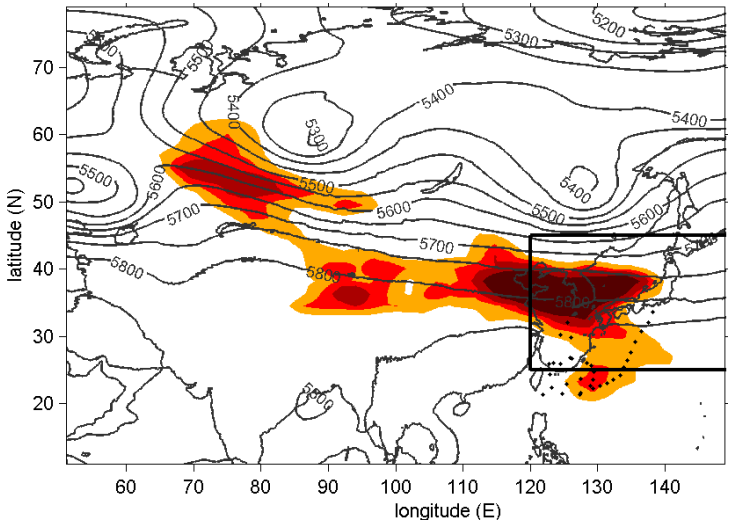
FC +48 h
of z 500 hPa:

ViObs FC
ReObs FC
Control FC
Verifying AN





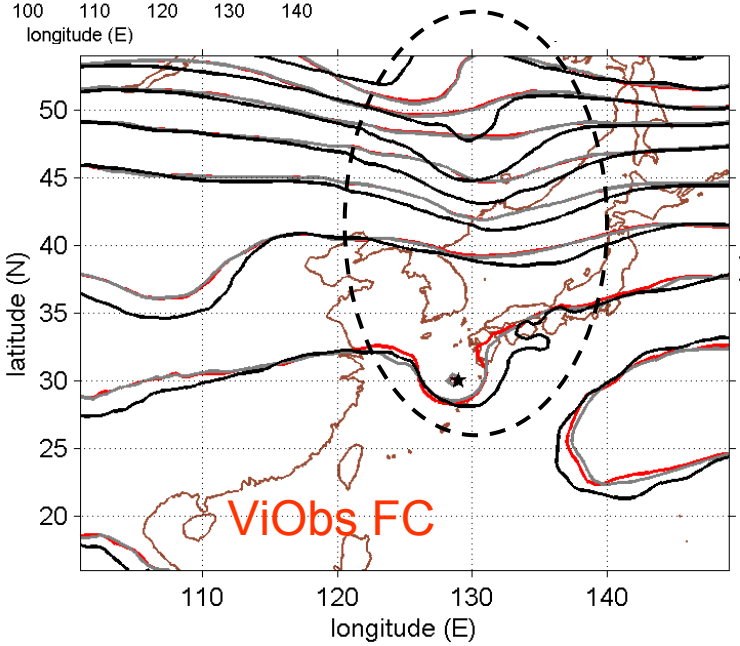
Influence of upstream flow: 00 UTC 16 Sept 2008

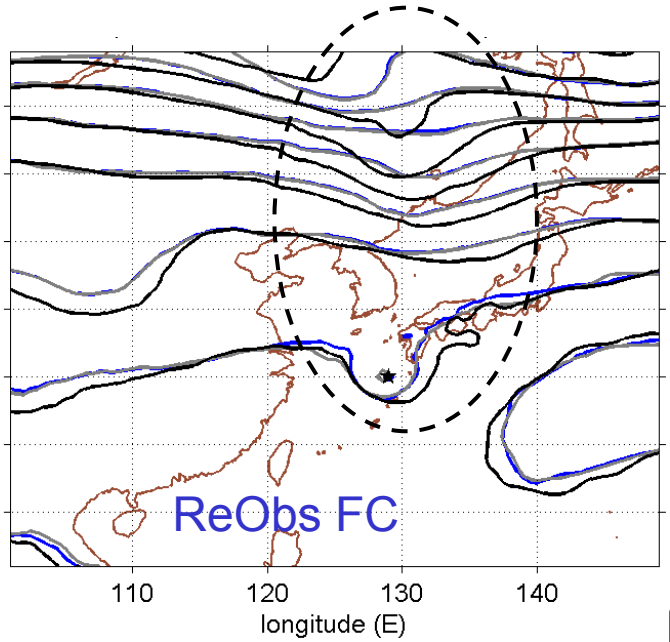


ECMWF SV
targeting 20080916 00 UTC
verification 20080919 00 UTC

FC +48 h
of z 500 hPa:

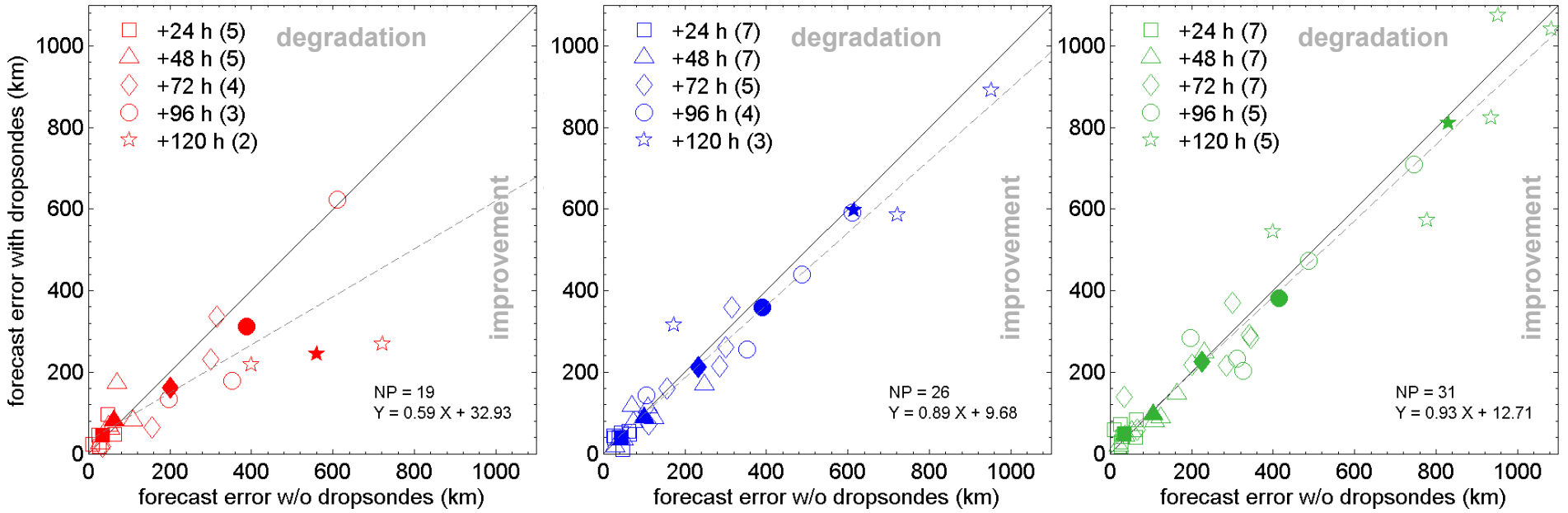
ViObs FC
ReObs FC
Control FC
Verifying AN





Which subset of dropsondes improves the typhoon track forecast the most?

typhoon vicinity	remote sensitive regions	typhoon center and core



1 2 3

Summary

- data denial experiments with the ECMWF global model
  for Sinlaku and Jangmi

- separation of dropsonde observations into three different subsets:
  → **typhoon vicinity**: largest improvements of the typhoon track forecast
  → **remote sensitive regions**: on average small positive to neutral influence
  → **typhoon center and core**: overall neutral influence

- differences in the influence on the typhoon track
  in the **pre- and post-recurvature** stage

- small but positive influence of all subsets on the typhoon intensity

Harnisch and Weissmann, MWR, in press