Co-ordination Group on Verification

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CBS Coordination Group on Forecast Verification

- **Terms of reference**
  - **a) In consultation with the relevant Expert Teams, review procedures for verification of the performance of forecasting systems to ensure that they are adequate and meet CBS needs**
  - **b) Ensure that verification systems are appropriate to emerging forecast types such as probabilistic forecasts, very high resolution NWP products, and nowcasting products**
  - **c) Develop suitable verification procedures for severe weather forecasts and warnings**
  - **d) Review Lead Centre activities and provide guidance as appropriate**
  - **e) Liaise with WWRP/WGNE as required**
  - **f) Provide guidance on how to implement verification systems**

Coordination Group on Forecast Verification

- **Targets for 2008**
  - **Initiate review the standard scores for operational deterministic global forecasts**
  - **initiate the link with the WWRP/WGNE group and begin to consider how the developments from the research side can be brought into operational use**
- **CG will be formed at CBS-XIV in 2009**

Joint Working Group on Verification (JWGV)

- **The JWGV is established under the WWRP and WGNE; group of experts on verification**
- **JWGV meeting 21-22 April 2008**
- **JWGV very positive about developing links with CBS**
  - **JWGV will propose one of its members to participate in the CG**
- **Areas for collaboration:**
  - **verification of NWP models for surface weather parameters**
  - **verification of severe weather (including SWFDP)**

Review of CBS standard verification

- **Standard procedures for the verification of NWP forecasts are given in the WMO Manual on the Global Data-Processing and Forecasting System, WMO-No. 485:**
  - **Attachment II.7 Table F (deterministic and EPS medium-range)**
  - **Attachment II.8 (SVS for LRF)**
- **EPS and LRF relatively recent and looked after by Expert Teams**
- **No similar structure to review the deterministic forecast scores. This is considered a high priority for the CG.**
  - **Current procedures were introduced in 1988 and have not changed since.**

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Verification against analyses

Variables MSLP, geopotential height, temperature, winds

Levels Extratropics: MSL, 500 hPa, 250 hPa

Tropics: 850 hPa, 250 hPa

Statistics Mean error, root-mean-square error (rmse), anomaly correlation, S1 skill score, root-mean-square vector wind error (rmsev)

Area N, S hemisphere extratropics (90°–20°) Tropics (20°N–20°S)

Grid Verify against own analysis on 2.5° latitude–longitude grid

Time 24, 48, 72, ... hours

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Verification against observations

Variables Geopotential height, temperature, winds

Levels 850 hPa, 500 hPa, 250 hPa

Statistics Mean error, root-mean-square error (rmse), trend correlation, root-mean-square vector wind error (rmsev)

Network Seven areas used in verification against radiosondes

Stations The list of radiosonde stations to be used in each network is updated annually by the lead centre for radiosondes.

Time 24, 48, 72, ... Hours

- Observation error
  - exclude values rejected by their objective analysis
  - Use bias-corrected observations to compute statistics

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Review of CBS standard verification

- **A questionnaire was sent to the current list of contacts for the exchange of standard scores.**
- **There are significant differences between centres in the ways they have implemented the verification. These have substantial impact on the scores and make comparison between centres difficult.**
- **The review of the standard verification will seek to establish a consistent implementation across participating centres, in particular in the interpolation, climatology and use of observations.**
- **Once this consistency is achieved, it will need to be maintained. One way to do this could be to establish a lead centre for deterministic verification as has already been done for EPS and LRF.**

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Global NWP centres

Centre	CBS verif email contact	exchange scores monthly	Contribute score annually to WMO	Reply to questions
ECMWF	Y	Y	Y	Y
CMC	Y	Y	Y	Y
JMA	Y	Y	Y	Y
Met Office	Y	Y	Y	Y
BoM	Y	Y	Y	Y
Meteo-France	Y	Y	Y	Y
NCEP	Y	Y	Y	N
DWD	Y	Y	Y	N
Russia	Y	Y	Y	N
CPTEC	Y	N	N	N
India NCMWRF	Y	N	N	N
CMA	N		Y	
KMA	N		Y	

Review of CBS standard verification

- **Scores are exchanged between some (not all) GDPFS centres monthly. But procedures not as consistent as they could be, some errors**
- **Verification against observations:**
  - **common list of radiosonde stations; in practice centres do not all use same list (can be large differences). Email contact list to be updated**
- **Verification against analyses:**
  - **Interpolation from model grid to 2.5° x 2.5° latitude-longitude grid (big difference in resolution for current NWP models). Grid and interpolation to be agreed**
  - **Climatology for anomaly correlation – can have large impact on scores. Common climatology would aid comparison of results**
- **Range of forecast parameters, steps, areas to be extended**

WMO verification against observations

- Seven areas used in verification against radiosondes
- The list of radiosonde stations to be used in each network is updated annually by the lead centre for radiosondes
- Number of stations has increased substantially over past 5 years, especially over Asia, tropics

YEAR	NH	TROP	SH	TOTAL
2000	261	51	61	373
2001	265	48	62	375
2002	279	64	62	405
2003	288	63	60	411
2004	308	71	64	443
2005	351	74	70	495
2006	410	87	75	572
2007	449	103	87	629

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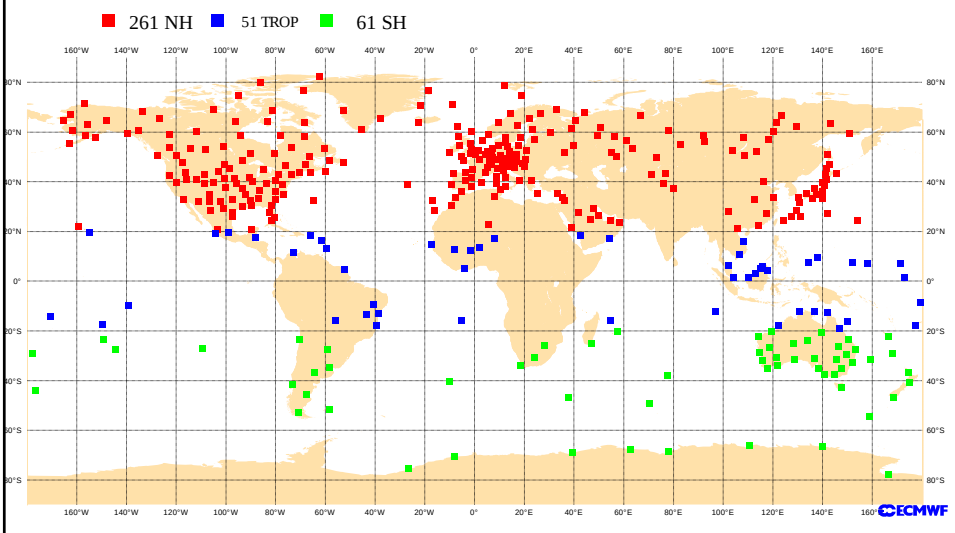
ECMWF list of UA stations used in WMO/CBS standard NWP verification
January - December 2000



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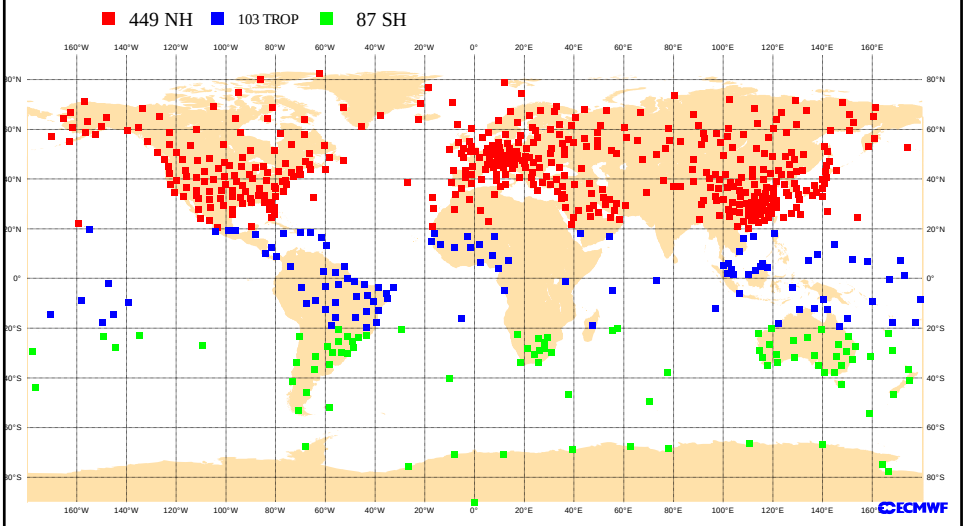
ECMWF list of UA stations used in WMO/CBS standard NWP verification
January - December 2007



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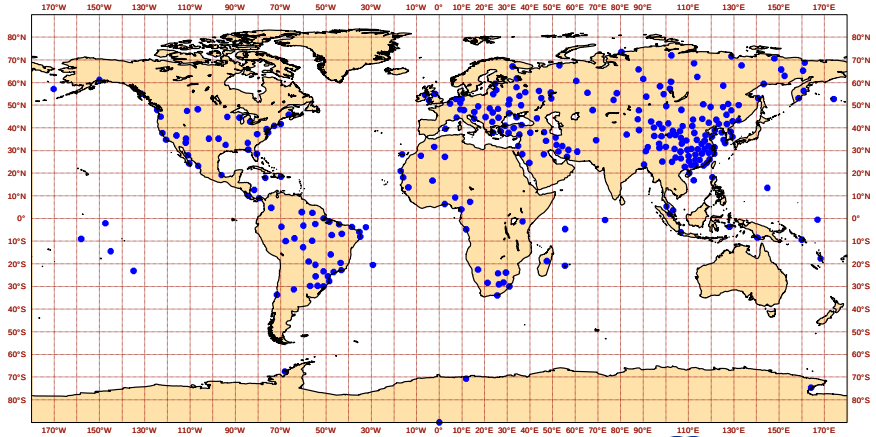
WMO scores - v obs

290 stations

RS in 2007 lists not in 2000 lists



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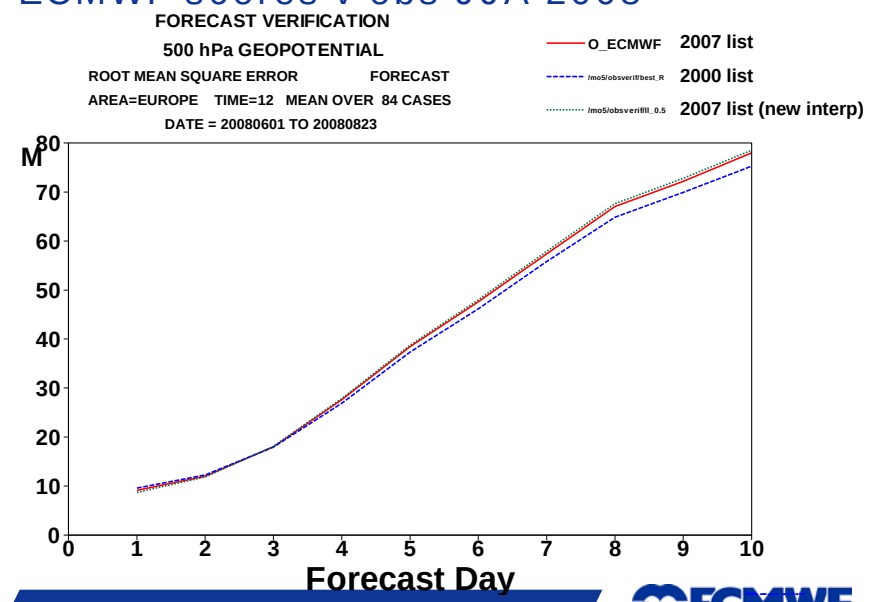
ECMWF scores v obs JJA 2008



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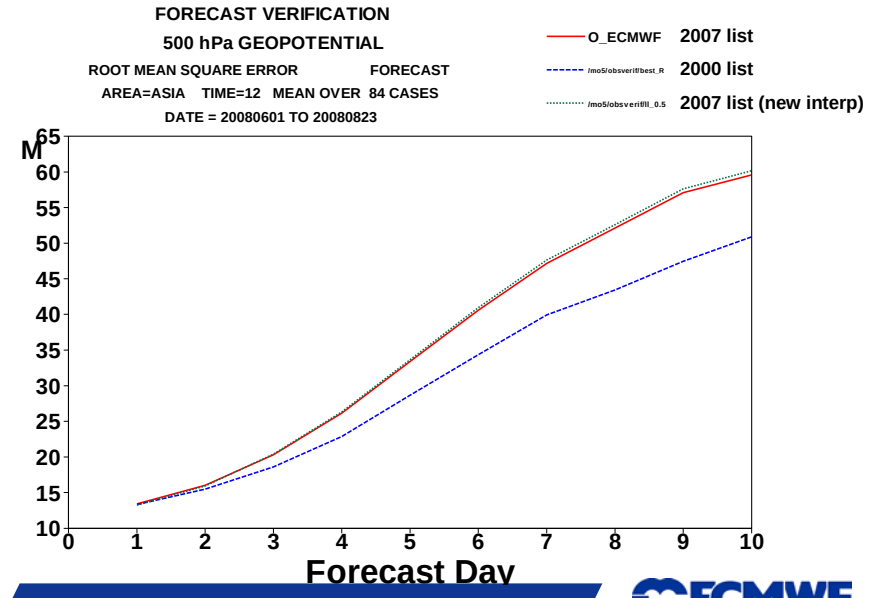
ECMWF scores v obs JJA 2008



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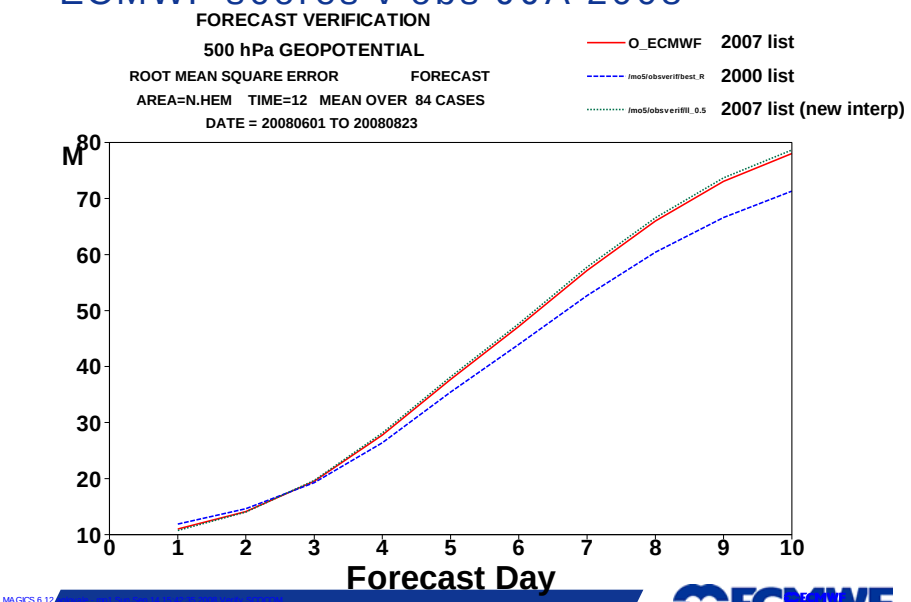
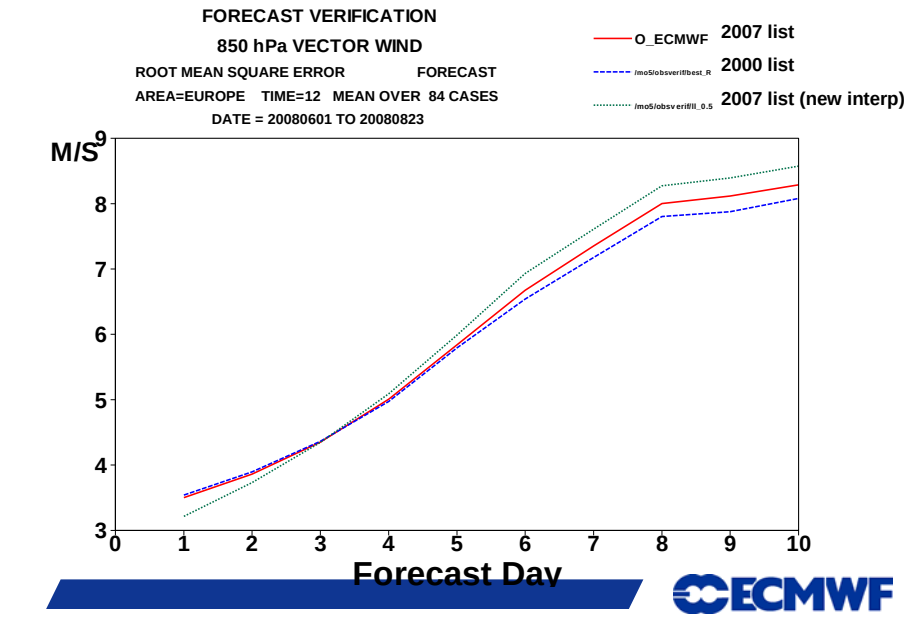
ECMWF scores v obs JJA 2008

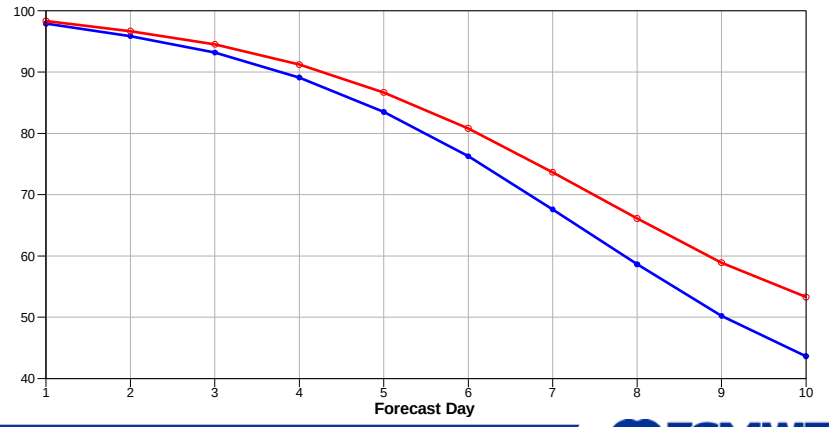


ECMWF scores v obs JJA 2008



ECMWF scores v analysis

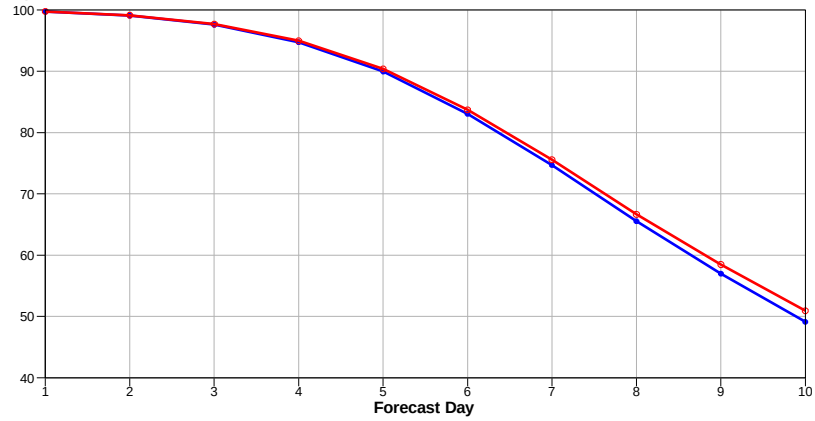
Mean curves
850hPa Temperature
Anomaly correlation forecast
N.hem Lat 20.0 to 90.0 Lon -180.0 to 180.0
Date: 20071201 00UTC to 20080229 12UTC
OPER od oper
Mean calculation method: fair
Population: 182,182,182,182,182,182,182,182,182,182



ECMWF

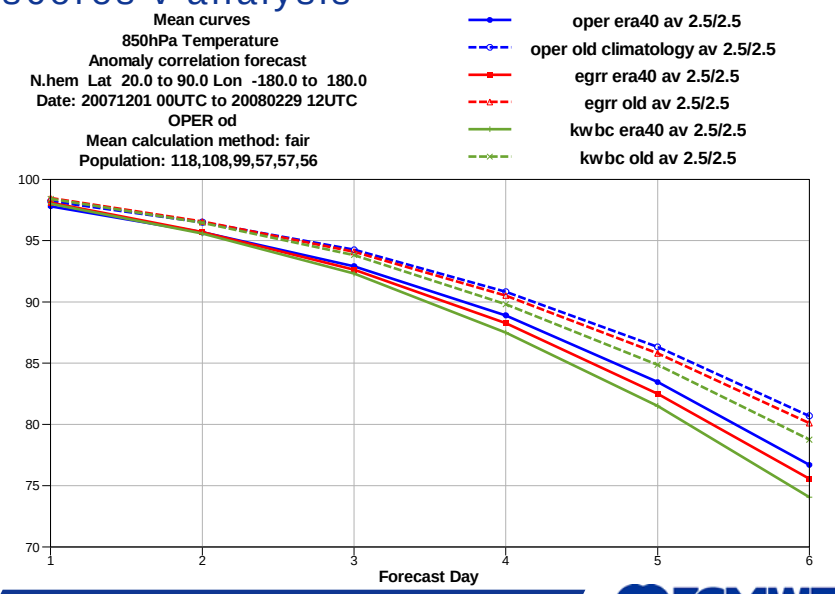
ECMWF scores v analysis

Mean curves
500hPa Geopotential
Anomaly correlation forecast
N.hem Lat 20.0 to 90.0 Lon -180.0 to 180.0
Date: 20071201 00UTC to 20080229 12UTC
OPER od oper
Mean calculation method: fair
Population: 182,182,182,182,182,182,182,182,182,182



ECMWF

scores v analysis



Questions for review of CBS standard verification

1. information on current procedures for calculating the CBS scores

- **a) How do you interpolate to the 2.5 degree grid**
- **b) How do you interpolate to radiosonde locations**
- **c) What bias correction and/or screening do you use for the radiosonde data**
- **d) Do you receive the WMO list of radiosonde stations issued annually by ECMWF to use for verification**
- **e) What climatology do you use for anomaly correlation**
- **f) How do you calculate the monthly mean scores**

Questions for review of CBS standard verification

2. Consideration of possible revisions to the current CBS procedures

a) **Change from 2.5 degree to higher resolution grid (given current resolution of global models)?**

b) **How to interpolate from model grid to verification grid – remove information on scales not resolved by verifying grid**

c) **Climatology can affect the anomaly correlation - can we consider using a common climatology to minimise the effect**

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Questions for review of CBS standard verification

3. Consideration of possible extension of CBS verification

a) **Add verification of humidity**

b) **Include some surface weather (e.g. EPS verification includes precipitation verified against GSN data, though I don't know if anyone actually does this)**

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Draft recommendations – in progress (1)

- **Resolution of verification grid should be increased. Need to agree what: 0.5, 1.0, 1.5 degree (are some models still coarser resolution than 1.0?)**
- **Interpolation to verification grid should remove scales not resolved by verification grid (but should not otherwise include any explicit smoothing). Method should be agreed, but may depend on native grid of model**
  - **Spectral model: truncate spectral fields to appropriate scale before interpolation to lat-long grid**
  - **Grid point models: area weighting is used by Met Office and proposed for CMC (is this OK for all?)**

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Draft recommendations – in progress (2)

- **Climatology for anomaly correlation. General agreement that common climatology would help comparison of scores. Several already based on ECMWF reanalysis. But JMA use own reanalysis (and note may be difficult to agree)**
- **Expand range of steps, areas:**
  - **Verify every 12 hours (currently every 24 hours). 6-hourly difficult for radiosondes, but would be possible for verification against analyses?**
  - **Verify against analyses for same areas as for against observations (currently v analyses only for NH, SH, tropics); would be useful check of the different verifying sets**
- **Add verification of humidity for upper-air fields. Is relative humidity OK?**

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Two important things to note for any changes:

- **Changes will introduce discontinuity in scores. Maintain old verification as well (for limited period?)**
- **CBS verification for EPS refers to these procedures for deterministic scores (ensemble mean, spread) so these will also be affected. Other groups may also follow CBS as guidelines**