# Reforecast/hindcast

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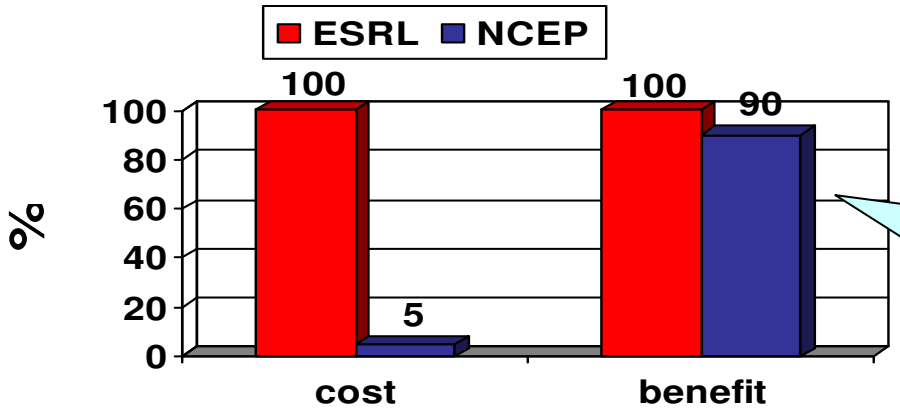
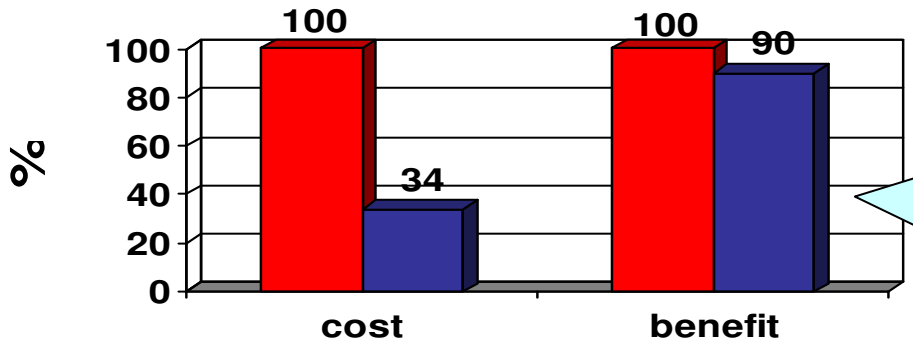
# Reforecast/hindcast for forecast calibration

- Both ESRL and NCEP agree:
  - Collaborate to each other for reforecast and calibration
  - Reforecast will add values to our forecast
  - The values depend on
    - Reforecast sample size (historical) – more is better
    - Ensemble size – larger is better
  - Looking for optimal design by considering the resources
- There are different strategic plans for ESRL and NCEP
  - ESRL:
    - Find resource to run past 30 years ensemble reforecast **at once**
    - Cost similar to NCEP/CCS/P6 full machine for half year (approximately)
    - Disk space and storage (huge ?)
    - Operation is not doable - full cost, optimal benefit (assume)
    - Only calibrate precipitation for HPC (could be extended to other variables)
    - Benefits will be decreased year by year when model upgrading
  - NCEP:
    - Design to run **real time** reforecast for past 10 years (or 5 years) ensemble control only, using NCEP best reanalysis (just finished).
    - Option 1: running 10 years (10 reforecast for each cycle) – cost 50% of current GEFS
    - Option 2: running 5 years (5 reforecast for each cycle) – cost 25% of current GEFS
    - Operation is doable, minimum the cost, maximum the benefit
    - Calibrate many forecast elements include precipitation
    - Support all service centers include HPC
    - Support THORPEX proposal for NAEFS products generation
    - The similar design from ECMWF – real time reforecast

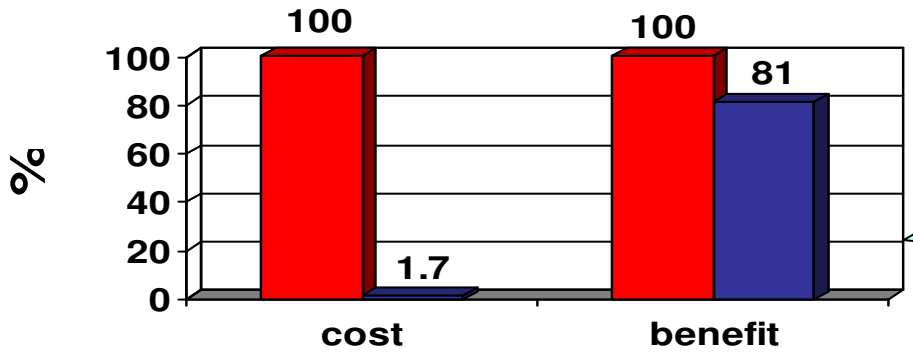
# Side by side comparison for cost and benefit




ESRL: using whole ensemble (20)
NCEP: using ensemble control
Refer to:
Hamill (presentation): 2007
Cui and etc: 2006




ESRL: using 30 year reforecast
NCEP: using 10 year reforecast
Refer to:
Hagedorn and etc: 2008 MWR
Hamill (presentation): 2007
Cui and etc: 2006



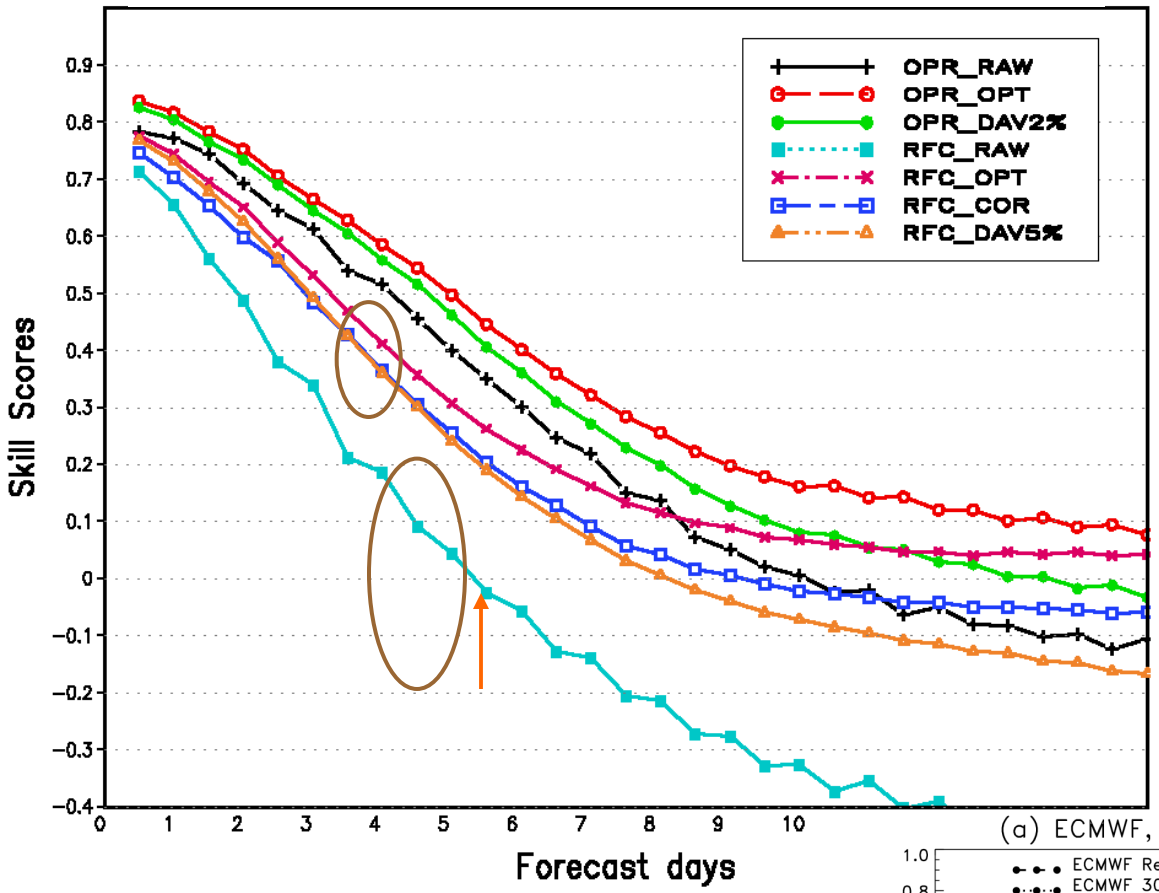

Combined above two factors
**NCEP's plan:**
**Using 1.7% cost, get 81% benefit**

**AND**

ESRL's plan can not keep highest performance by model upgrade every year
NCEP's plan could guarantee the good performance continuously, operationally

# Raw, Optimal & Actual Bias Corrected Ensembles

RPSS of 500 mb Height
Northern Hemisphere, 2004 Summer



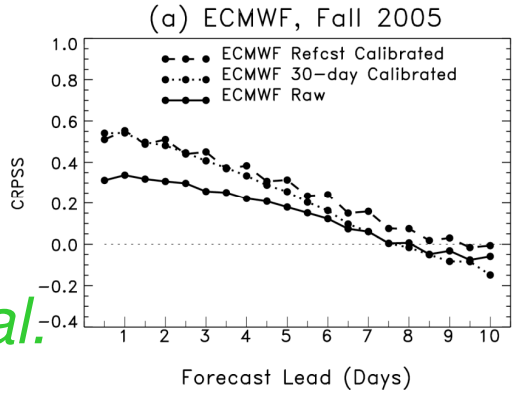

*Bo et al.*

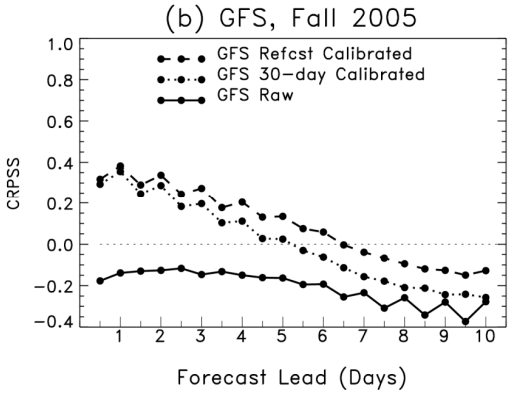
Decaying average applied to CDC reforecast

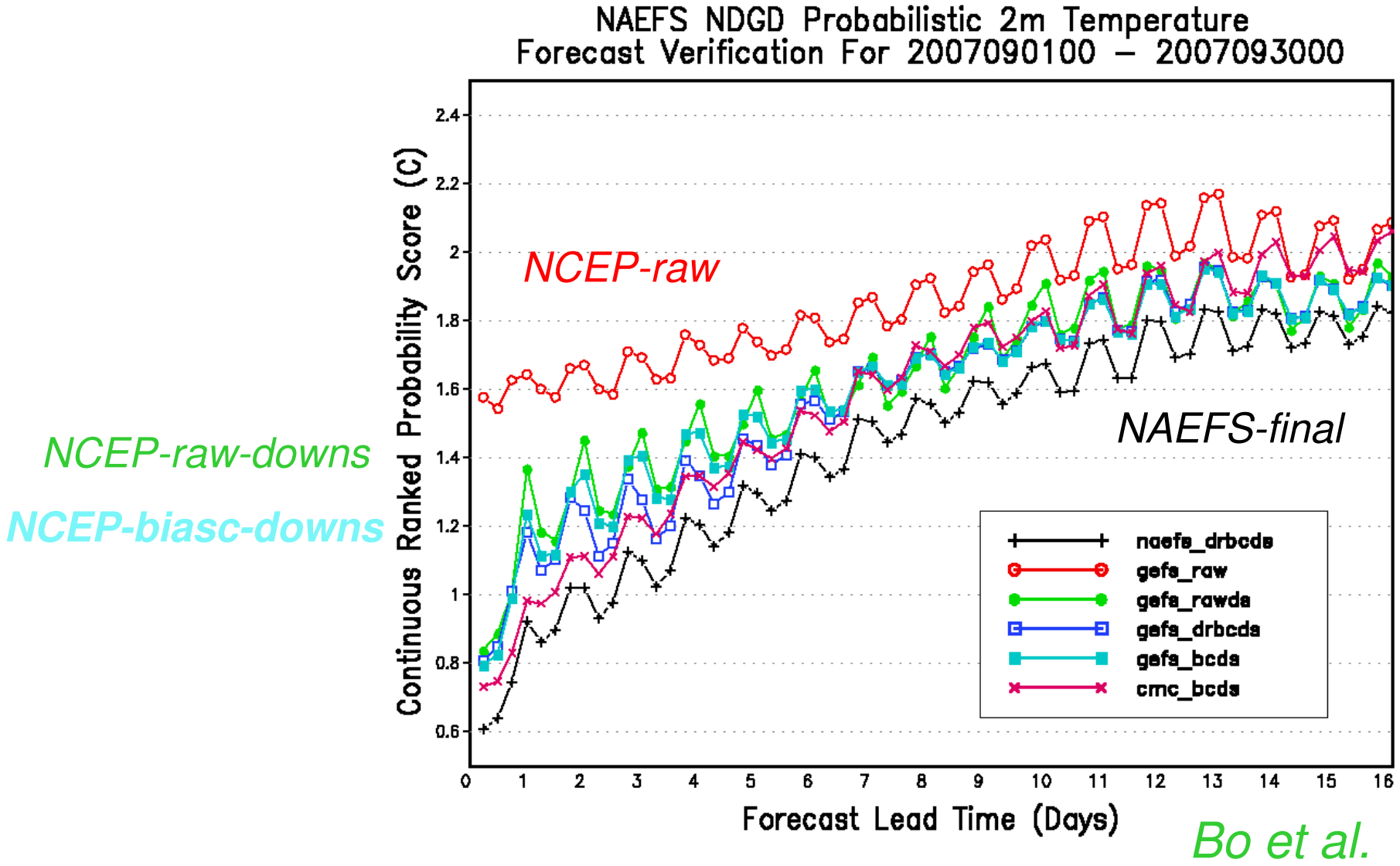
- decaying method gives better results than climate mean bias estimation for short range (~day 5), value of regime dependent correction

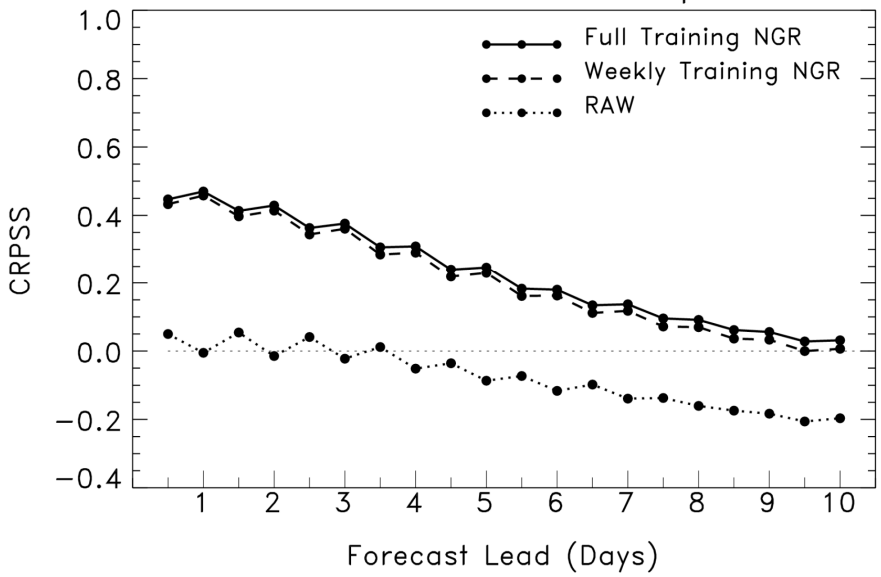
- some gain from climate mean bias correction after _5 days

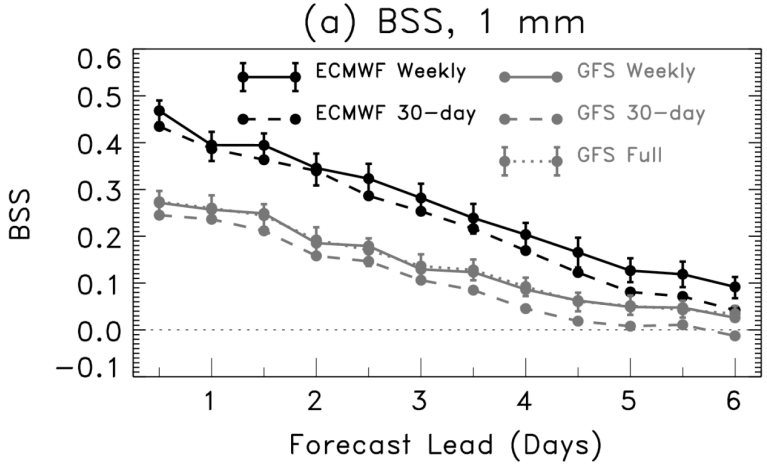
*Hamill et al.*

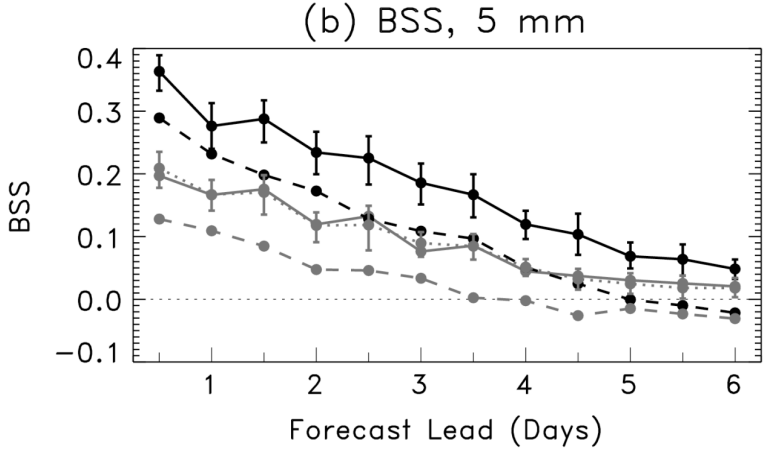


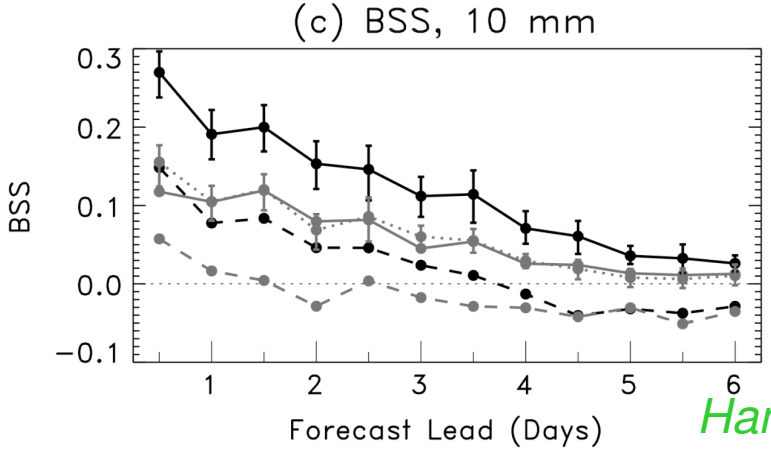




NAEFS NDGD Probabilistic 2m Temperature
Forecast Verification For 2007090100 – 2007093000
Continuous Ranked Probability Score (C)
Forecast Lead Time (Days)
NCEP-raw
NAEFS-final
NCEP-raw-downs
NCEP-biasc-downs
naefs_drbcds
gefs_raw
gefs_rawds
gefs_drbcds
gefs_bcds
cmc_bcds
Bo et al.


GFS CRPSS of Surface Temperature
Full Training NGR
Weekly Training NGR
RAW
CRPSS
Forecast Lead (Days)


(a) BSS, 1 mm
ECMWF Weekly
ECMWF 30−day
GFS Weekly
GFS 30−day
GFS Full
BSS
Forecast Lead (Days)


(b) BSS, 5 mm
BSS
Forecast Lead (Days)


(c) BSS, 10 mm
BSS
Forecast Lead (Days)

*Hamill et al.*