OSSE at JCSDA and NCEP

New High Resolution Nature Run

OSSEs with Uniform Data

Lidar Adaptive Experiments

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http://www.emc.noaa.gov/research/osse

WHERE AMERICA'S CLIMATE AND WEATHER SERVICES BEGIN

NCEP

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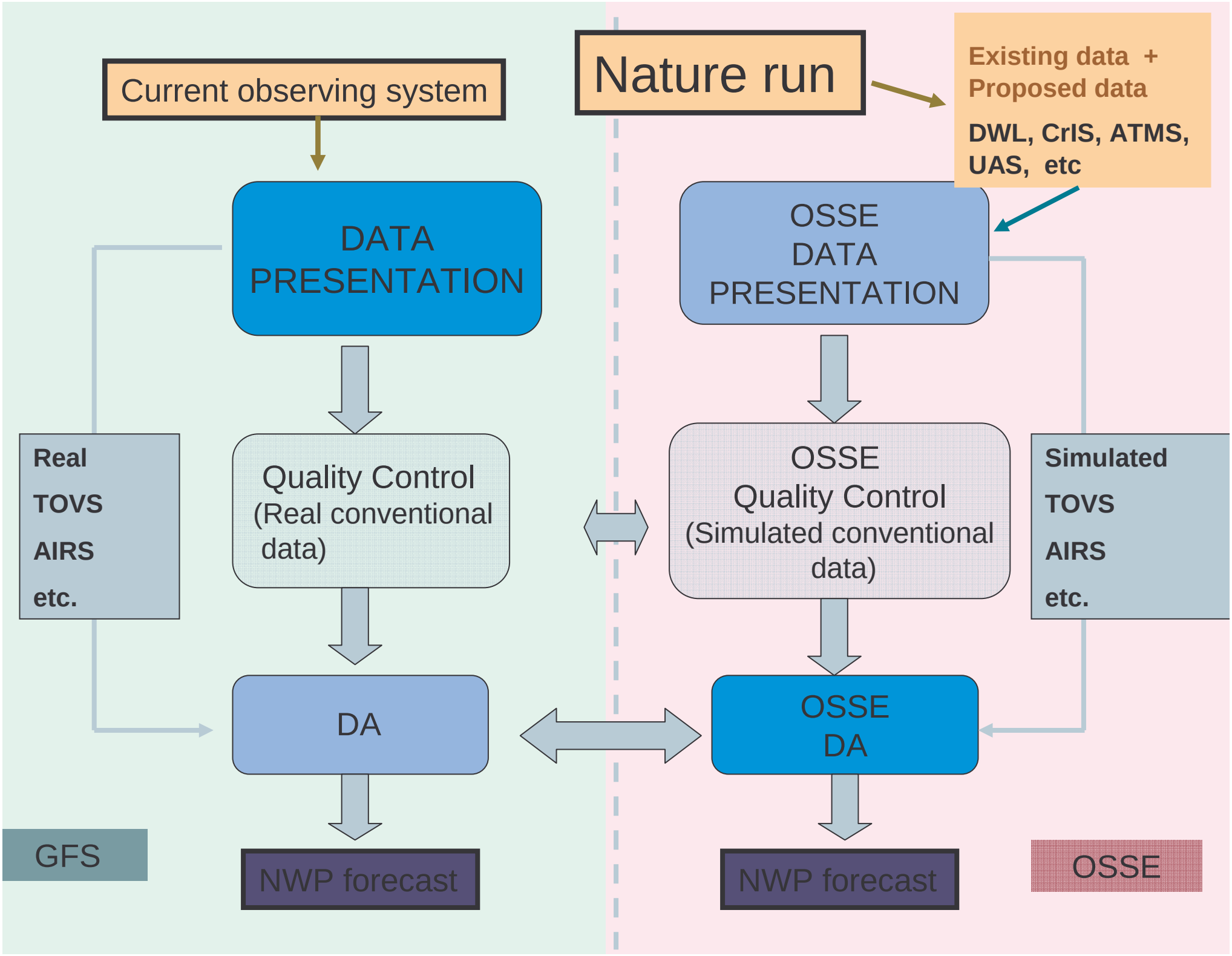
OSSEs: Observing Systems Simulation Experiments
JCSDA: Joint Center for Satellite Data Assimilation


Current observing system
Nature run
Existing data +
Proposed data
DWL, CrIS, ATMS,
UAS, etc
DATA
PRESENTATION
OSSE
DATA
PRESENTATION
Real
TOVS
AIRS
etc.
Quality Control
(Real conventional
data)
OSSE
Quality Control
(Simulated conventional
data)
Simulated
TOVS
AIRS
etc.
DA
OSSE
DA
GFS
NWP forecast
NWP forecast
OSSE

Observing Systems Simulation Experiments

The New Nature Run and Collaborations

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June 2006

OSSEs are very labor intensive project.

Need one or two good new nature runs which will be used by many OSSEs.

Share the simulated data
Compare the results.

Nature Run: Serve as a true atmosphere for OSSEs

Preparation of the nature run consume significant amount of resources.
If different NRs are used the results can not be compared.
Many nature runs will delay the delivery of the OSSE results

Forecast run forced by daily SST and ICE will be used for the Nature run

- Analysis is forced by observation and has jump in time evolution
- Analysis is affected by the data assimilation scheme
- Forecast run allows frequent sampling

Analysis lack the dynamical consistency

New Nature Run by ECMWF

Based on Recommendations by
JCSDA, NCEP, GMAO, GLA, SIVO, SWA, NESDIS, ESRL

Low resolution Nature Run

Spectral resolution : T511
Vertical level: L91
3 hourly dump
13 month starting spring 2005
Daily SST and ICE
(Provided by NCEP)

High resolution Nature run

for selected period
T799 resolution, 91 levels,
one hourly dump
Get initial condition from L-NR
Two six week periods
(to be confirmed)

To be archived in MARS system
In the THORPEX server at ECMWF
Accessed by external users
Copies at US for designated users
(Current list: NCEP NASA/GSFL, ESRL. SWA)

2005-2006 was selected.
Summer 2005 was active
Winter 2005-2006: many weather event
Most recent year is better

T511L91 run was completed; evaluation and data processing is in progress

Sample data is available from
http://www.emc.ncep.noaa.gov.research/osse

Contacts for the New Nature Run

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NESDIS Thomas J. Kleespies
SWA Steven Greco
ESRL Tom Schlatter
THORPEX
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Jo Schmetz (EUMETSAT)
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Richard Swinbank (Met Office)
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Extended international collaboration within Meteorological community is essential for timely and reliable OSSEs

JCSDA , NCEP, NESDIS,NASA, ESRL
ECMWF, ESA, EUMETSAT
THORPEX, IPO
Operational Test Center OTC – Joint THORPEX/JCSDA

Simulation of the data must be done from model levels and full resolution.

Pressure level data will be available for diagnostics and evaluation only limited isentropic level data become available.
Bufr will be used
Grib2 will be the final format

ECMWF will produce set of basic routine diagnostics for the Nature Run

Collaboration in NASA-NOAA

NCEP/EMC,NESDIS/ORA
JCSDA
NASA/GSFC GMAO, SIVO, GLA
ESRL/Global Systems Division (formerly FSL)
ESRL/Physical Science Division (formerly CDC)
SWA

Meeting every 2-3 month
Frequent E-mail exchange and update
Frequent communication with ECMWF

US group accomplished to produce a common recommendation for the design of the Nature run.

ECMWF made commitment based on the recommendation.

After each meeting Draft summaries are updated many times with comments and attachments.

The final summary of the meetings are shared with other many OSSE interest scientists including Universities.

Progress

Sample data is provided

Testing code with sample data

Extra features have been added to the ECMWF postprocessor satisfy the recommendation from NASA-NOAA.

Pre-cursor run withT159 run with IFS cycle 30r1 has been completed
From May1,2005 for 13 month
This is to test the scripts.

Model used for the Nature run will be same as interim re-analysis IFS cycle 31r1

Agenda

Evaluation of Nature run

Verification Method

Design of simulation model.
Simulate radiance data using CRTM (Community radiative Transfer Model used by data assimilation)

Strategies for OSSE for instrument under development
Strategies for OSSEs for instruments considered as possibility

Role of each institute

Data format, media, computing resources and other technical issues

Data and model resolution

Comparison between impact of Adding best DWL and increase of model resolution from T62 to T170

ØHigh resolution data may be analyzed better in high resolution model

ØOSSEs with T170 model were conducted

Best DWL: DWL with scanning and sample from both low and upper level

Data Impact in T62 vs. T170

200 mb V

Differences in anomal

T62 and T170 CTL
(Conventional data only)

T62 CTLwith
Non Scan DWL
-T62 CTL

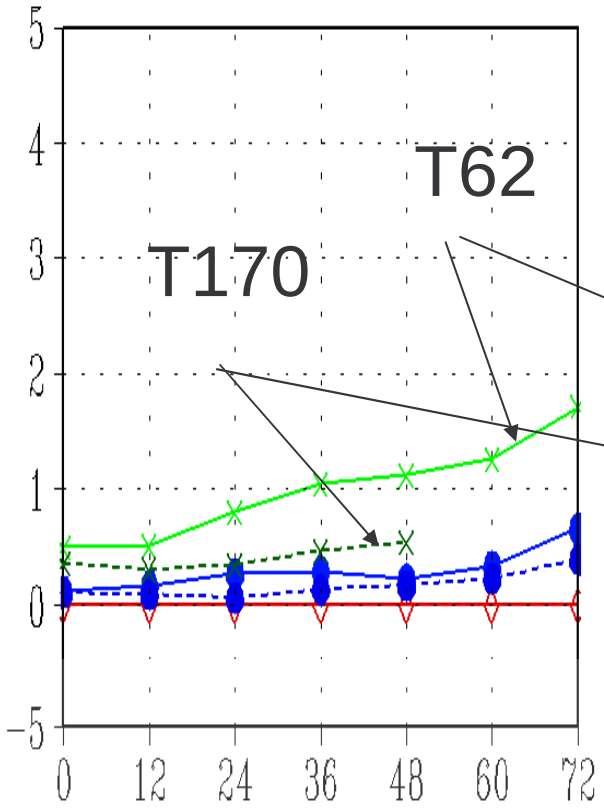
T62 CTL with
Scan DWL
-T62 CTL

T170 CTL with
Non Scan DWL
-T170 CTL

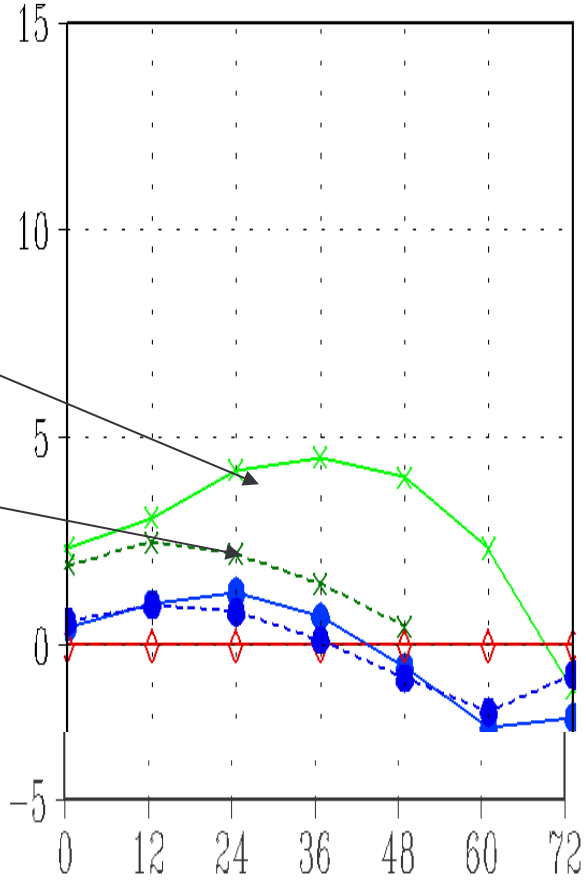
T170 CTL with
Scan DWL
-T170 CTL

◊ CTL
● Non-ScanDWL
X Scan DWL

Total scale



Synoptic Scale



Impact with T170 model look less than with T62 model

Data Impact of scan DWL vs. T170

200 mb V

Differences in anomaly correlation

Impact of DWL + T170

T62 CTL (reference)
(Conventional data only)

T62 CTL with Scan DWL - CTL

T170 CTL - CTL

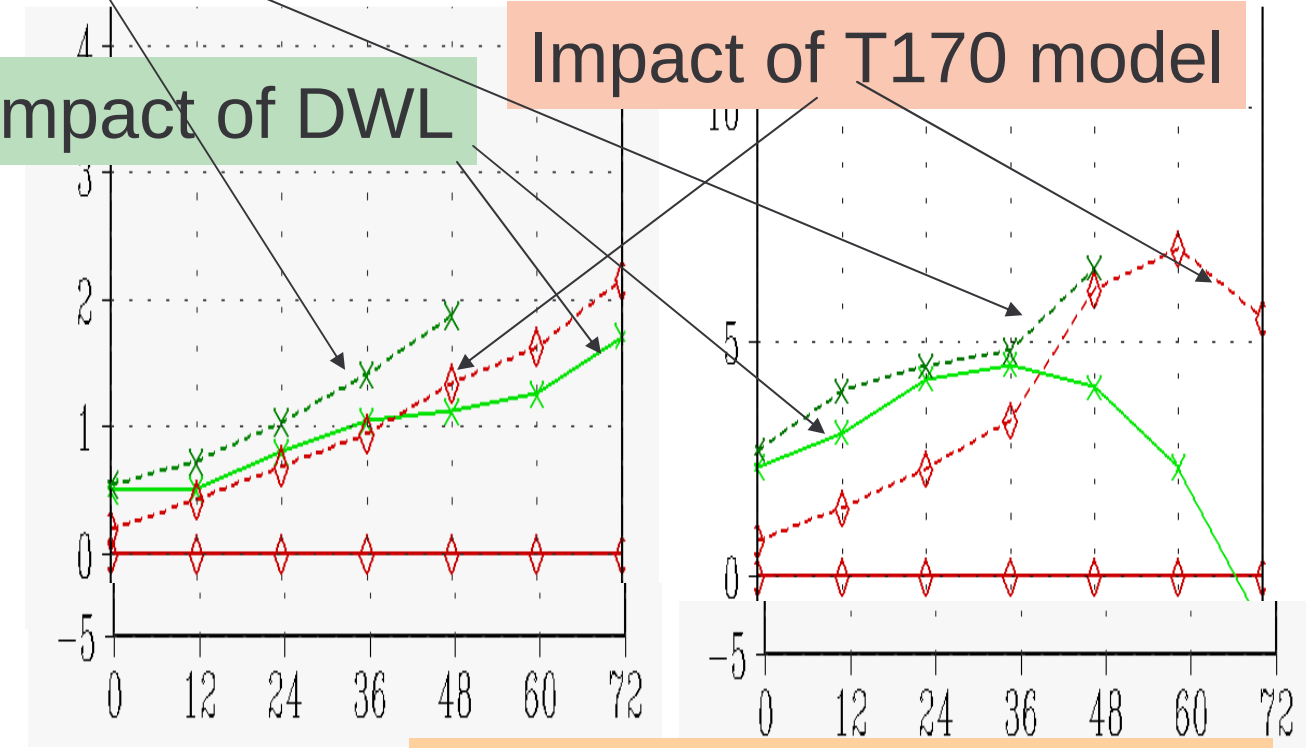
T170 CTL with Scan DWL - CTL

Total scale

Synoptic Scale

Impact of DWL

Impact of T170 model



◊ CT

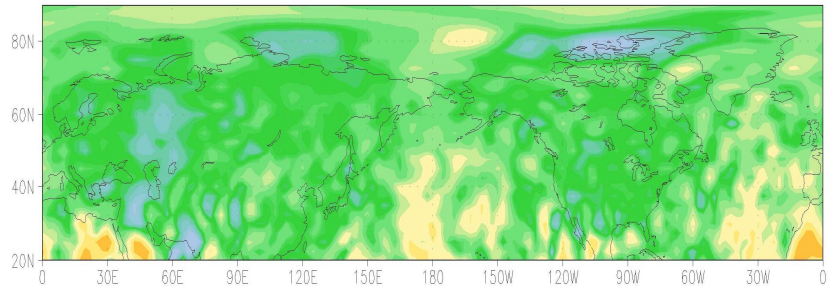
X CT

In planetary scale T170 is better than adding DWL with scan

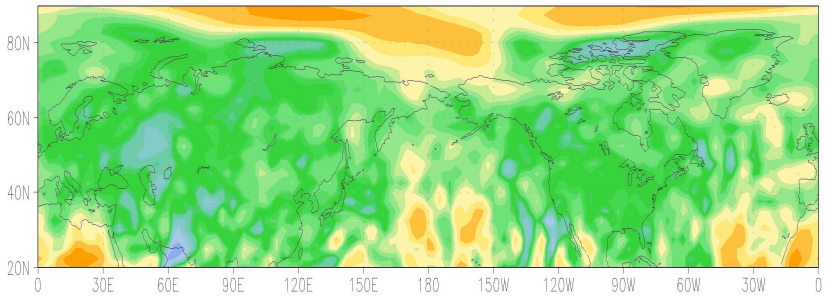
In smaller scale, adding DWL with scan is more important than T170 model

Impact of DWL with Scanning (Best DWL) T170 vs. T62

T170

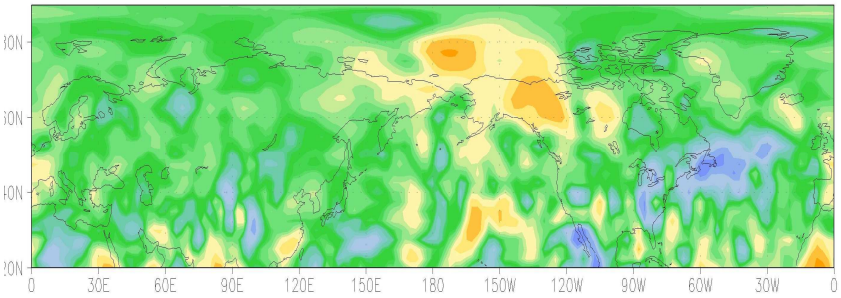


T62

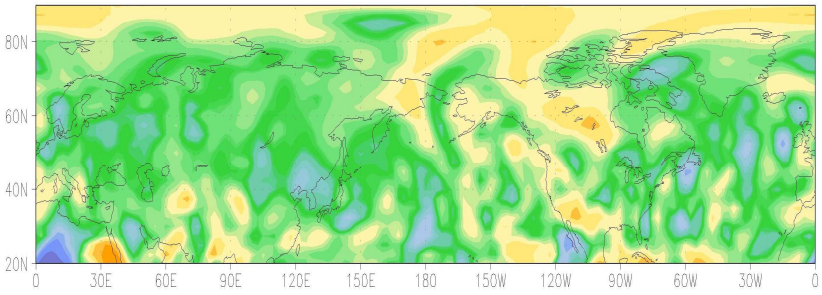


Analysis

T170



T62

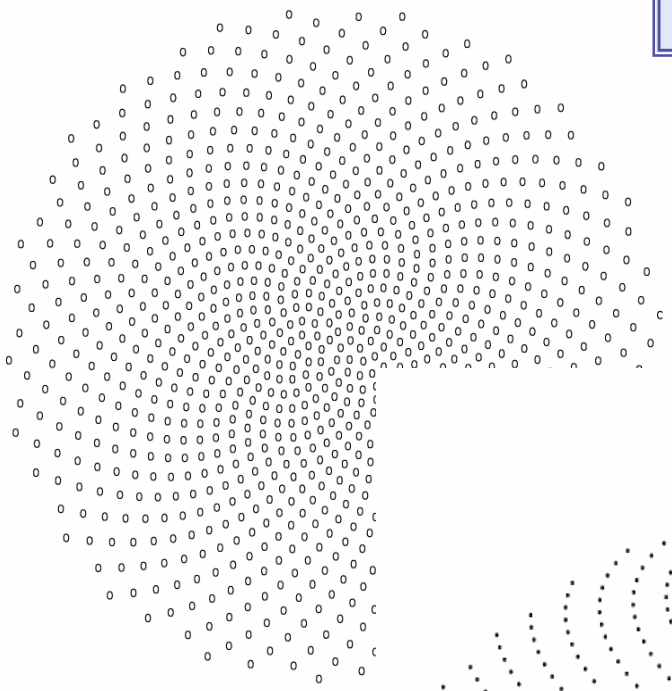


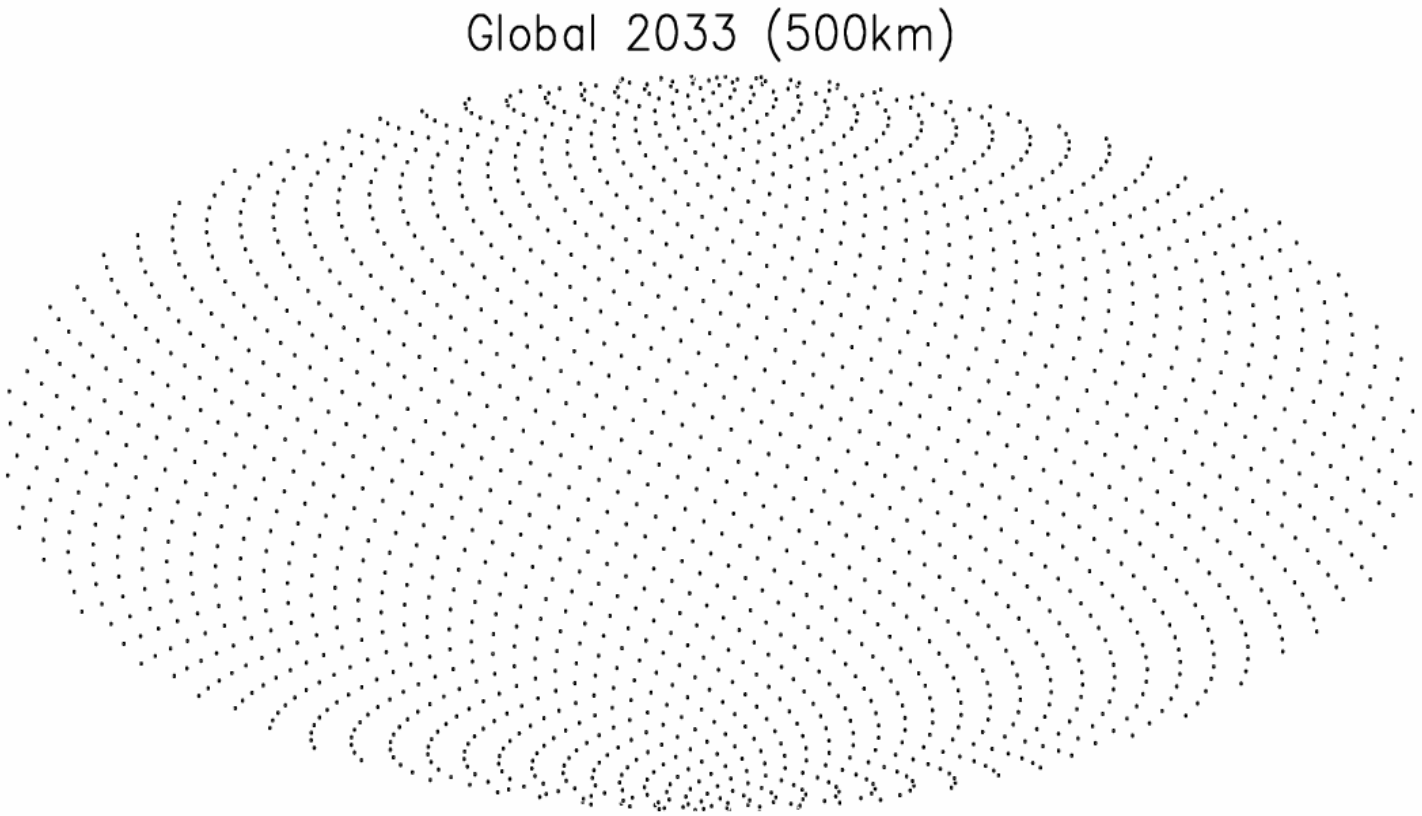
48 hr

Apparent data impact is less in a high resolution model (T170 or better model) because the guess is already good. However, improvement from the new data becomes more robust in high resolution model. Much of the apparent improvement in a low resolution model diminishes in the forecast fields.

OSSEs with Uniform Data

More data or better model?





Fibonacci Grid used in the uniform data coverage OSSE

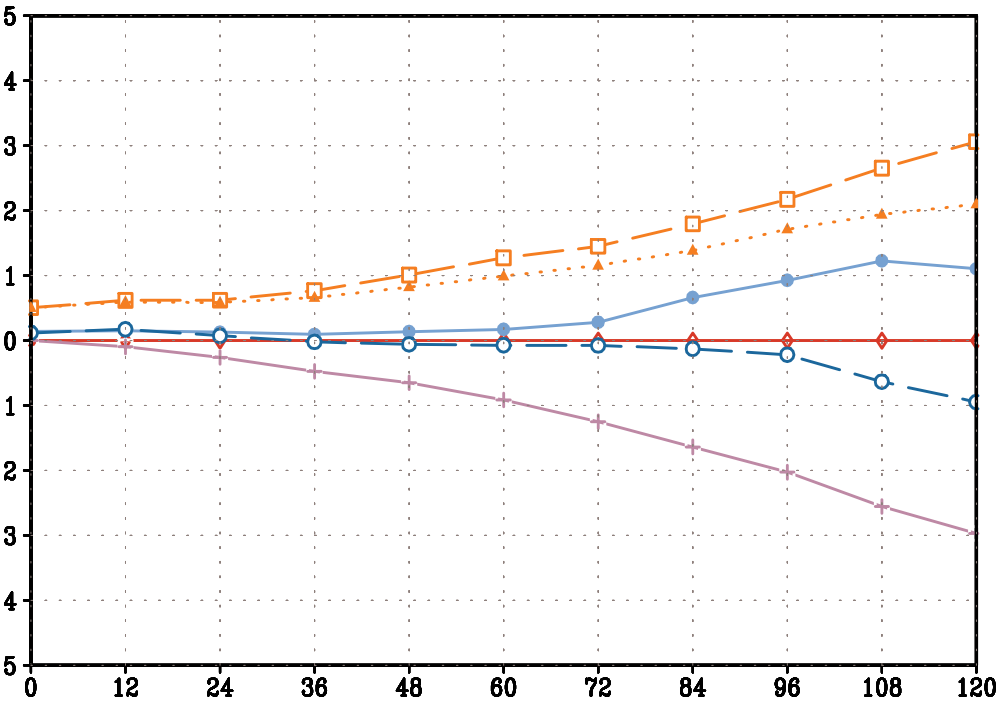
Comparison of N. Hem. Forecast Skill Upper Tropospheric Wind & Temp. Global Rawinsondes

40 levels Equally spaced data

Anomaly Correlation %

The differences from selected CTL are presented

Time averaged from Feb13-Feb28
12 hourly sampling
200mb U and 200mb T are presented



500km T62L64 anal and fcst

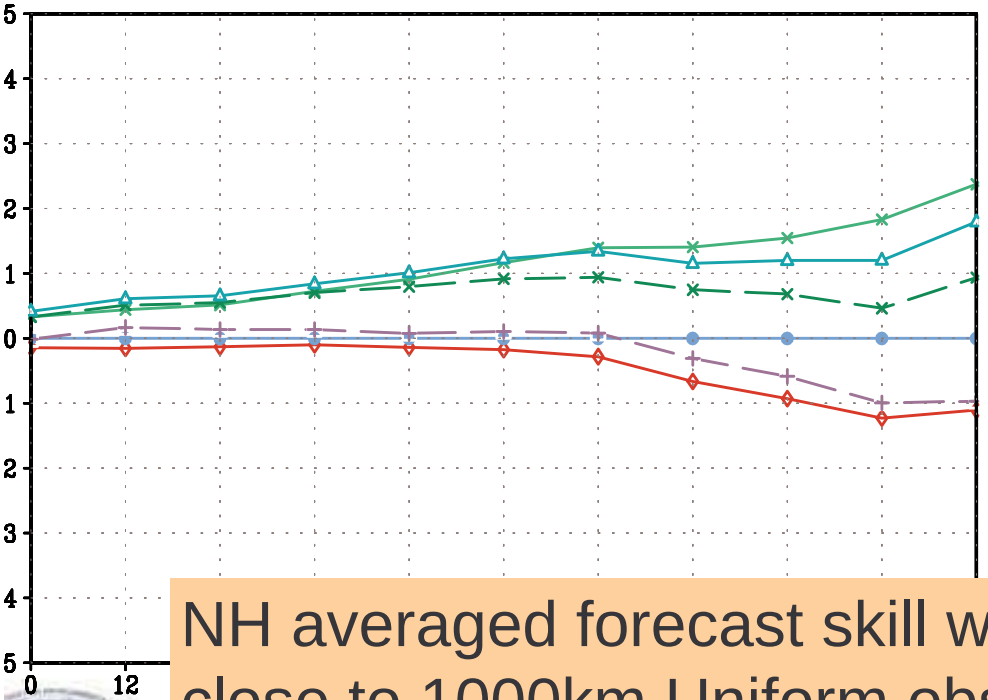
500km T62L64 anal T62L28 fcst

T170Conv+TOVS

1000km T62L28 anal T62L28 fcst

T62 Conv+TOVS CTL

T62 Conv only



500Km T170L42 anal and fcst

200Km T170L42 anal T62L28 fcst

500Km T170L42 anal T62L28 fcst

1000km T170L42 anal T62L28 fcst

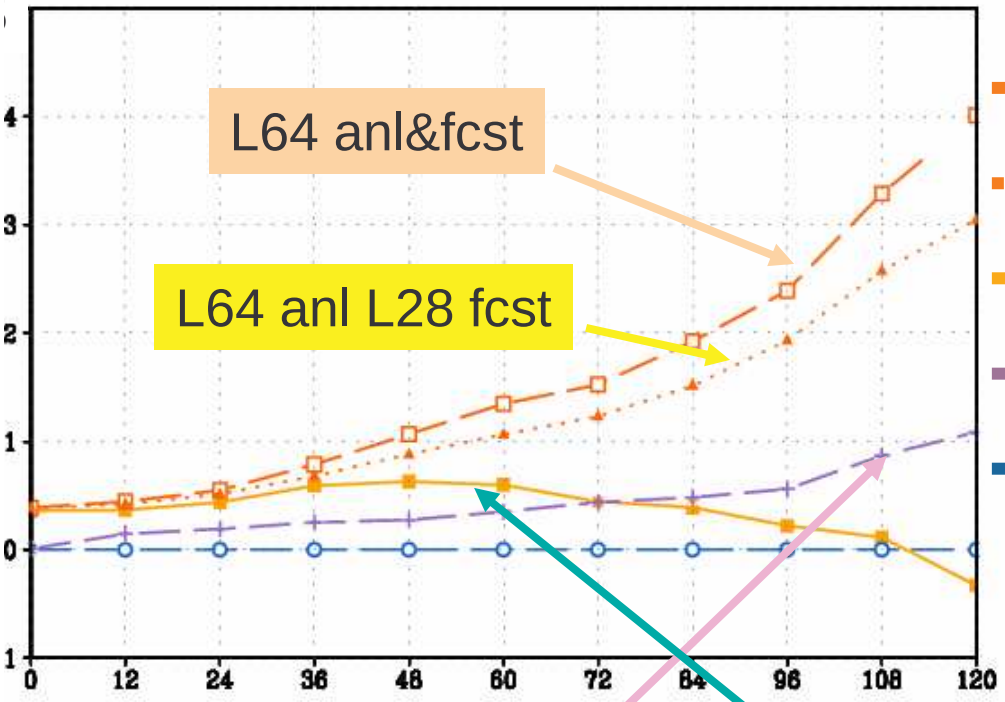
T170Conv+TOVS CTL

T62 Conv+TOVS

NH averaged forecast skill with current observins system is close to 1000km Uniform observation

Benefit of increasing the number of levels

U 200 hPa



500km Raob **T62L64** anal **T62L64** fcst

500km Raob **T62L64** anal T62L28 fcst

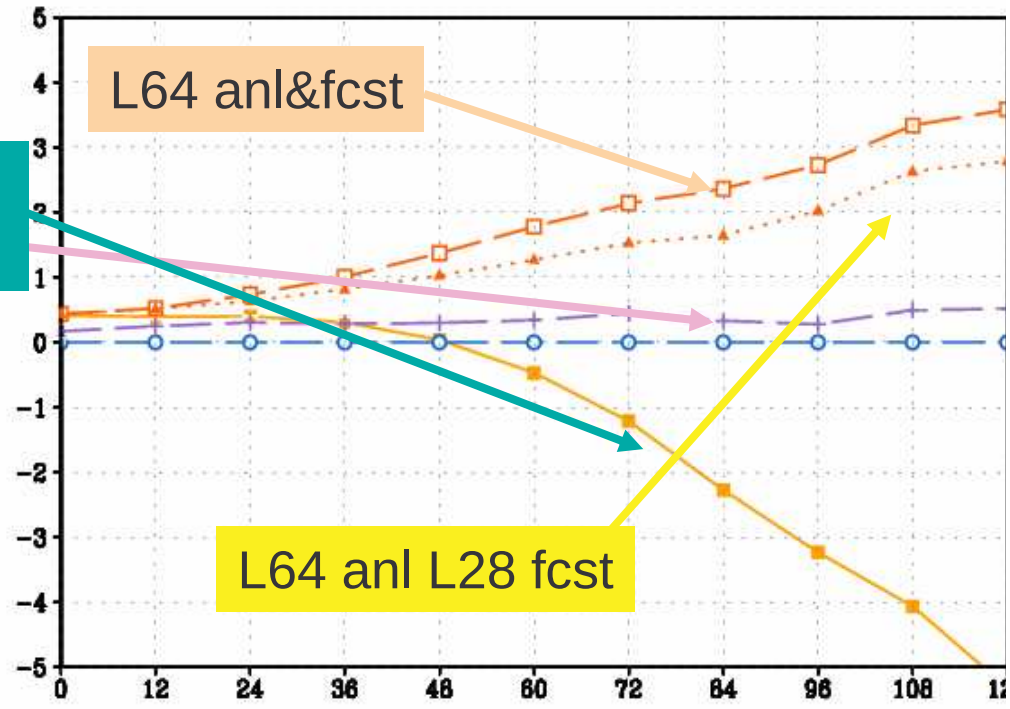
500km RaobT62L28 anal & fcst

1000km Raob**T170L42** analT62L28 fcst

1000km RaobT62L28 anal & fcst

CTL

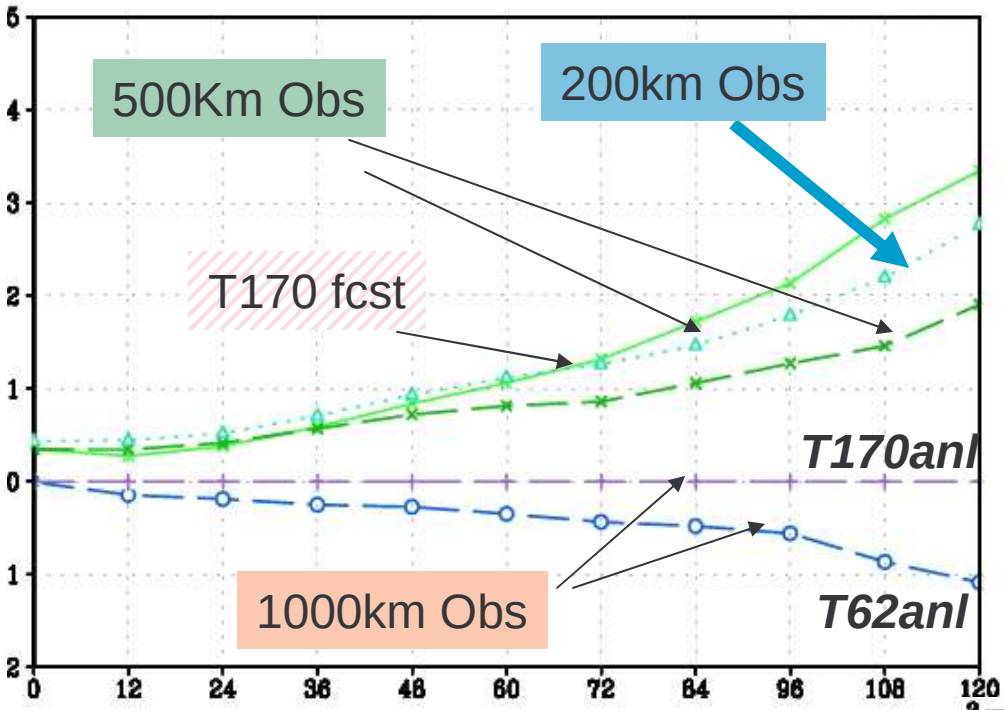
T 200 hPa



High density observation give better analysis but it could cause poor forecast

In creasing vertical resolution was important for high desity observation

U 200 hPa



500Km RaobT170L42 Anal & T170L42 fcst

200Km RaobT170L42 analT62L28 fcst

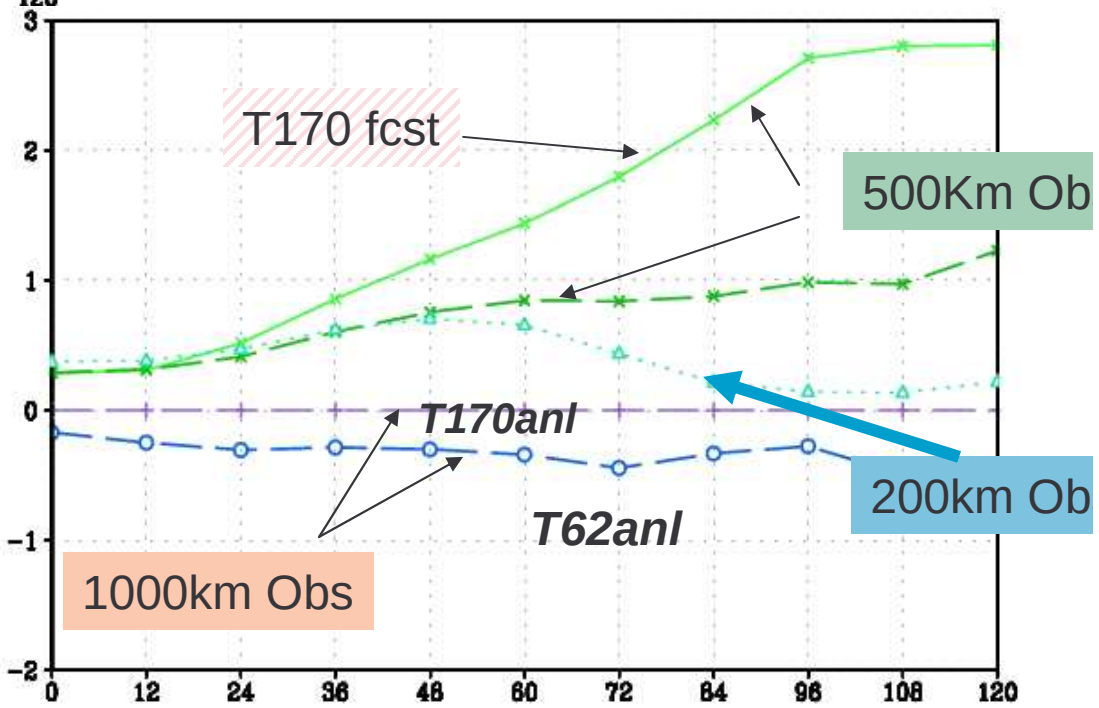
500Km RaobT170L42 analT62L28 fcst

1000km RaobT170L42 analT62L28 fcst

1000km Raob T62L28 anal &fcst

CTL

T 200 hPa



Using T170 model 500km obs help good forecasts.

Even for T170 model 200km obs may make worse forecast in temperature

High density observation cannot help forecast if the model does not have good resolution.
Too much data with poor model could damage the forecasts.

In creasing vertical resolution was important for observation with high density

Temperature suffer more than wind from excessive data

Targeted DWL experiments

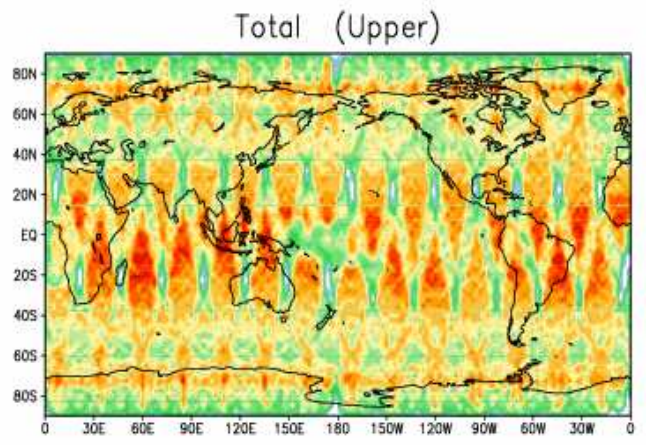
Combination of two lidar

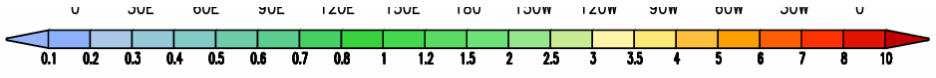
DWL-Upper: An instrument that provides mid and upper tropospheric winds only down to the levels of significant cloud coverage.
Operate only 10% (possibly up to 20%) of the time

DWL-Lower: An instrument that provides only wind observations from clouds and the PBL.
Operate 100% and keep the instruments warm

Data selection Cases

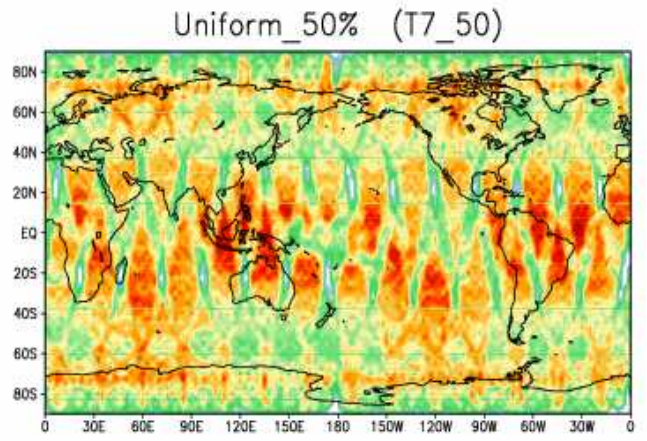
(200mb Feb13 - Mar 6 average)



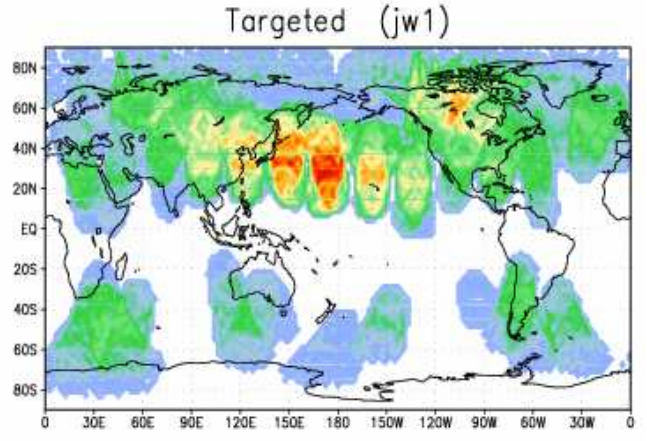


100% Upper Level

Doubled contour

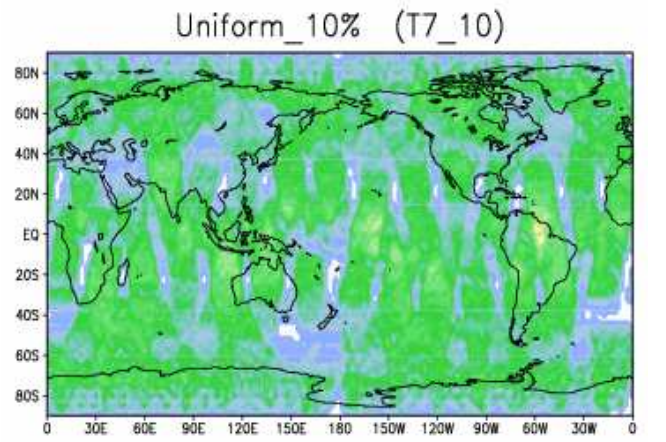


50% Upper Level regular sampling

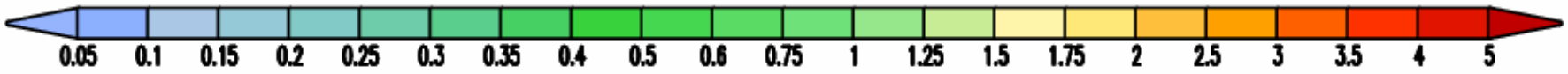


10% Upper Level Adaptive sampling

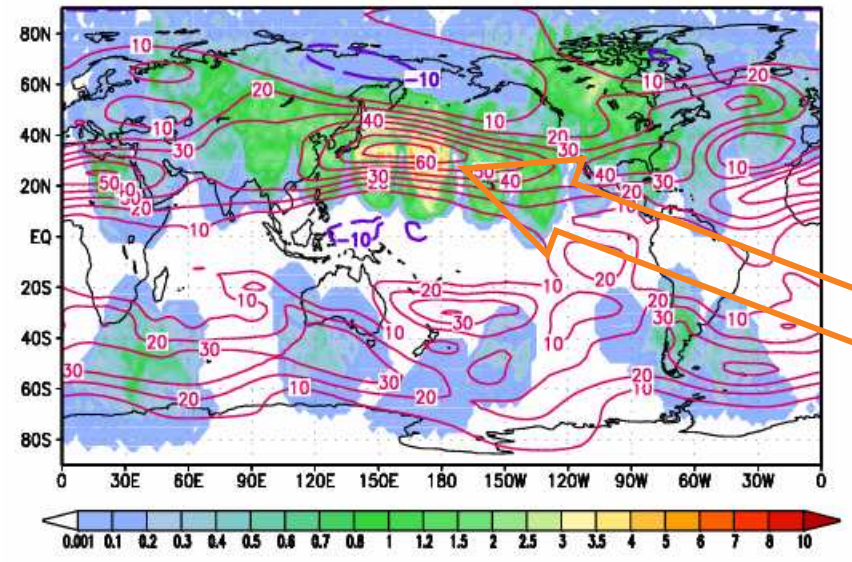
(based on the difference of first guess and NR, three 3mins of segments are chosen – the other 81 mins discarded)



10% Upper Level

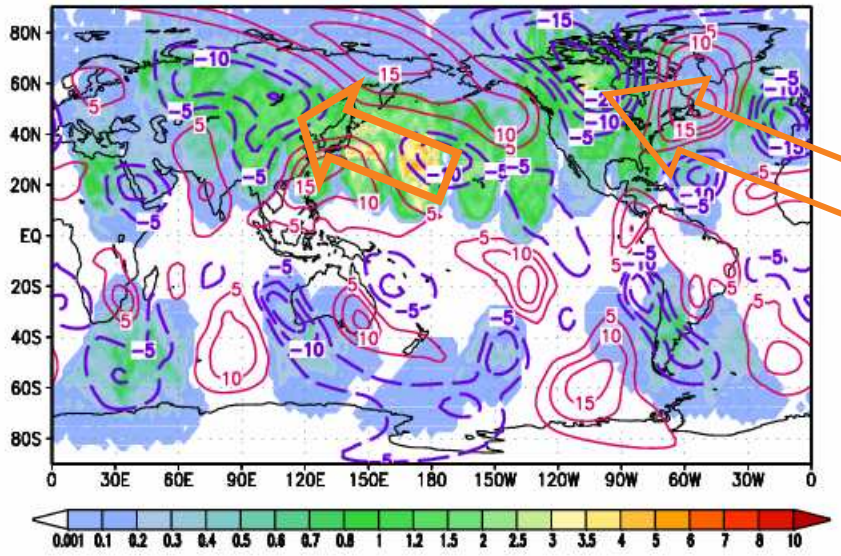


Target and 200U

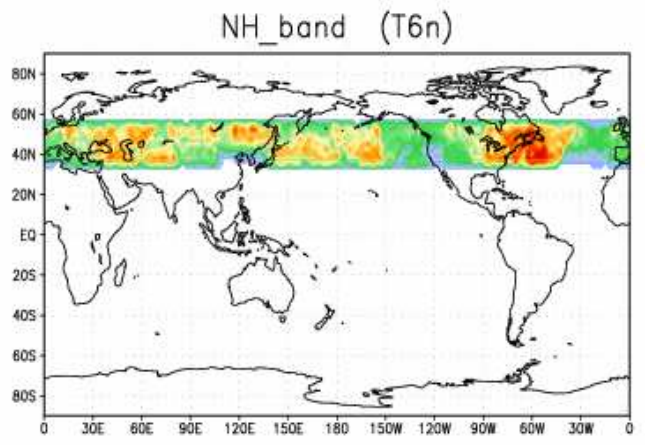


Target in Jet region

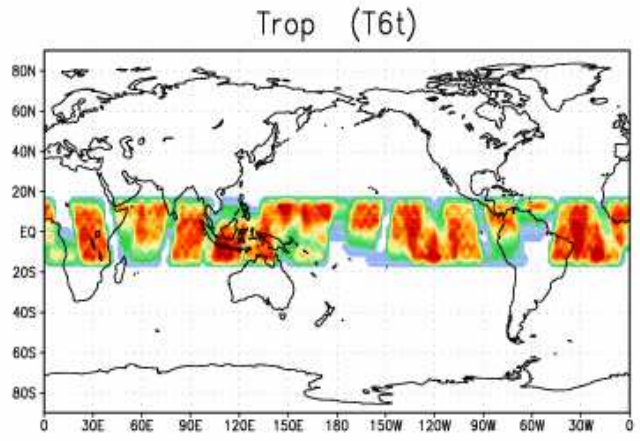
Target and 200V



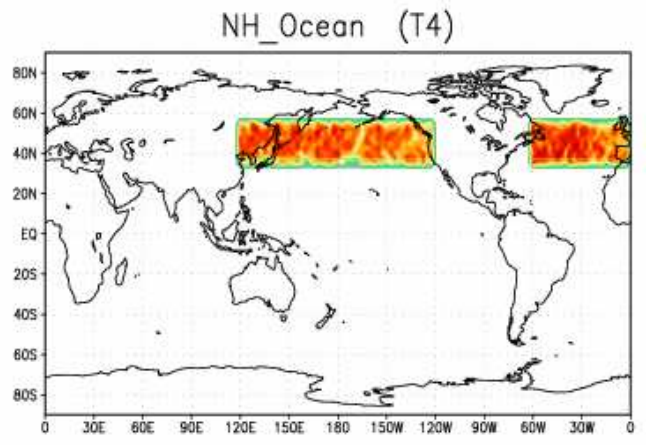
Target in North America and Euracia associated with Northerly wind



10% Upper Level NH band

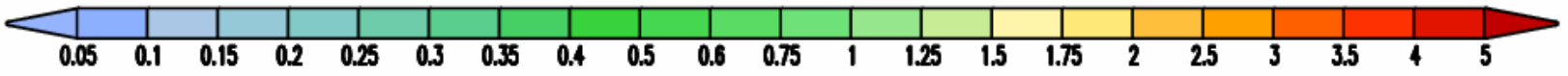


10% Upper Level tropics

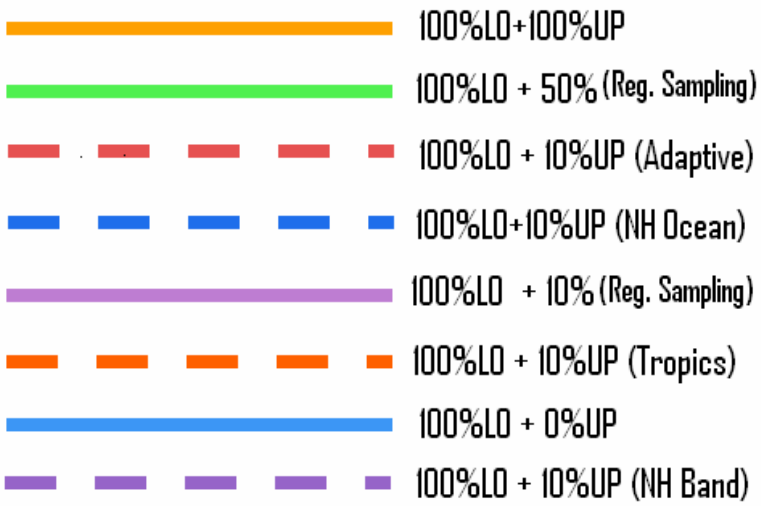


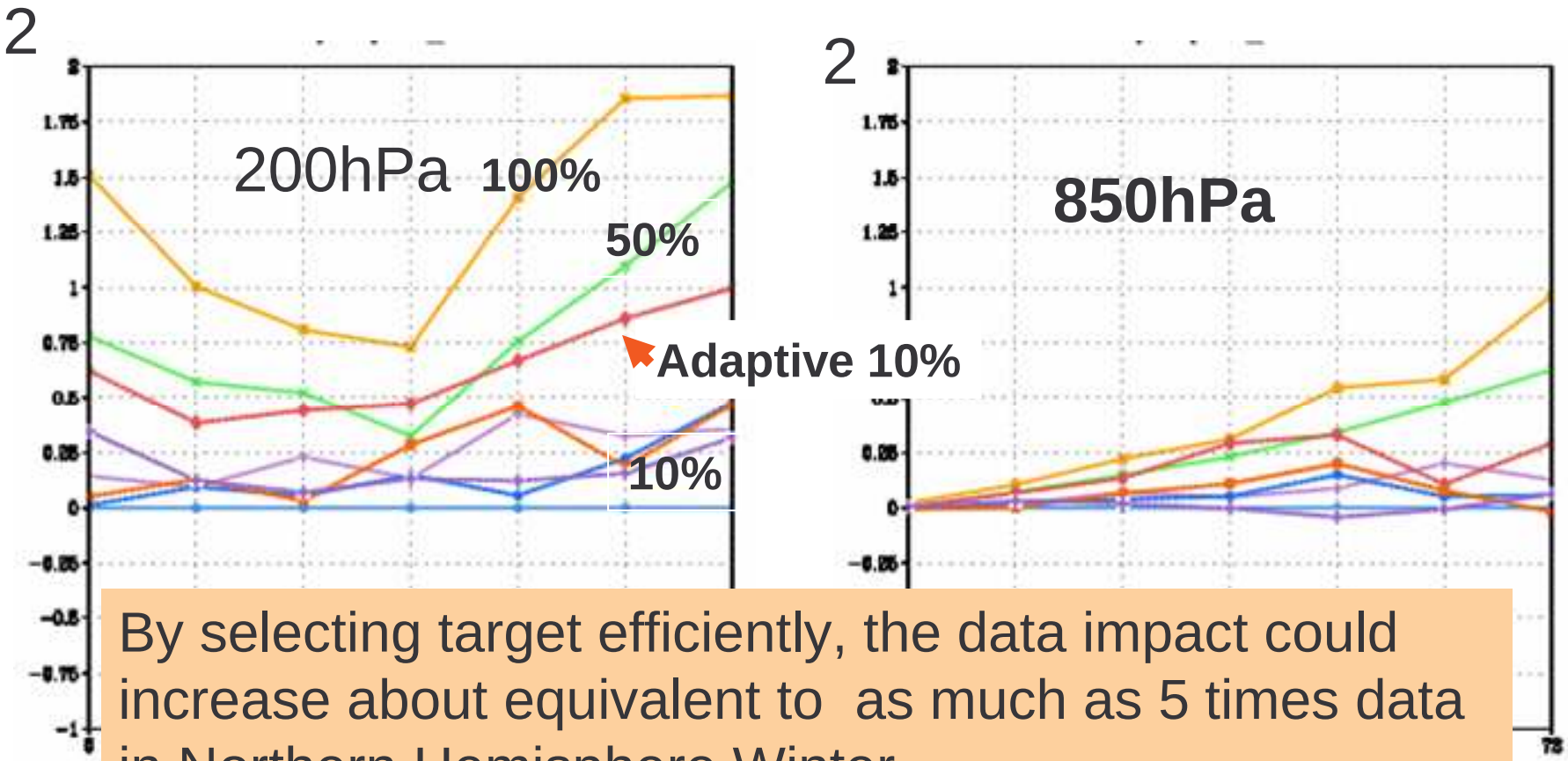
10% Upper Level NH Ocean

The values are number of selected data within a 2.5 by 2.5 degree box



Anomaly correlation at NH
Difference from No upper DWL
Synoptic scale Meridional wind (V)

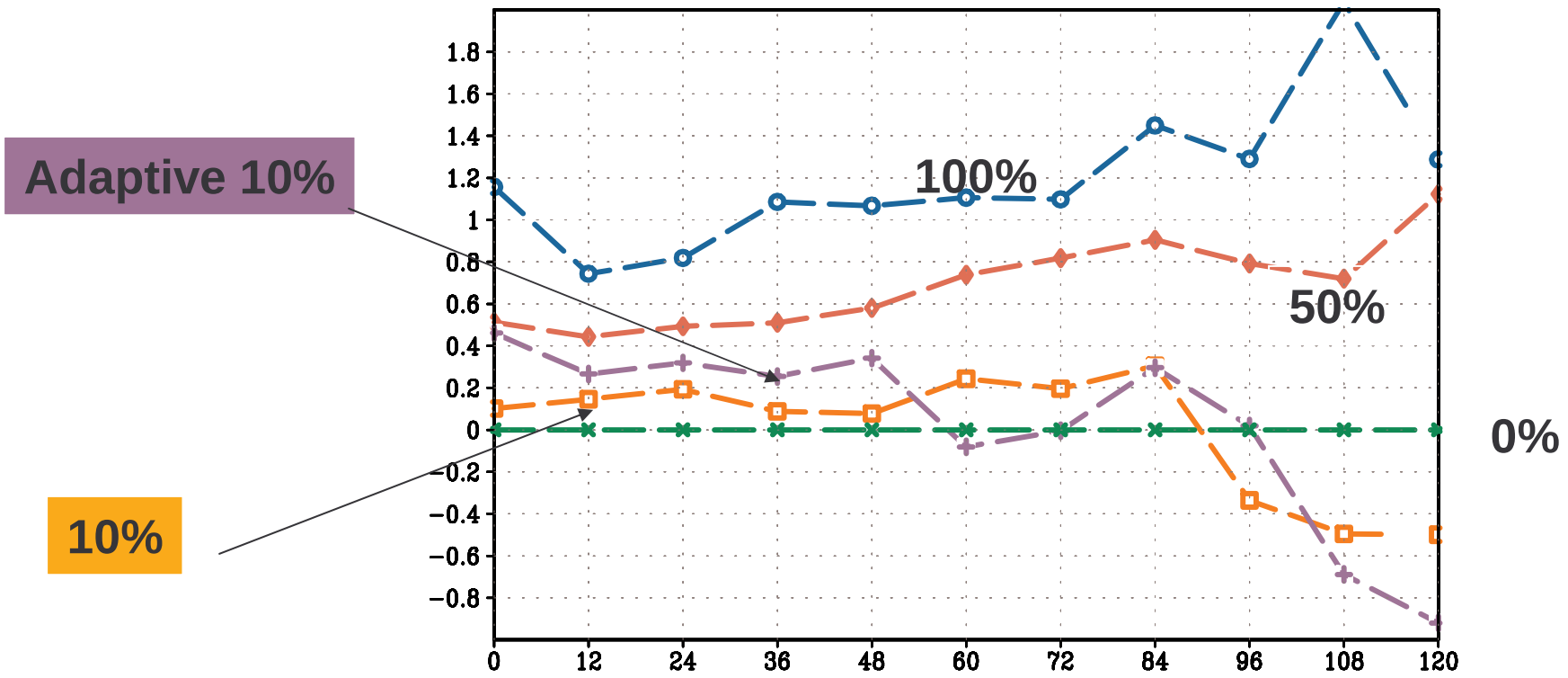




By selecting target efficiently, the data impact could increase about equivalent to as much as 5 times data in Northern Hemisphere Winter.

Experiments with High resolution model

Anomaly correlation at NH
Difference from No upper DWL 200hPa
Synoptic scale Meridional wind (V)



Adaptive targeted DWL produce better analysis but forecast impact reduced due to better forecast by high resolution model

AC to Nature run 500hPa height Total scale

100%L+ 0%U

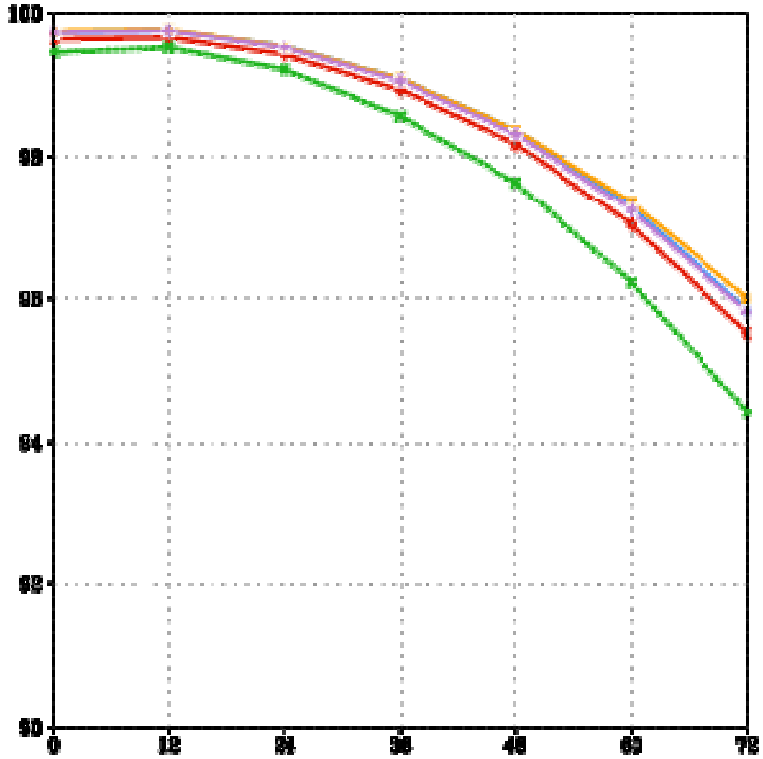
100%L+100%U

100%L+10%U

NODWL

NODWL NOTOVS

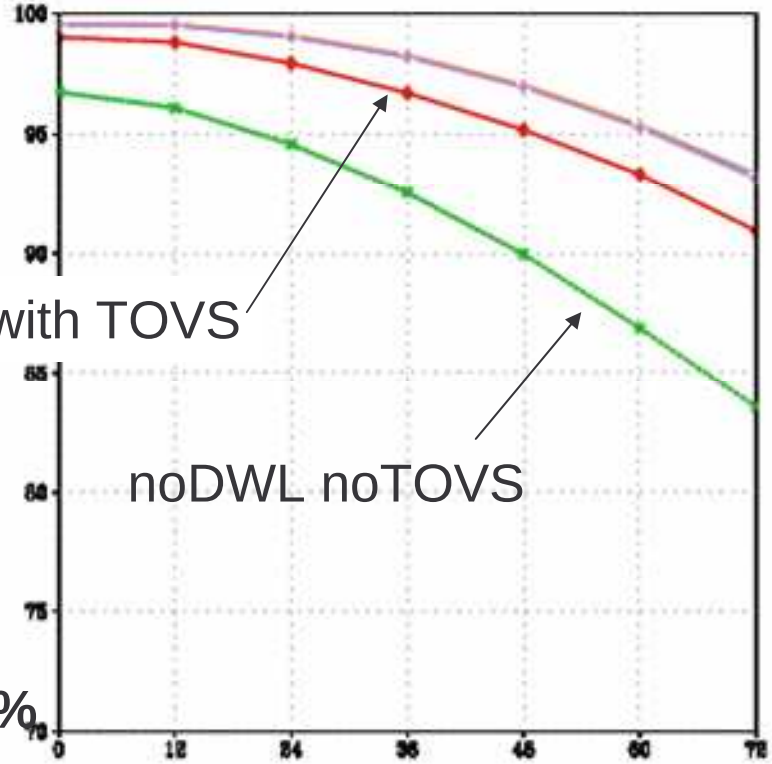
NH



)0%

72

SH



70%

72

Summary

Extended international collaboration within Meteorological community is essential for timely and reliable OSSEs to influence the decision.

The next nature run is being prepared with international team work. ECMWF, NOAA, NASA, THORPEX EUMETSAT ESA

High density observation cannot help forecast if the model does not have good resolution.
Too much data with poor model could damage the forecasts.

By selecting target efficiently, the data impact could increase about equivalent to as much as 5 times data in Northern Hemisphere Winter.

END

http://www.emc.ncep.noaa.gov/research/osse

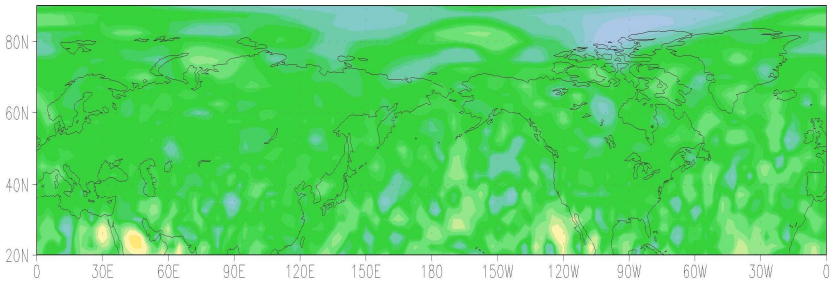
Non-Scan Lidar vs. RAOB Wind
T170 (Feb13- Feb20)

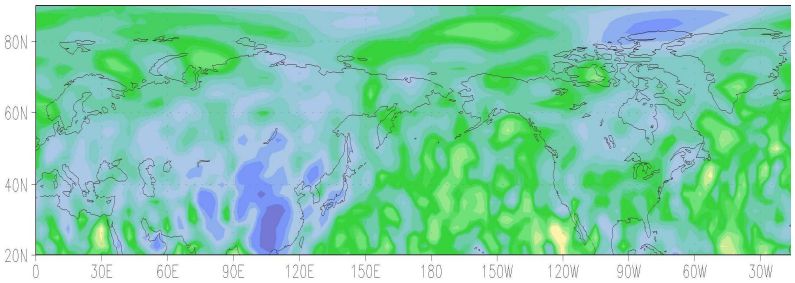
Non-scan Lidar over CTL

CTL: Conventional Data no Satellite data

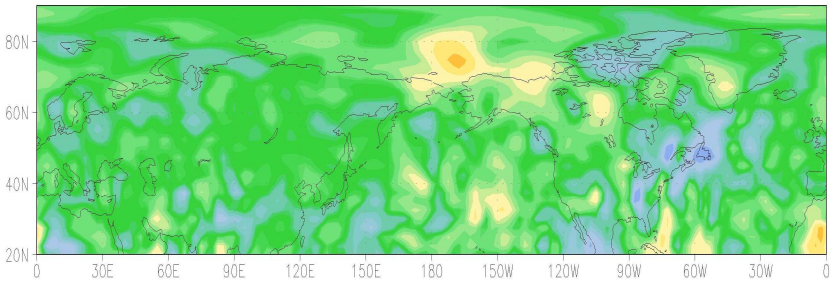
Non-scan Lidar vs. RAOB Wind

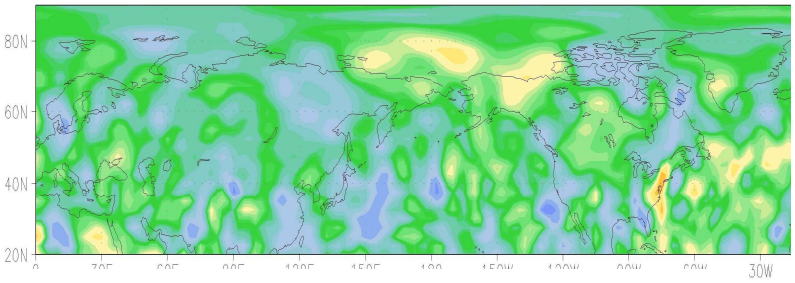
Analysis

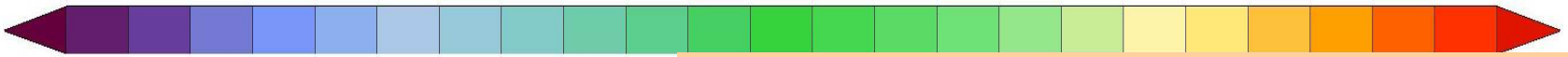




48 hr







Non scan lidar showed minimum impact over RAOB wind

Non scan lidar has more impact over ocean and RAOB has mode impact over land
Impact increase in forecast fields

Red: DWL has positive impact
Blue: DWL has negative impact

Red: DWL has more impact
Blue: RAOB Wind has more impact