

# GFS configurations - experiments

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<http://wwwt.emc.ncep.noaa.gov/gmb/yzhu/>

# Motivations

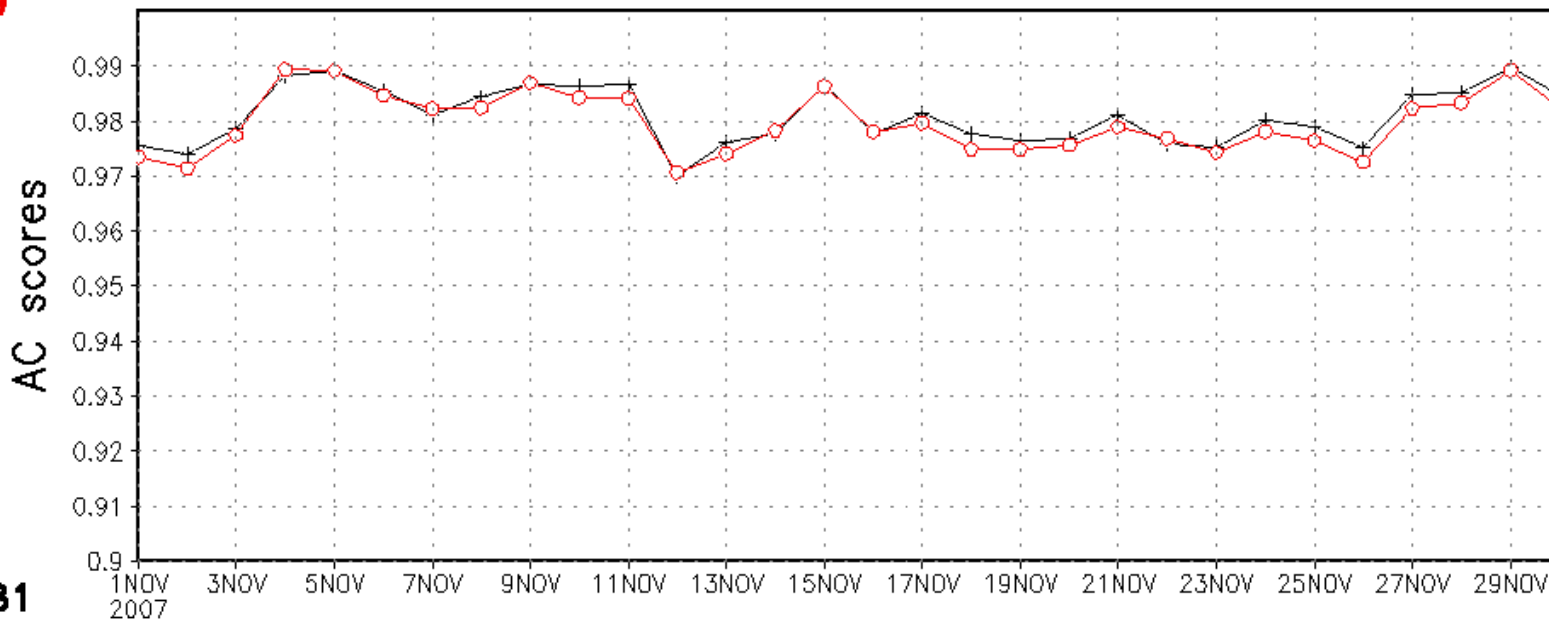
- To use limited resource, maximize the improvement.
- Current global ensemble configuration:
  - T126L28, 20+1 per cycle
- Global ensemble's priorities:
  - Hindcast – to improve extended forecast (1.4 factor)
  - Increase vertical resolution from L28 to L64 (2.3 factor)
  - Increase horizontal resolution from T126 to T190 (~3.4 factor)
    - For variable resolutions: T190(d0-7), T126(d7-16), (reduce factor to 2.1)

T126 for L28 and L64

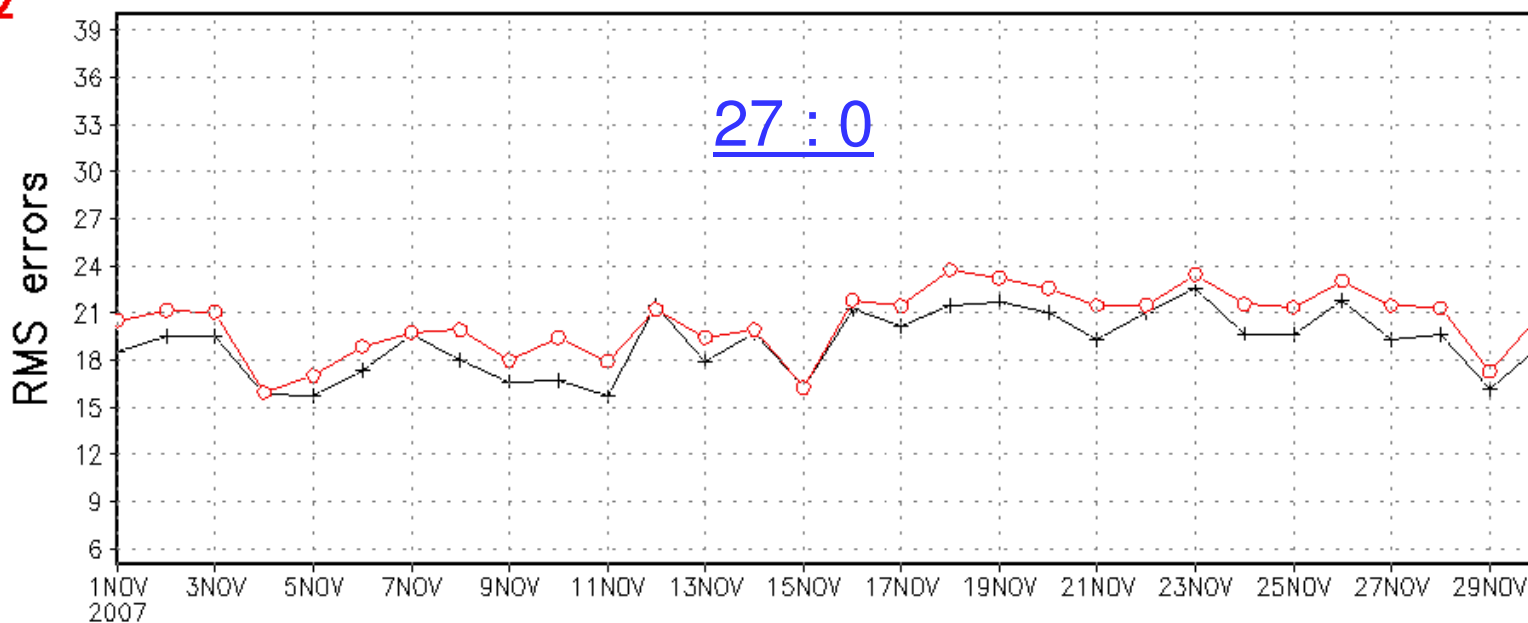
(2.3 factor of resources)

# NH 500 hPa Geopotential Height at day 2 for 00Z01NOV2007 - 00Z30NOV2007

**F28=0.980**  
**F64=0.979**

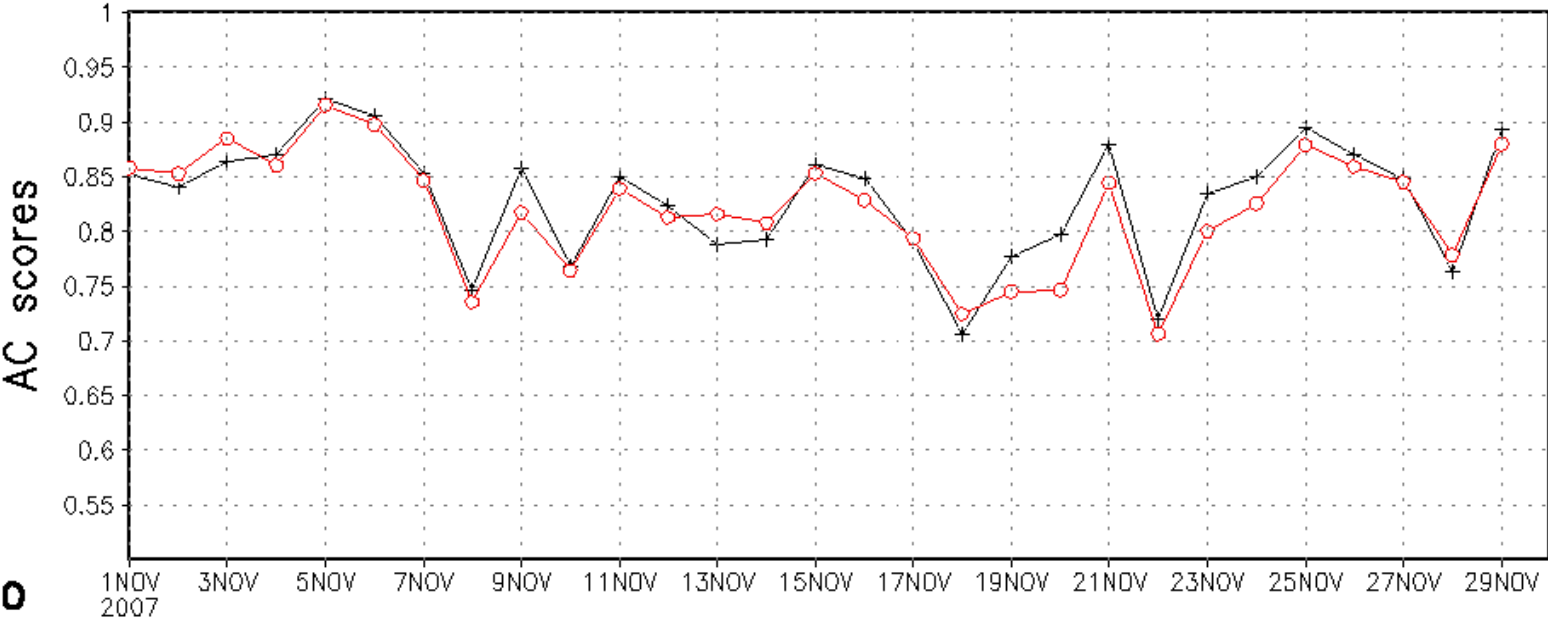


**F28=19.081**  
**F64=20.422**

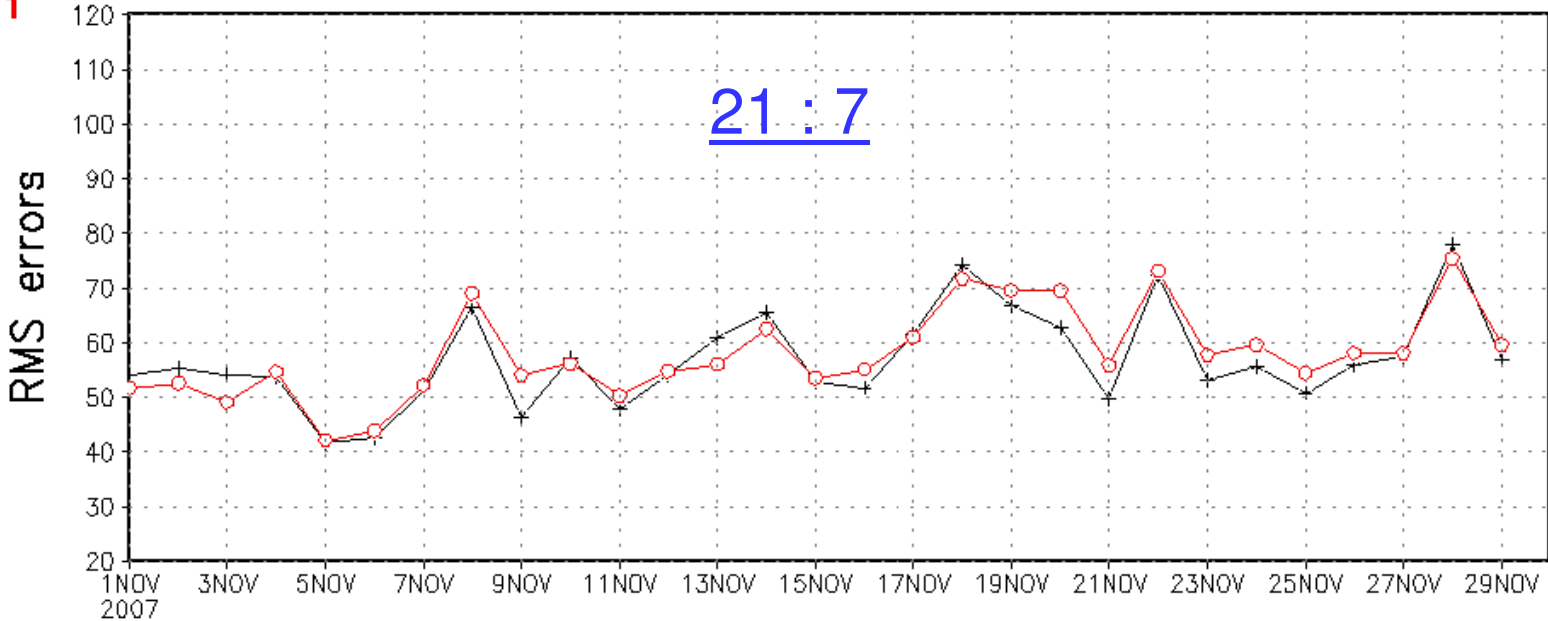


NH 500 hPa Geopotential Height at day 5  
for 00Z01NOV2007 – 00Z30NOV2007

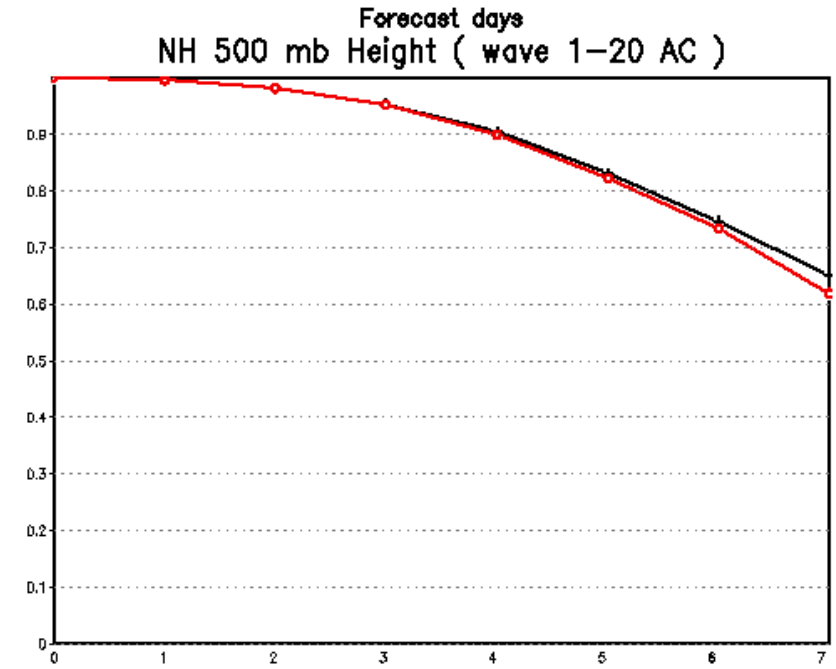
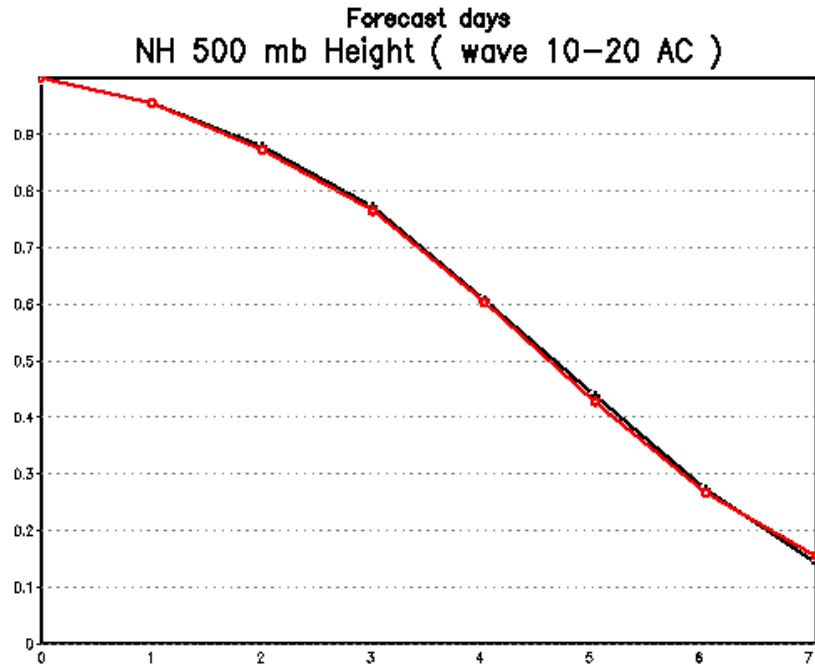
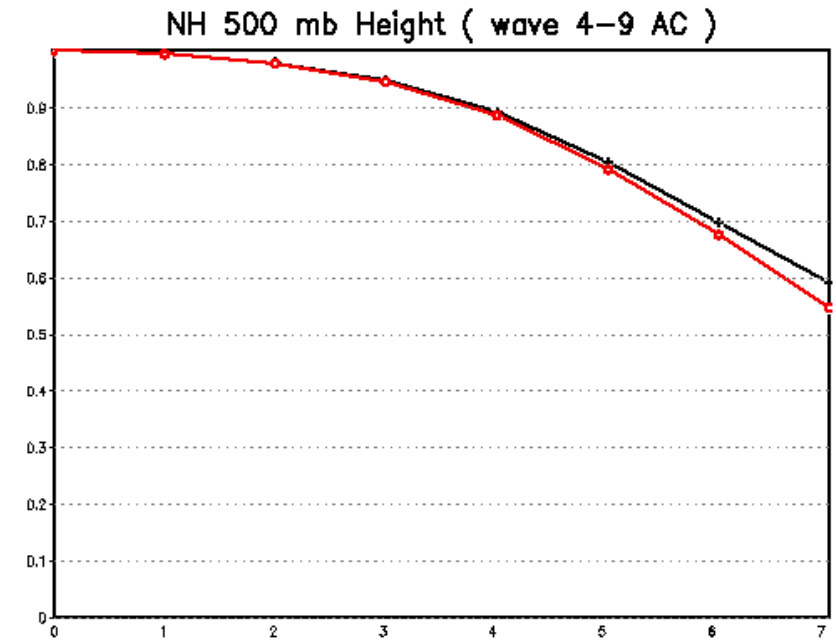
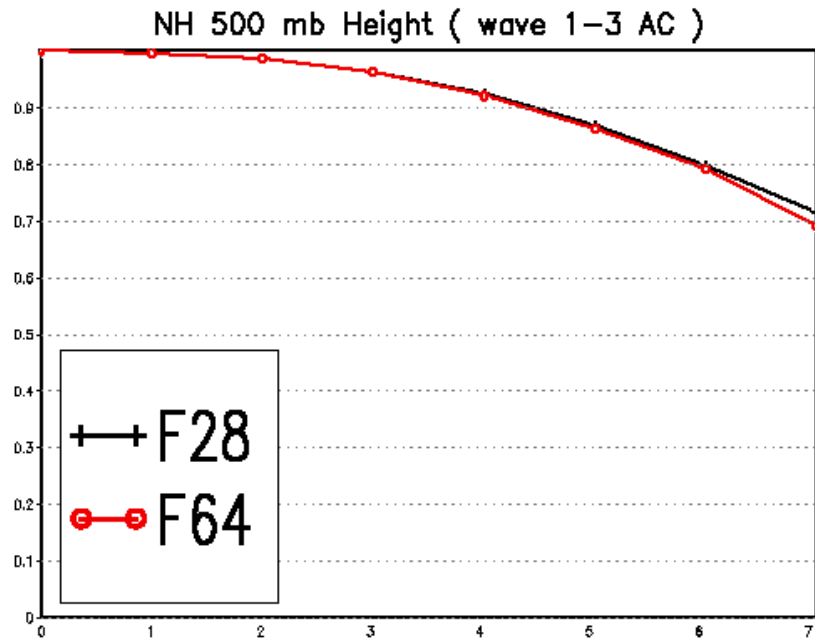
**F28=0.829**  
**F64=0.821**



**F28=56.930**  
**F64=57.981**



# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

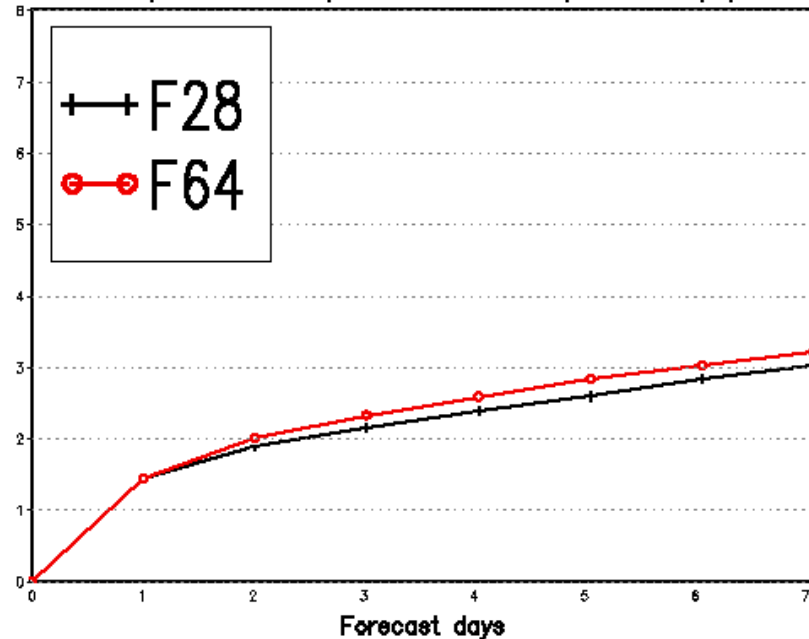


Forecast days

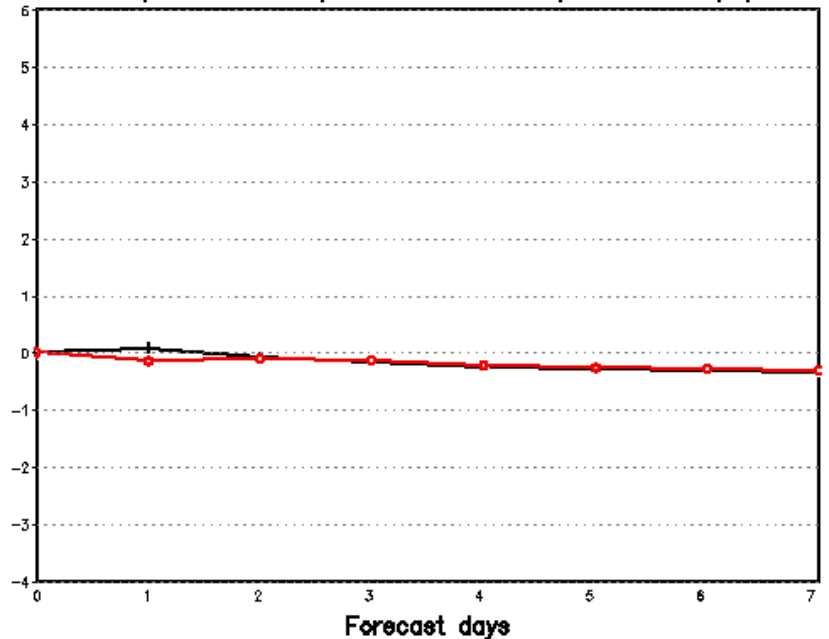
Forecast days

# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

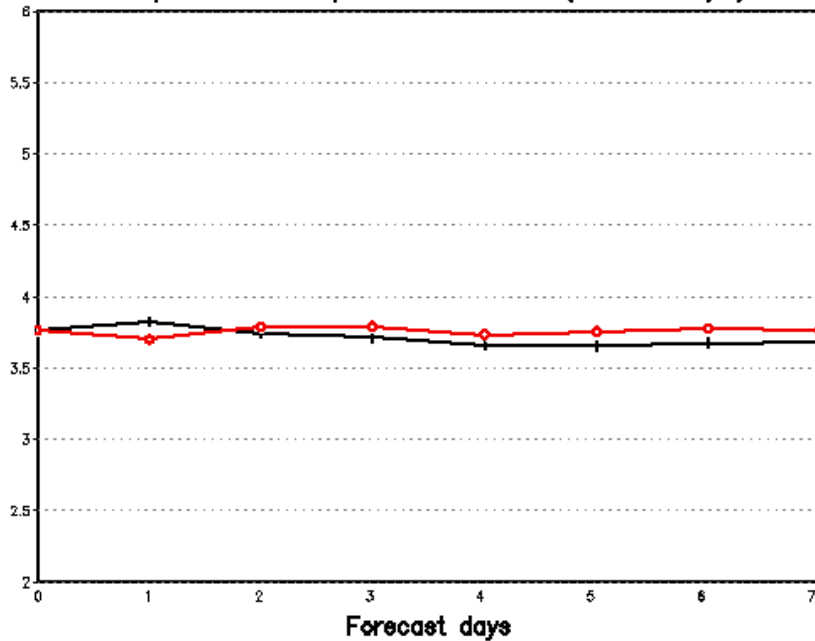
Tropical wind spd at 850 mb (F-A rms)



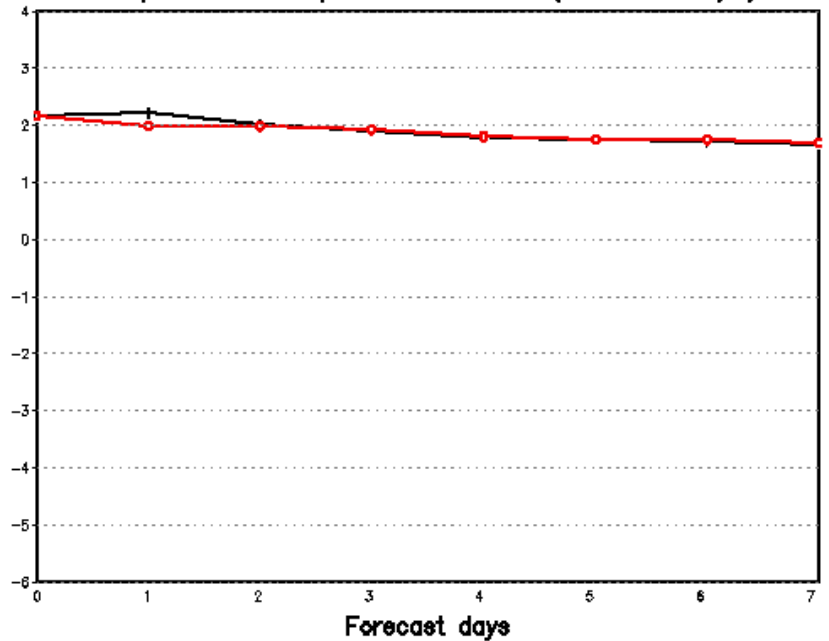
Tropical wind spd at 850 mb (F-A mean)



Tropical wind spd at 850 mb (F-C rms)

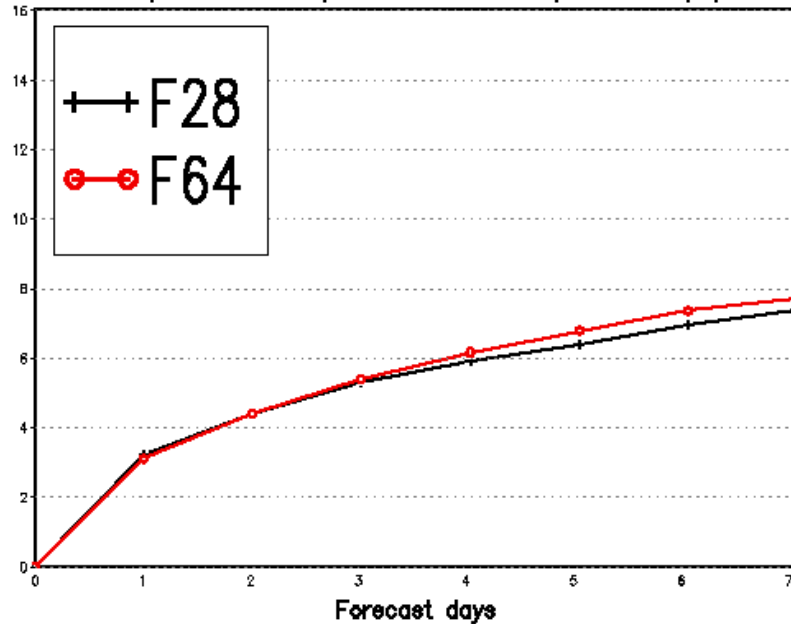


Tropical wind spd at 850 mb (F-C mean)

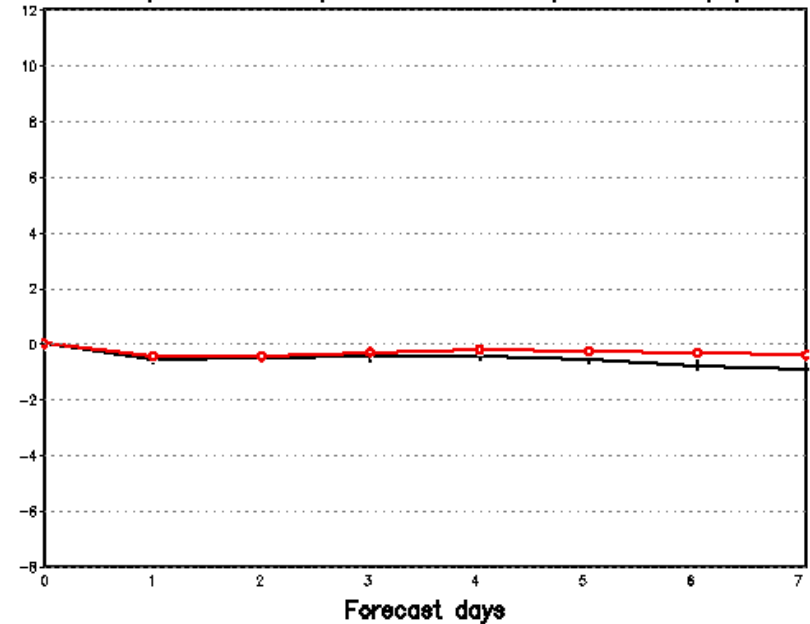


# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

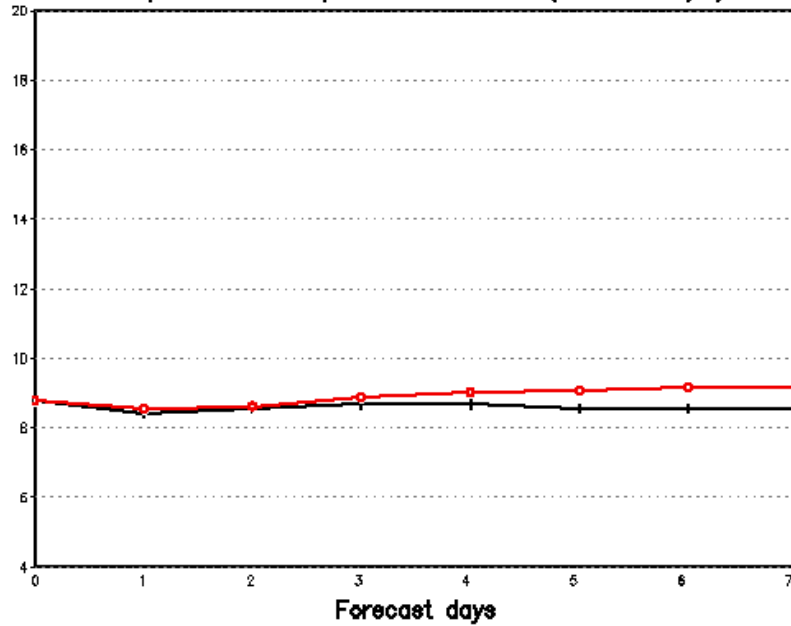
Tropical wind spd at 200 mb (F-A rms) )



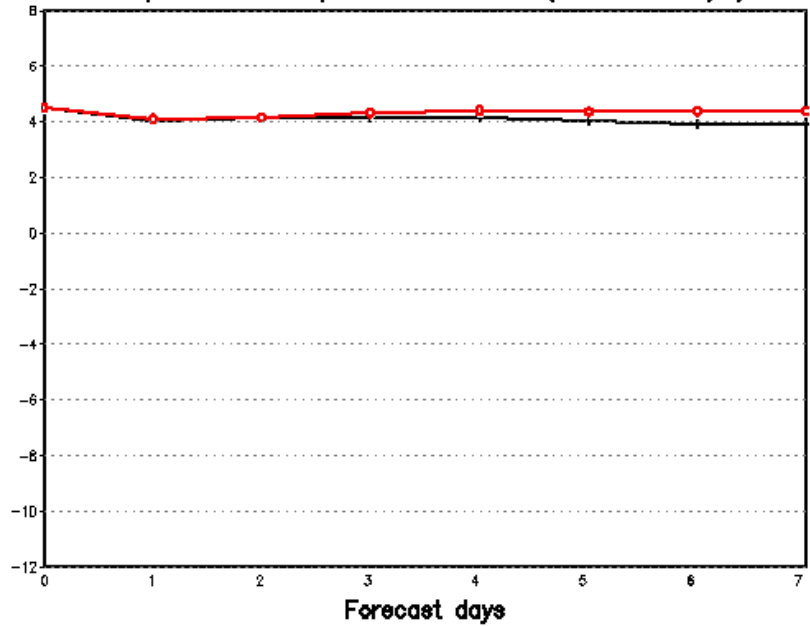
Tropical wind spd at 200 mb (F-A mean) )



Tropical wind spd at 200 mb (F-C rms) )



Tropical wind spd at 200 mb (F-C mean) )



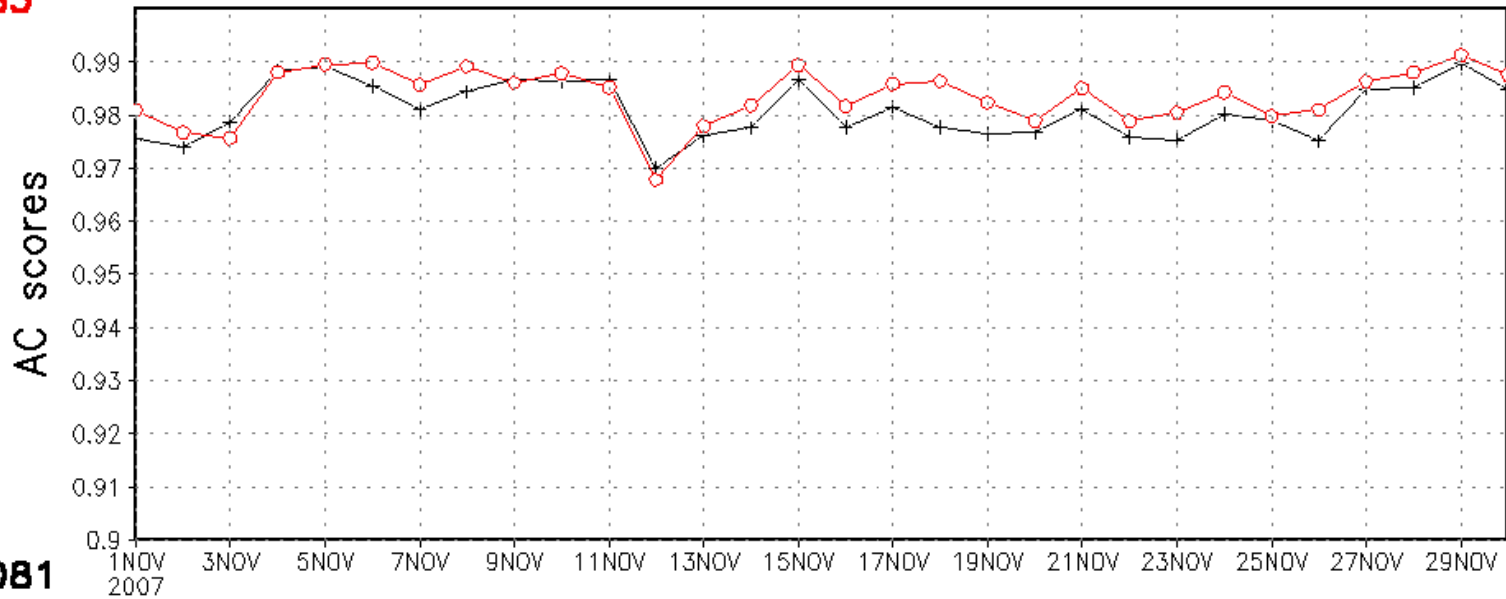


L28 for T126 and T190

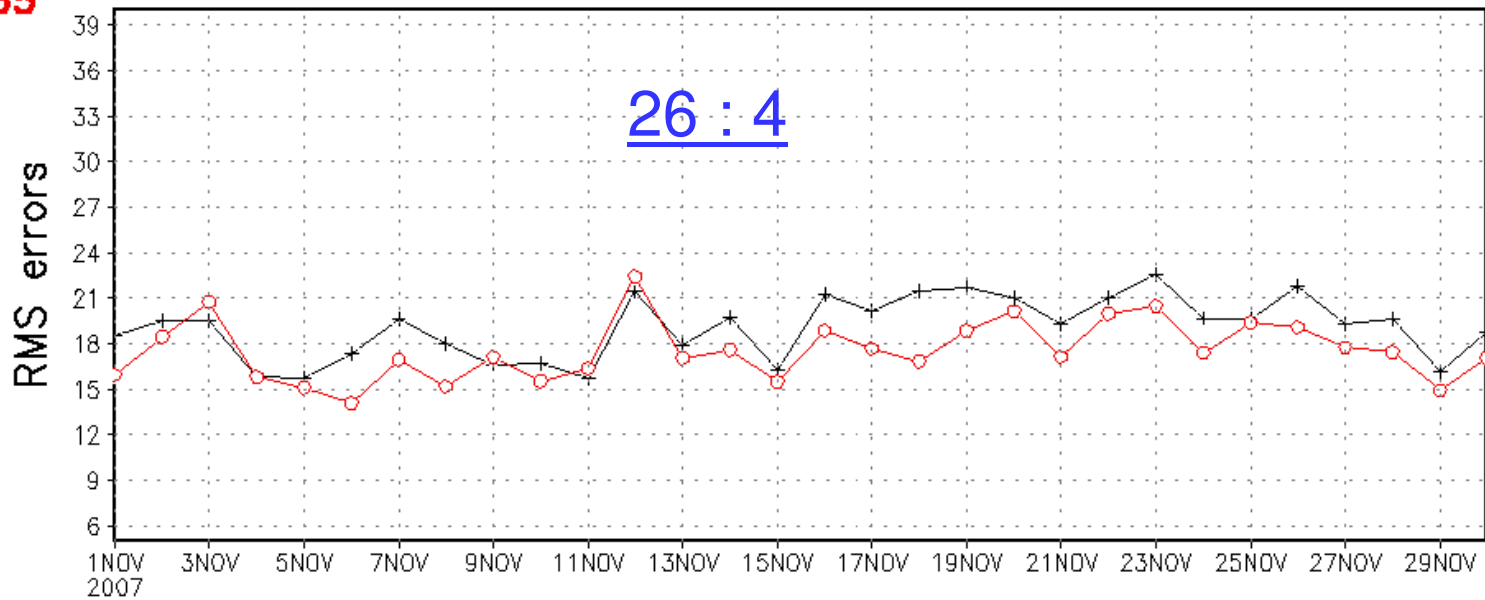
(~3.0 factor of resources)

### NH 500 hPa Geopotential Height at day 2 for 00Z01NOV2007 – 00Z30NOV2007

**T126=0.980**  
**T190=0.983**



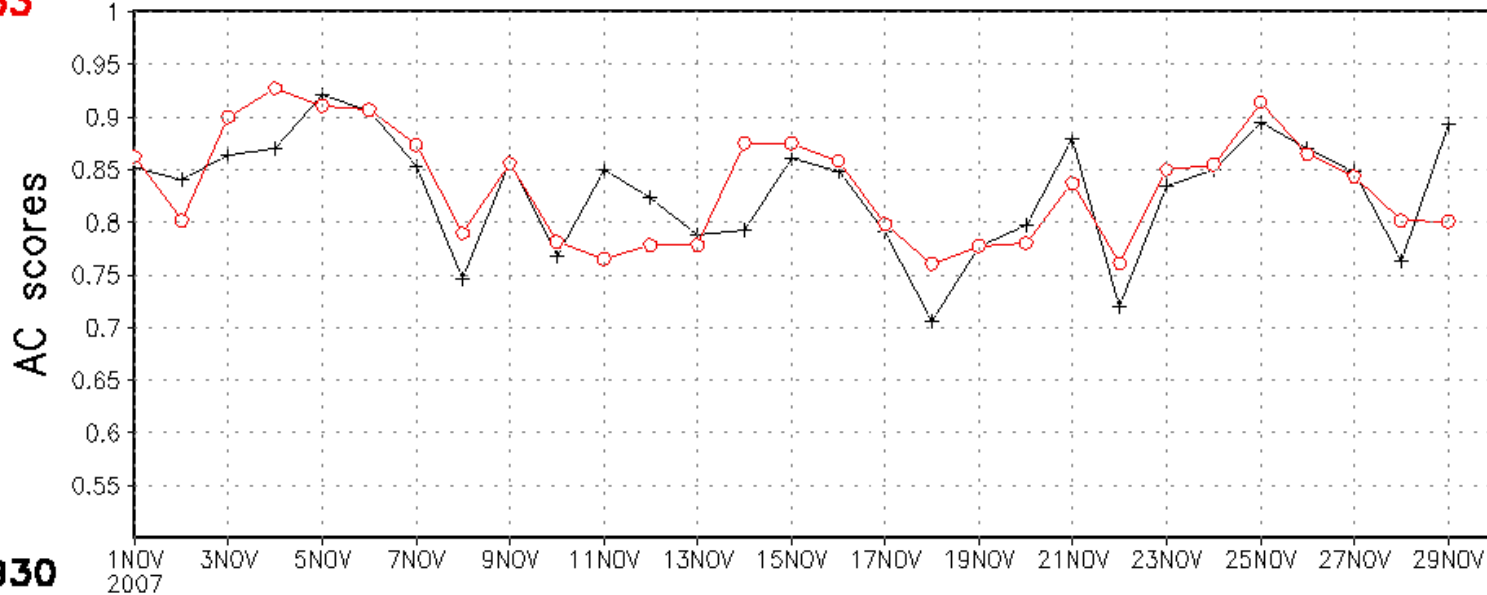
**T126=19.081**  
**T190=17.565**



### NH 500 hPa Geopotential Height at day 5 for 00Z01NOV2007 – 00Z30NOV2007

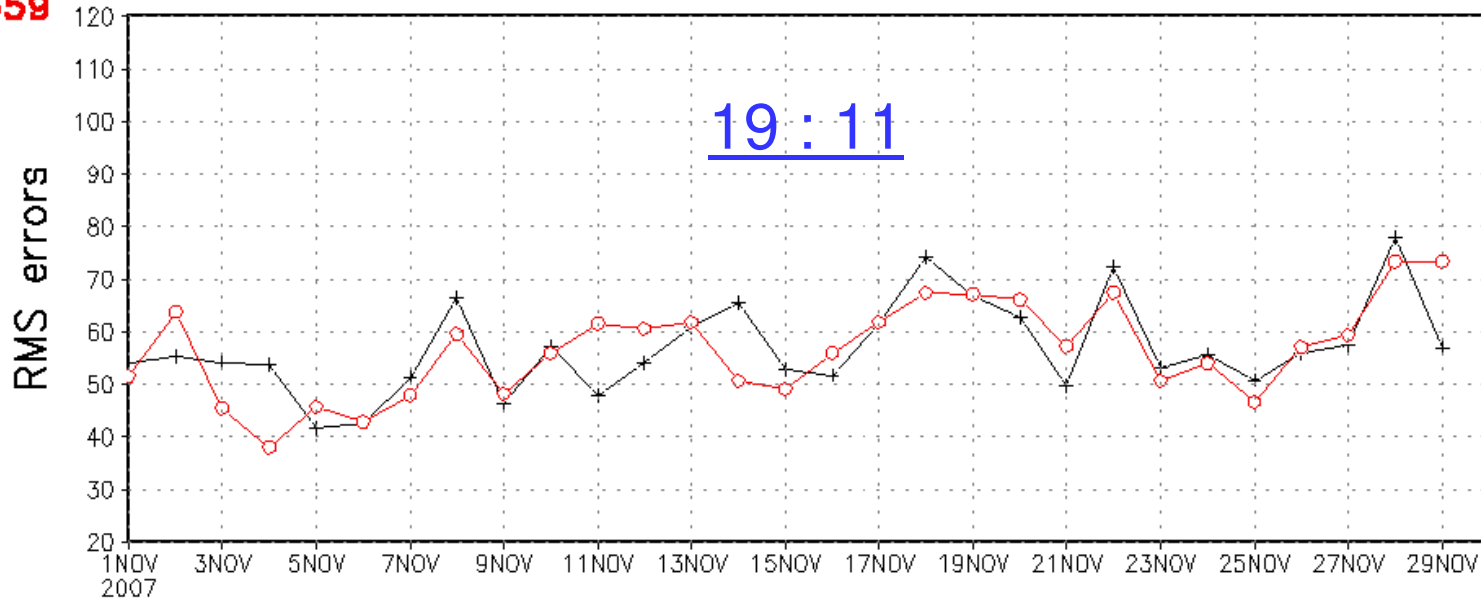
**T126=0.829**

**T190=0.833**



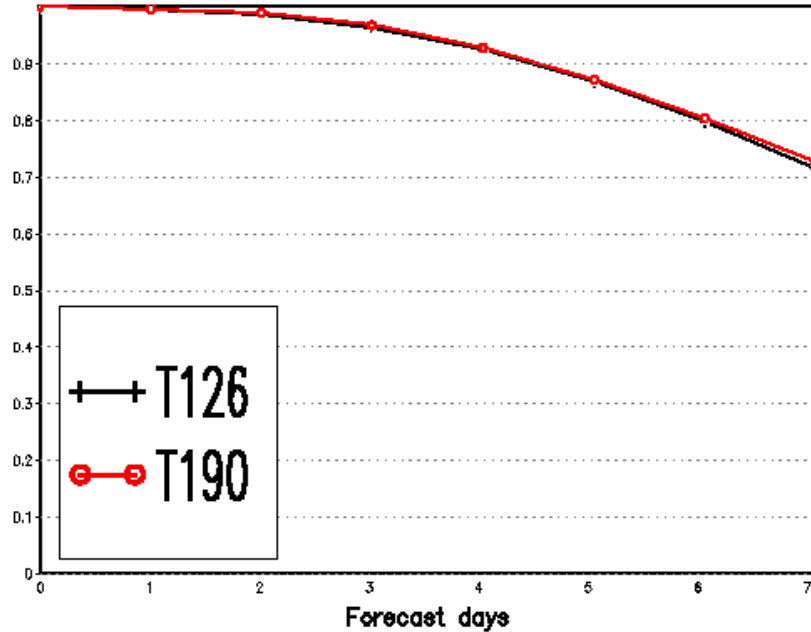
**T126=56.930**

**T190=56.559**

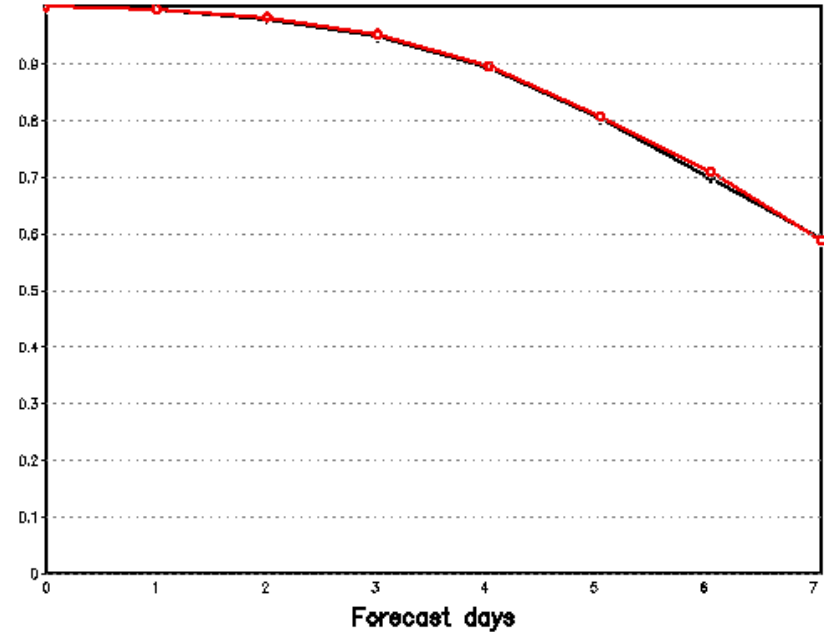


# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

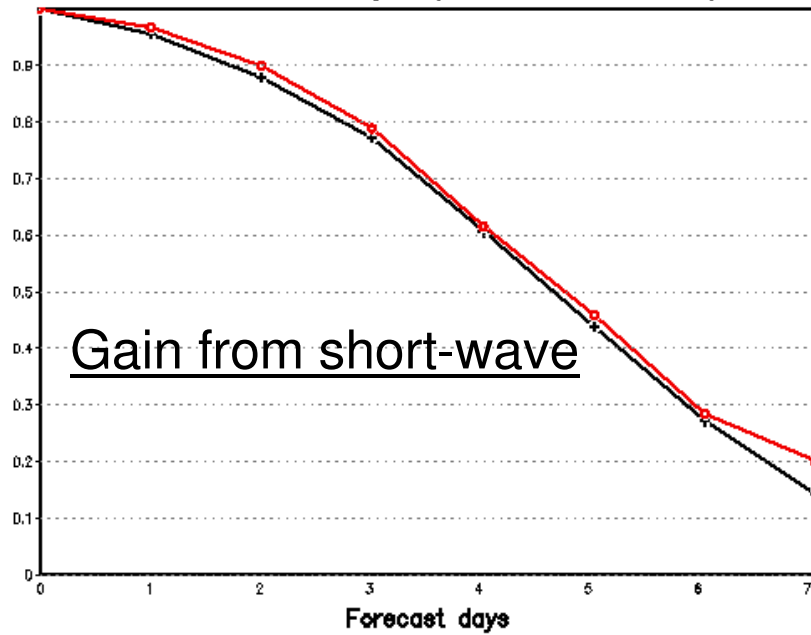
NH 500 mb Height ( wave 1-3 AC )



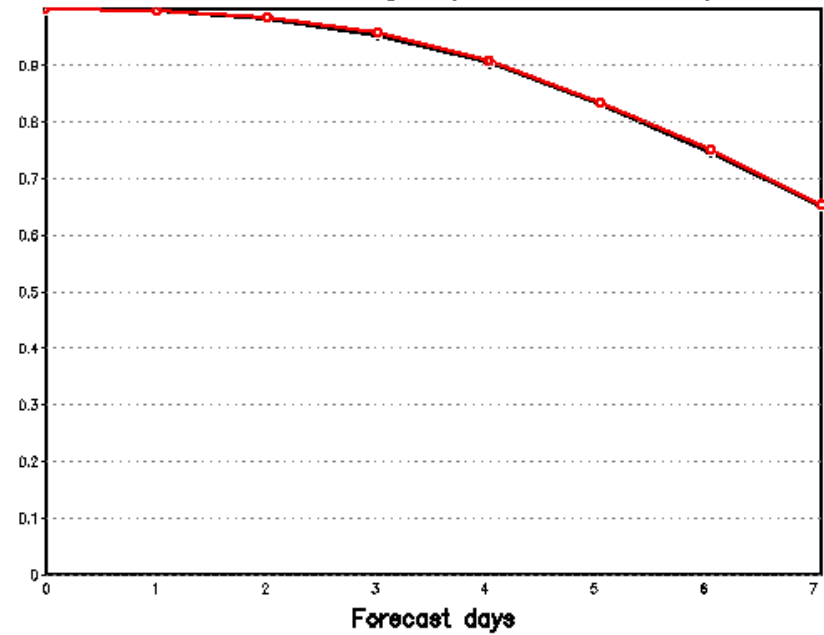
NH 500 mb Height ( wave 4-9 AC )



NH 500 mb Height ( wave 10-20 AC )

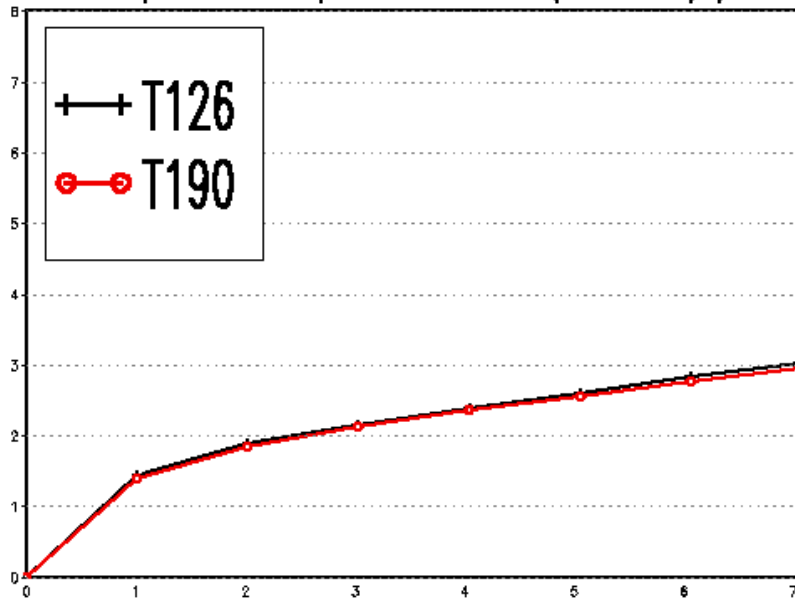


NH 500 mb Height ( wave 1-20 AC )

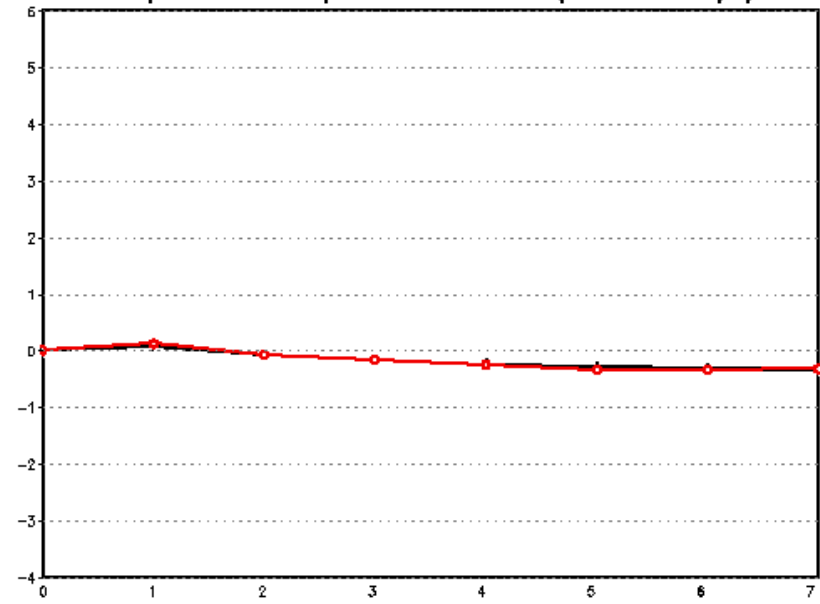


# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

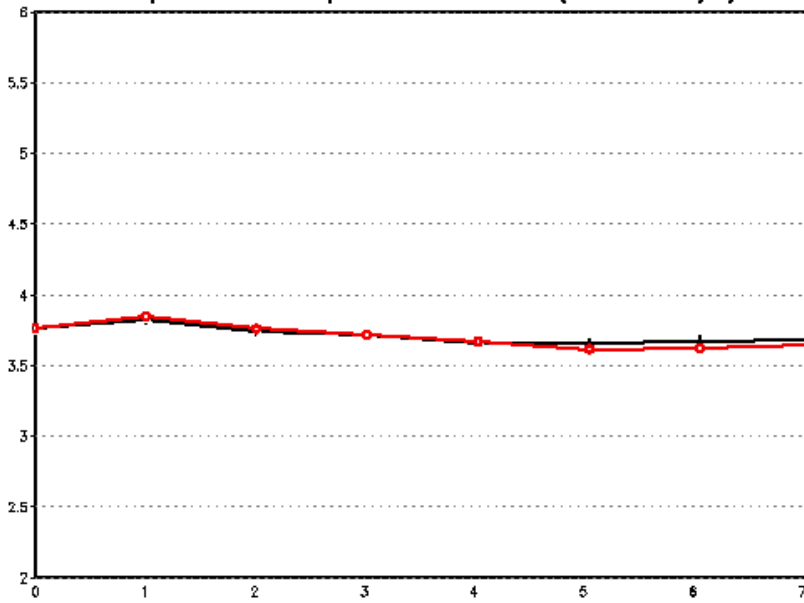
Tropical wind spd at 850 mb (F-A rms) )



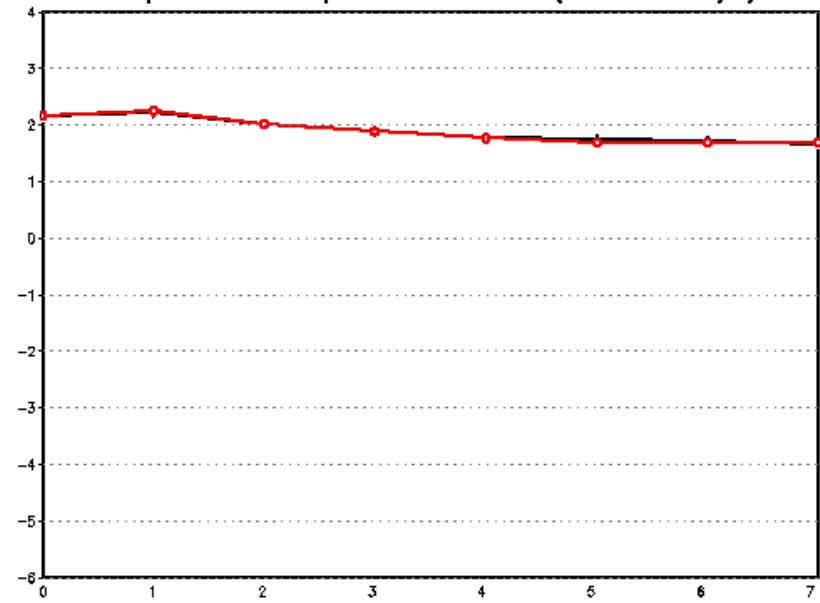
Tropical wind spd at 850 mb (F-A mean) )



Tropical wind spd at 850 mb (F-C rms) )

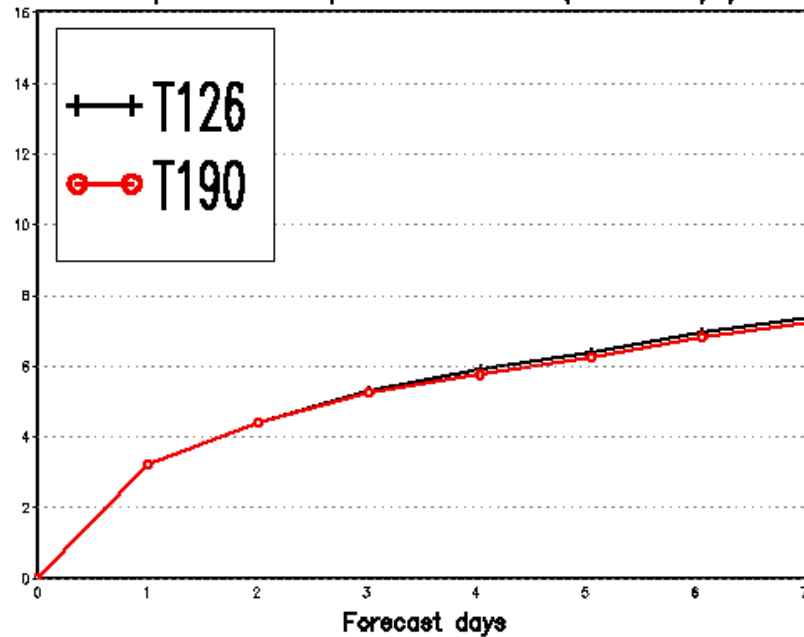


Tropical wind spd at 850 mb (F-C mean) )

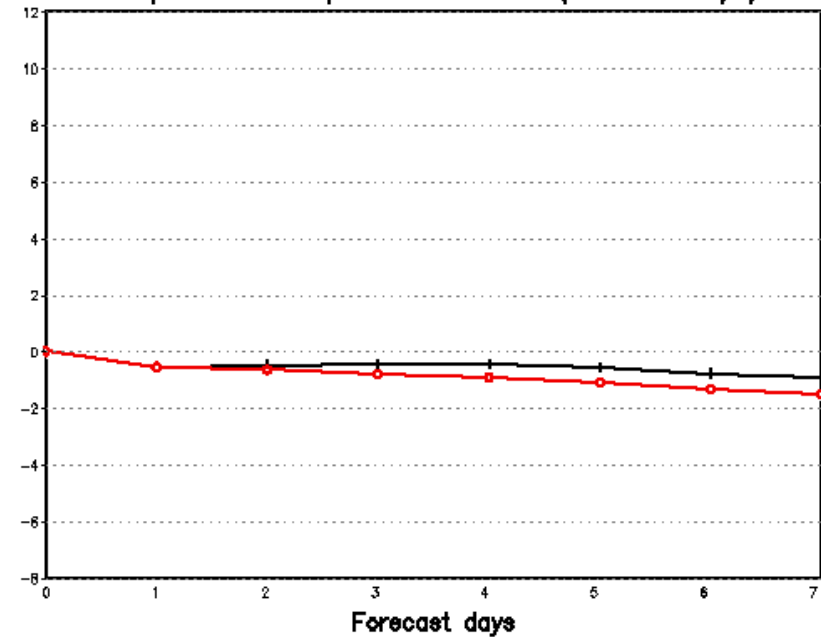


# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

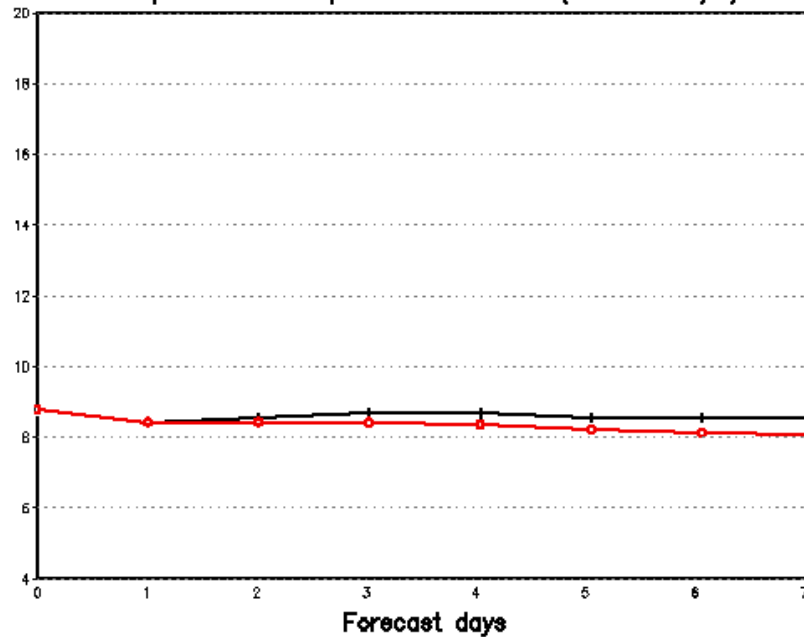
Tropical wind spd at 200 mb (F-A rms) )



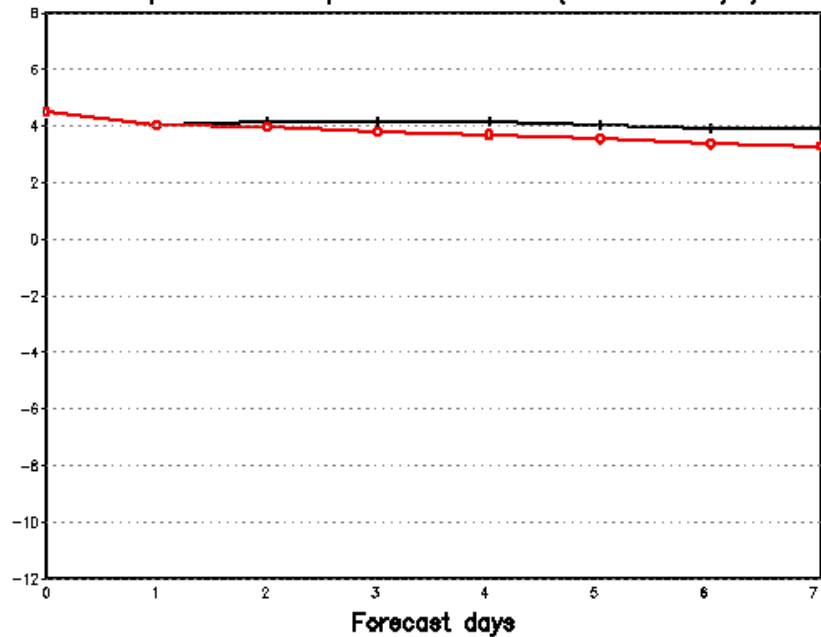
Tropical wind spd at 200 mb (F-A mean) )



Tropical wind spd at 200 mb (F-C rms) )



Tropical wind spd at 200 mb (F-C mean) )

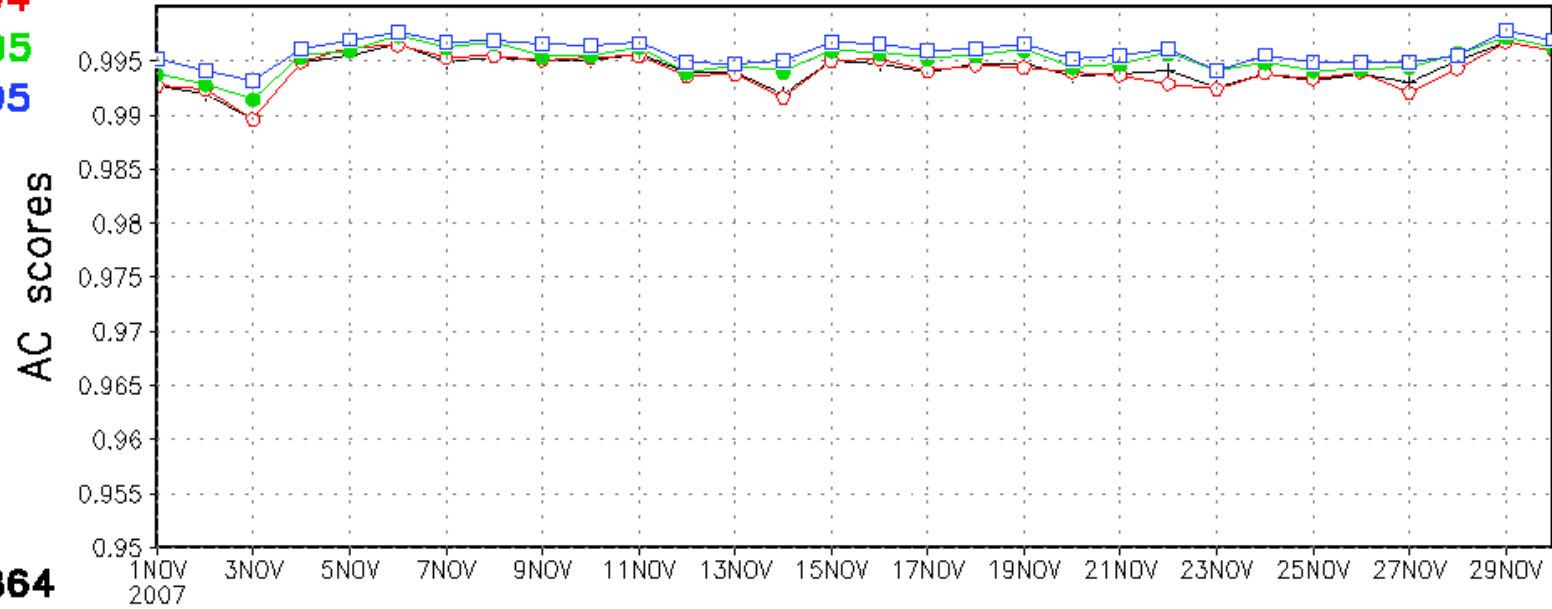


## More comparison:

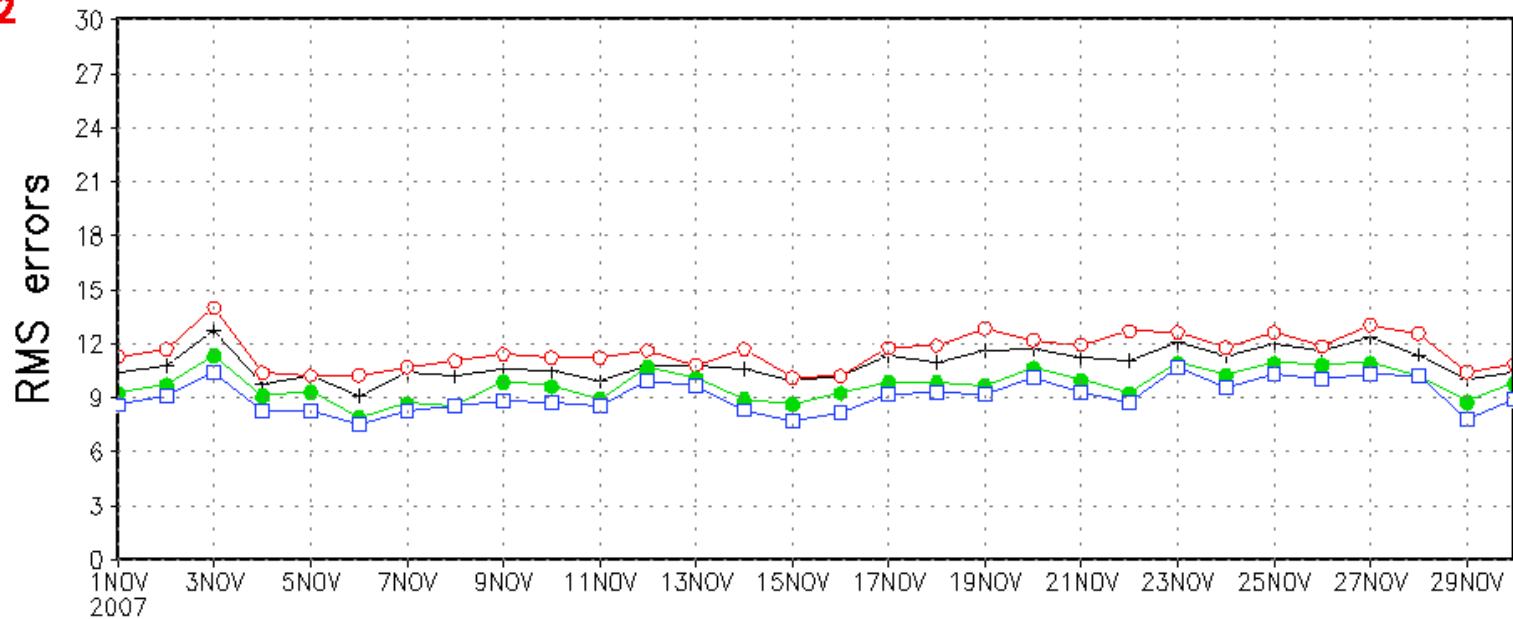
1. T126L28 (F28)
2. T126L64 (F64)
3. T190L28 (190)
4. T382L64 (GFS)

# NH 500 hPa Geopotential Height at day 1 for 00Z01NOV2007 – 00Z30NOV2007

**F28=0.994**  
**F64=0.994**  
**190=0.995**  
**GFS=0.995**



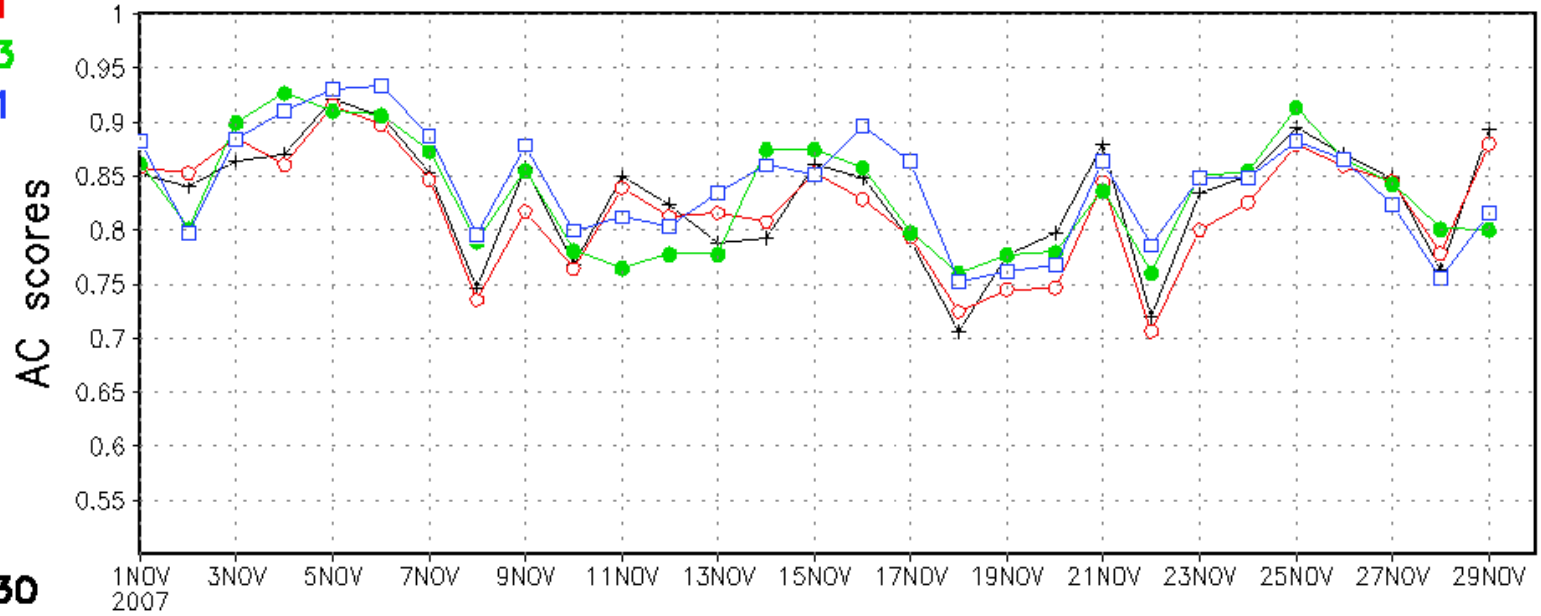
**F28=10.864**  
**F64=11.562**  
**190=9.752**  
**GFS=9.086**



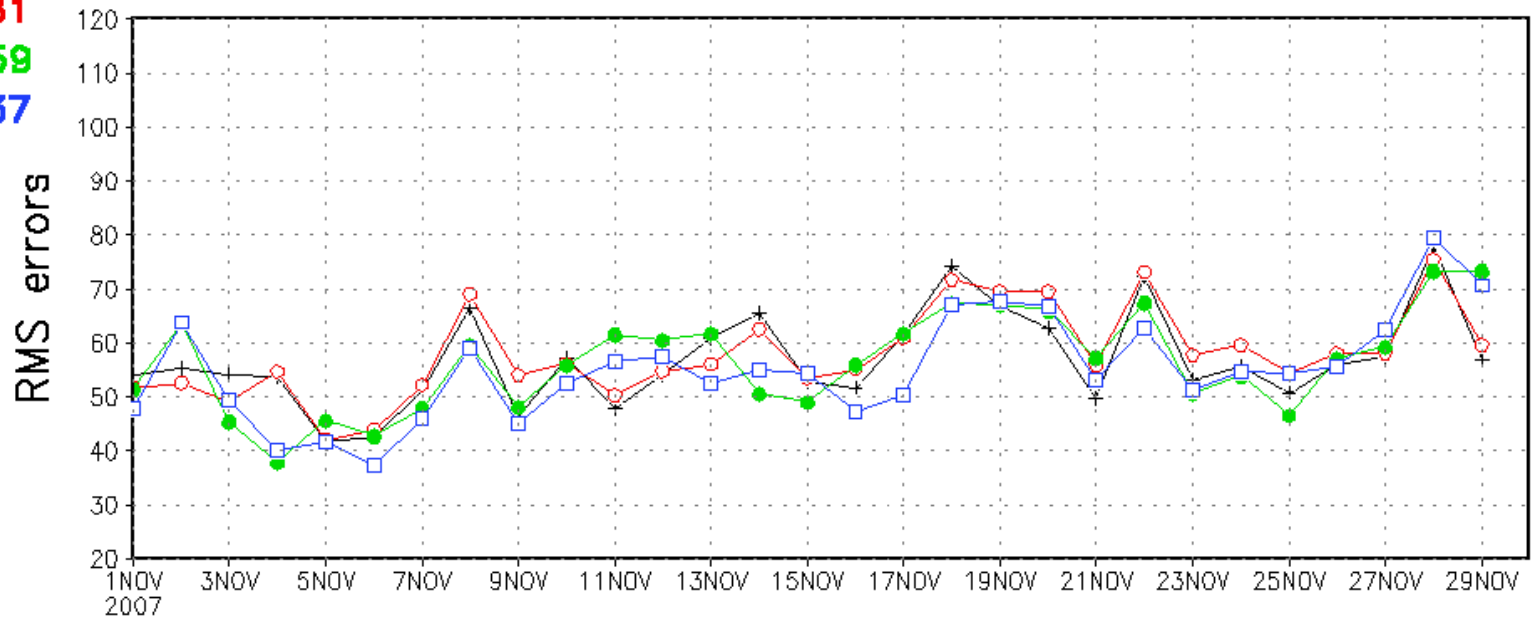


### NH 500 hPa Geopotential Height at day 5 for 00Z01NOV2007 – 00Z30NOV2007

**F28=0.829**  
**F64=0.821**  
**190=0.833**  
**GFS=0.841**

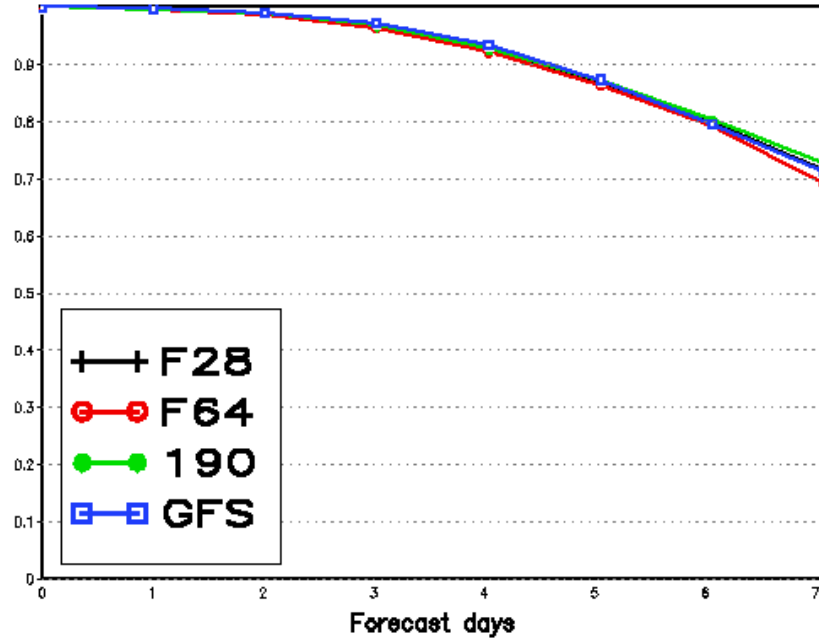


**F28=56.930**  
**F64=57.981**  
**190=56.559**  
**GFS=55.237**

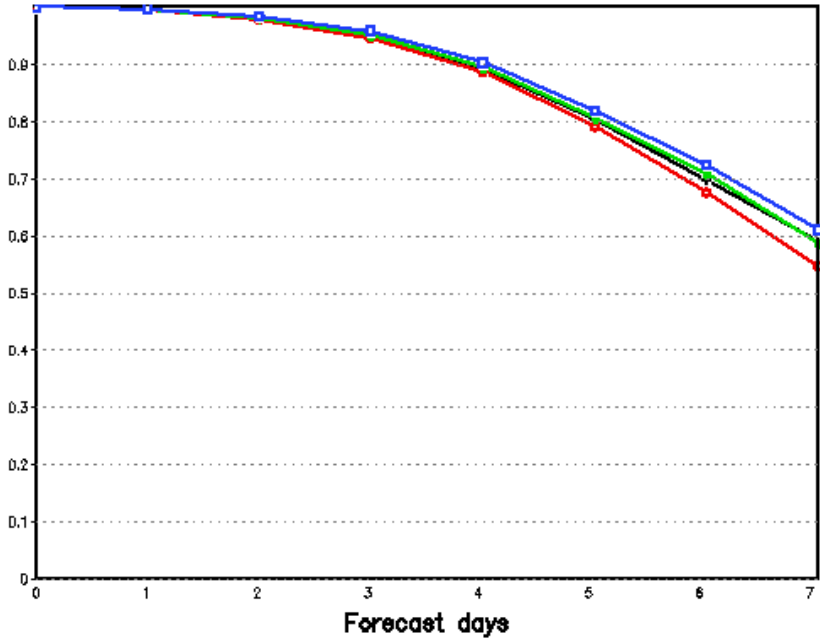


# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

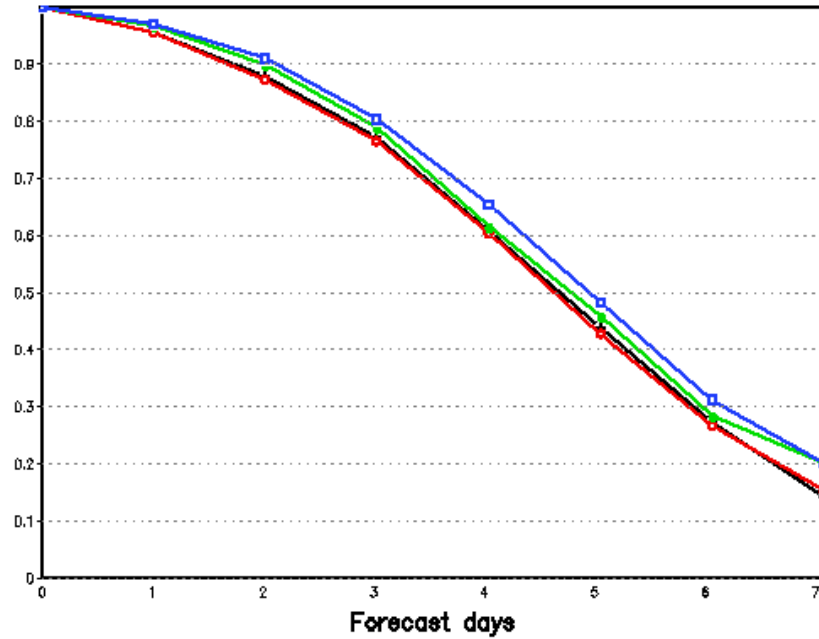
NH 500 mb Height ( wave 1–3 AC )



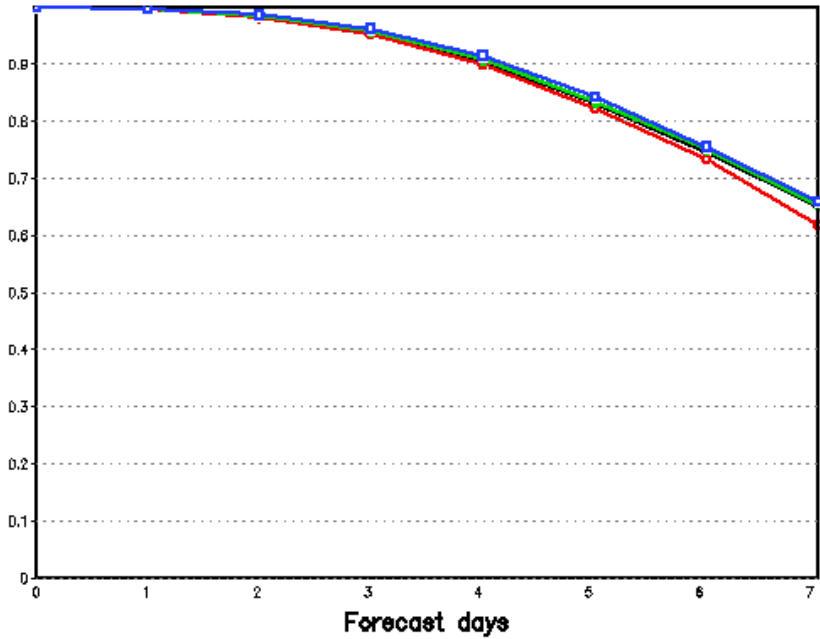
NH 500 mb Height ( wave 4–9 AC )



NH 500 mb Height ( wave 10–20 AC )

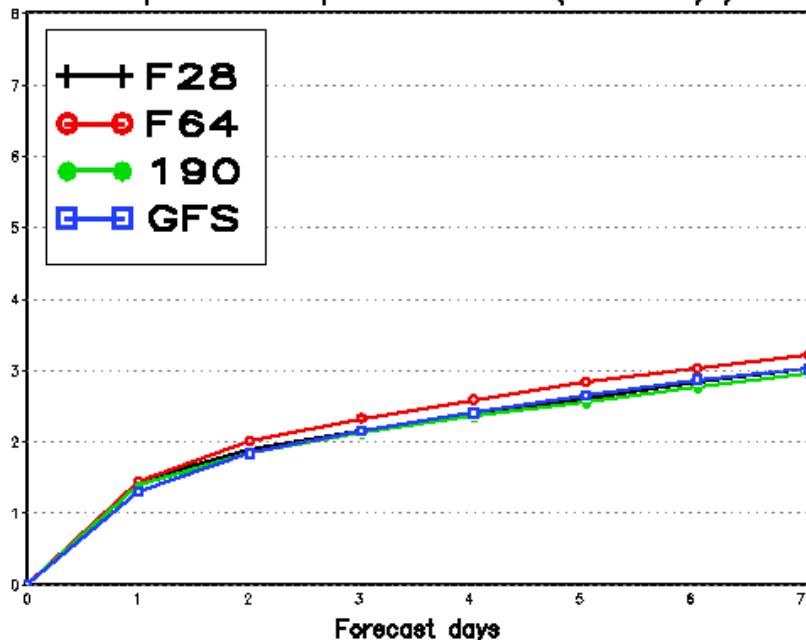


NH 500 mb Height ( wave 1–20 AC )

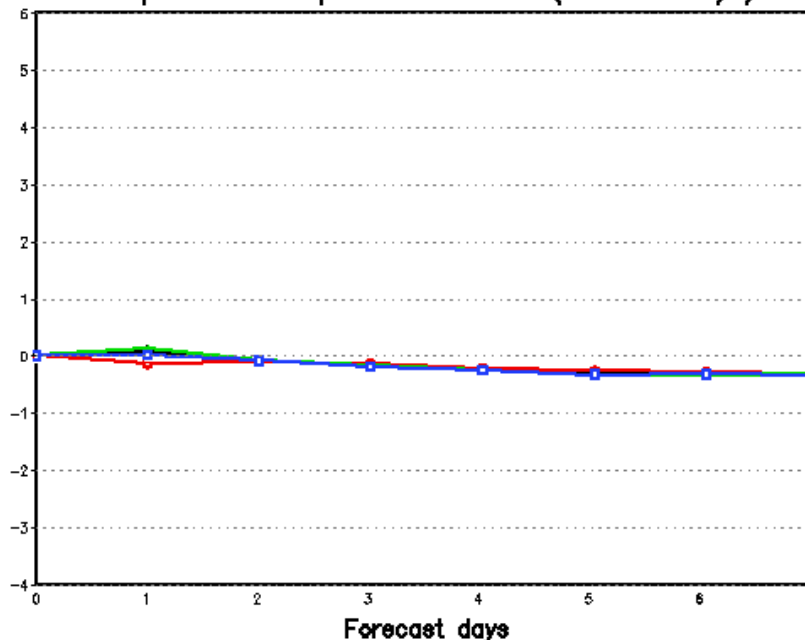


# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

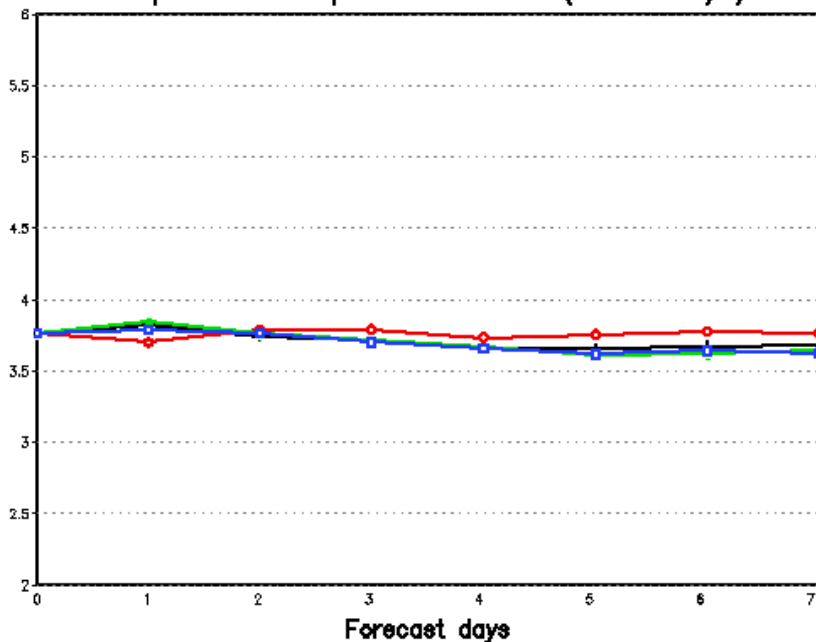
Tropical wind spd at 850 mb (F-A rms)



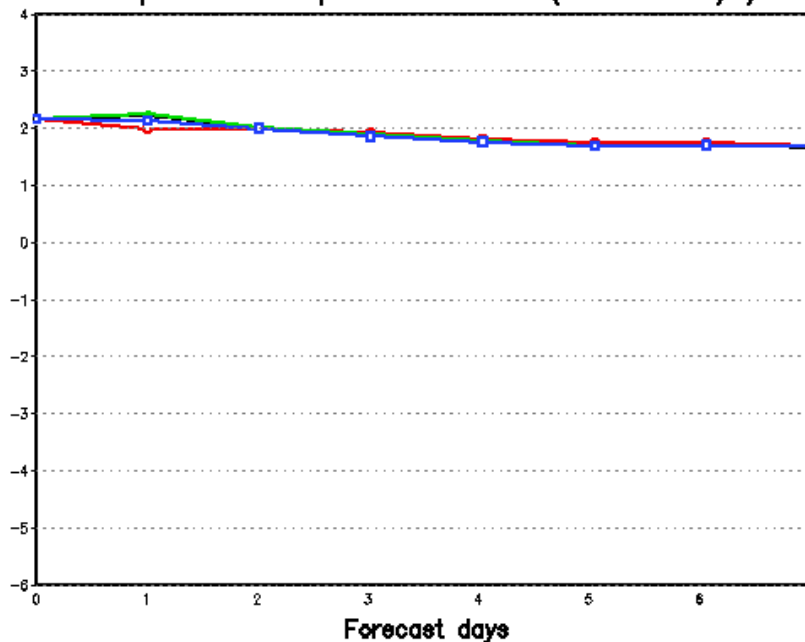
Tropical wind spd at 850 mb (F-A mean)



Tropical wind spd at 850 mb (F-C rms)



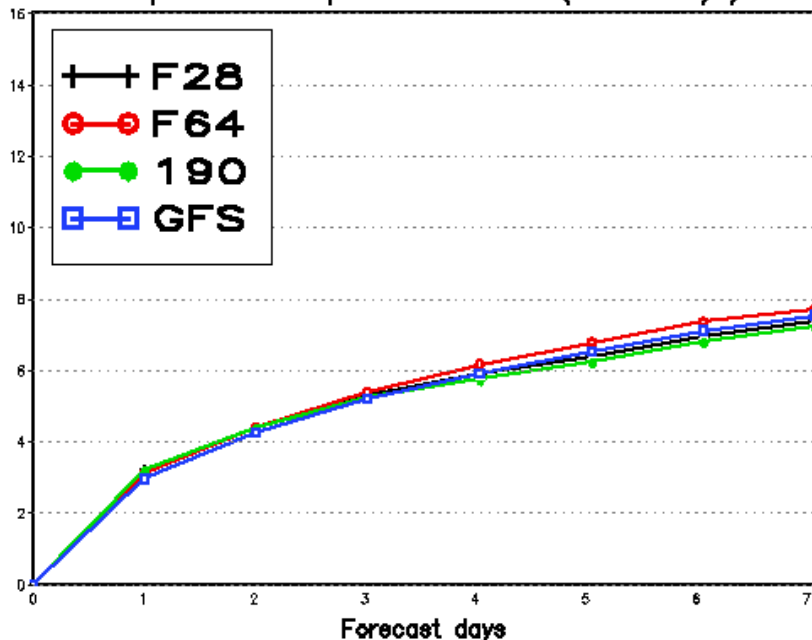
Tropical wind spd at 850 mb (F-C mean)



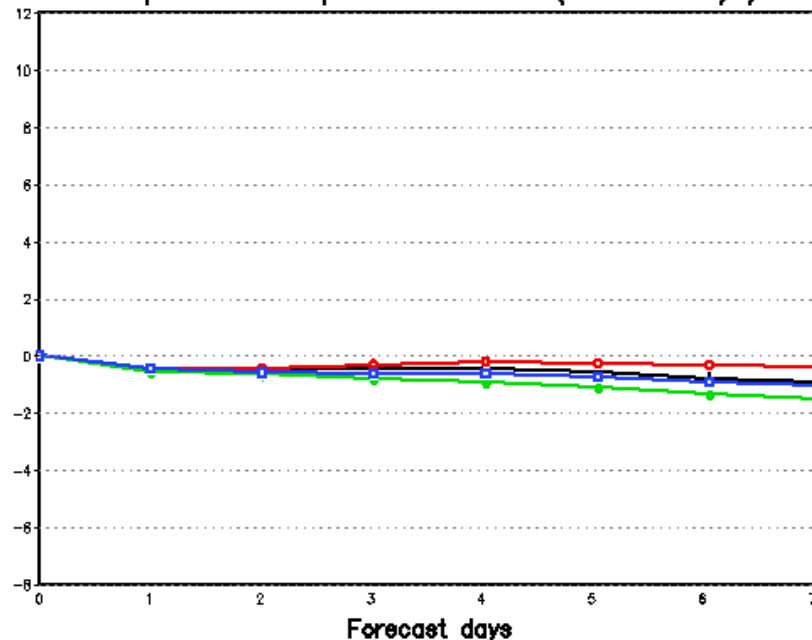
# AVERAGE FOR 00Z01NOV2007 – 00Z30NOV2007

)

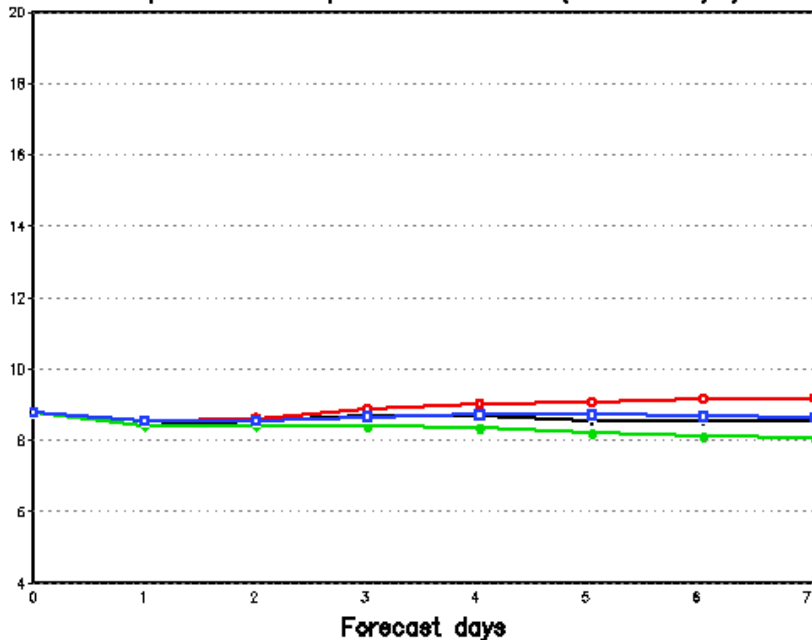
Tropical wind spd at 200 mb (F-A rms)



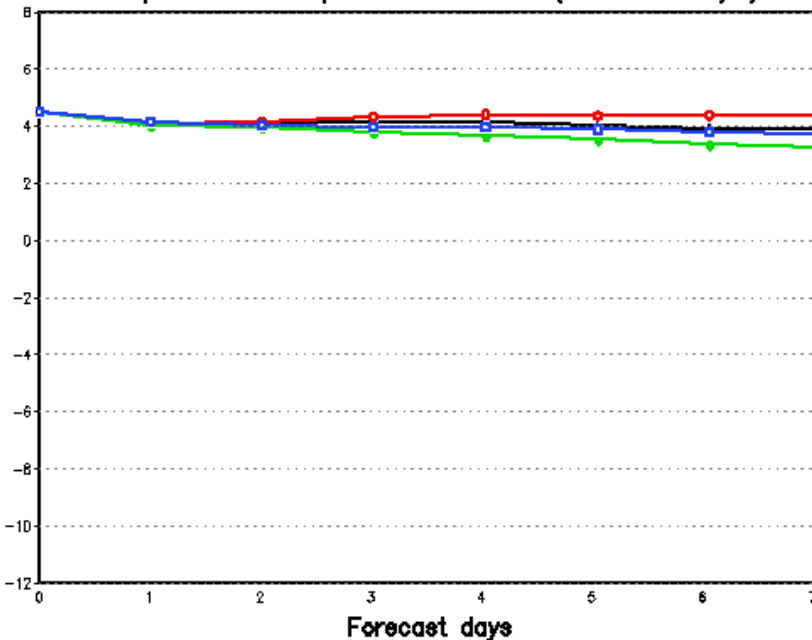
Tropical wind spd at 200 mb (F-A mean)



Tropical wind spd at 200 mb (F-C rms)



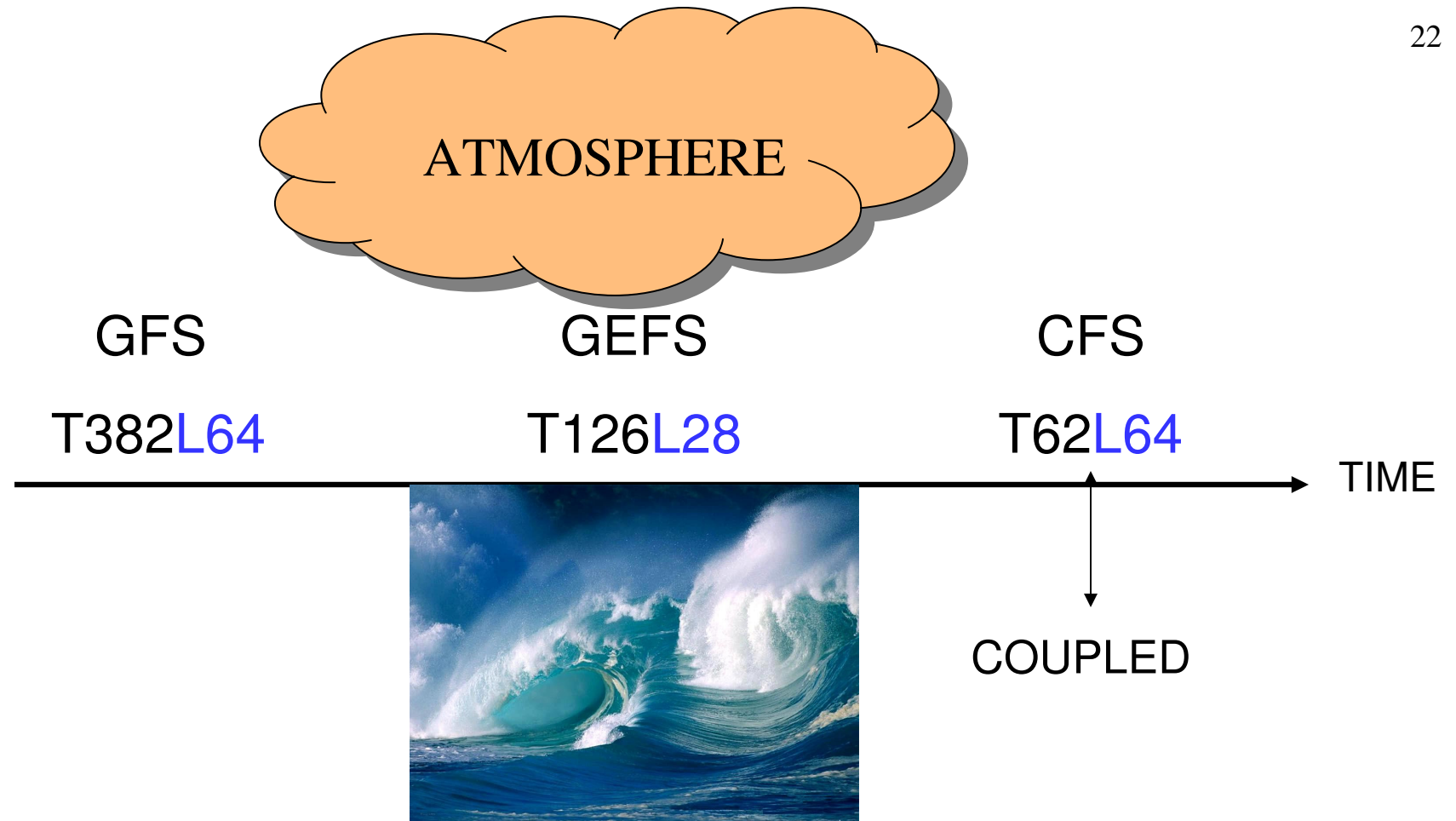
Tropical wind spd at 200 mb (F-C mean)



**CONCLUSION / ANSWER!**

**NO**

**CONFUSION**



BUT THE RESULTS TELL US

**T126L64** IS NOT AS GOOD AS OTHERS

UPTO 7 DAYS

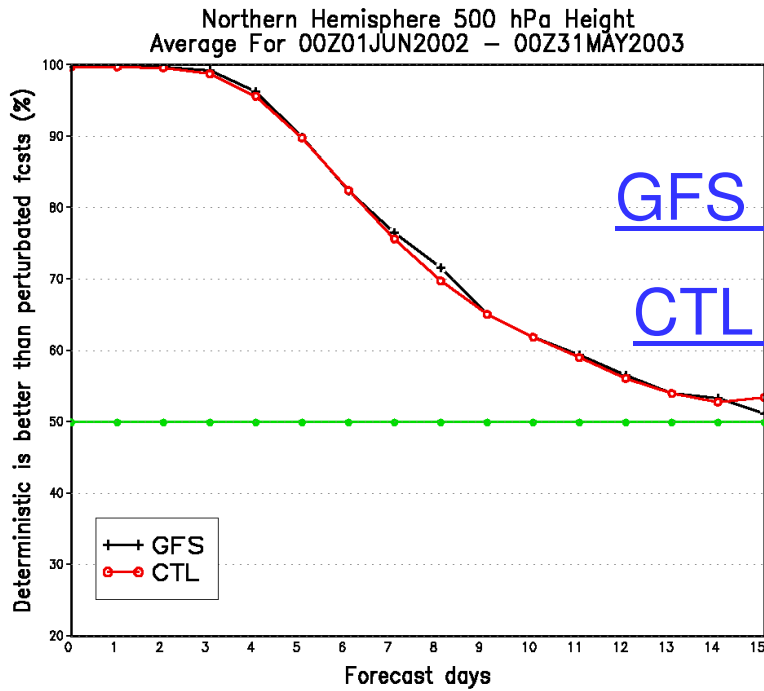
## Glenn's comments for L28/L64

*CFS03—effects of coupling to ocean model and of increasing vertical resolution in atmospheric model*

*--much better simulation in coupled mode with 64 than with 28 levels in atmospheric component*

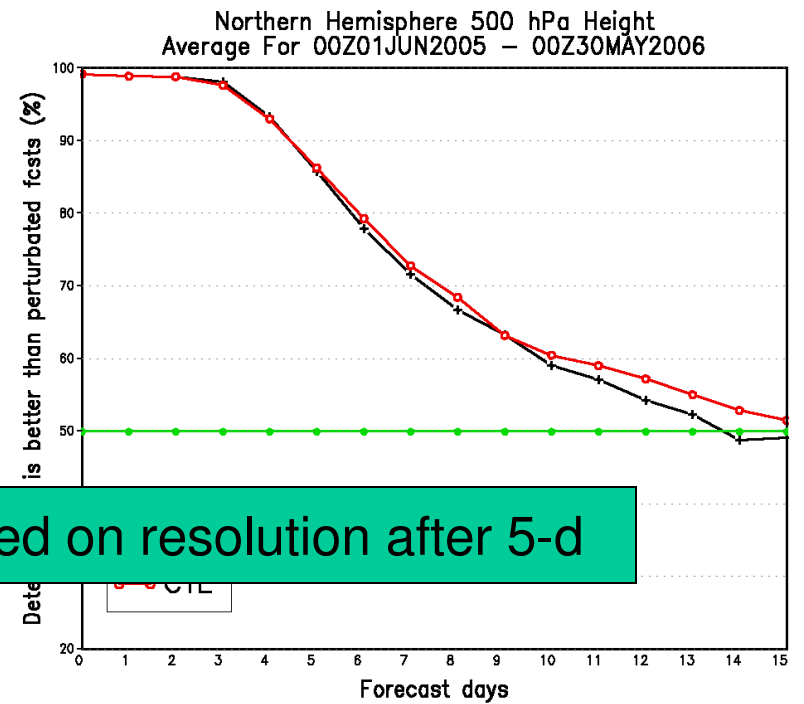
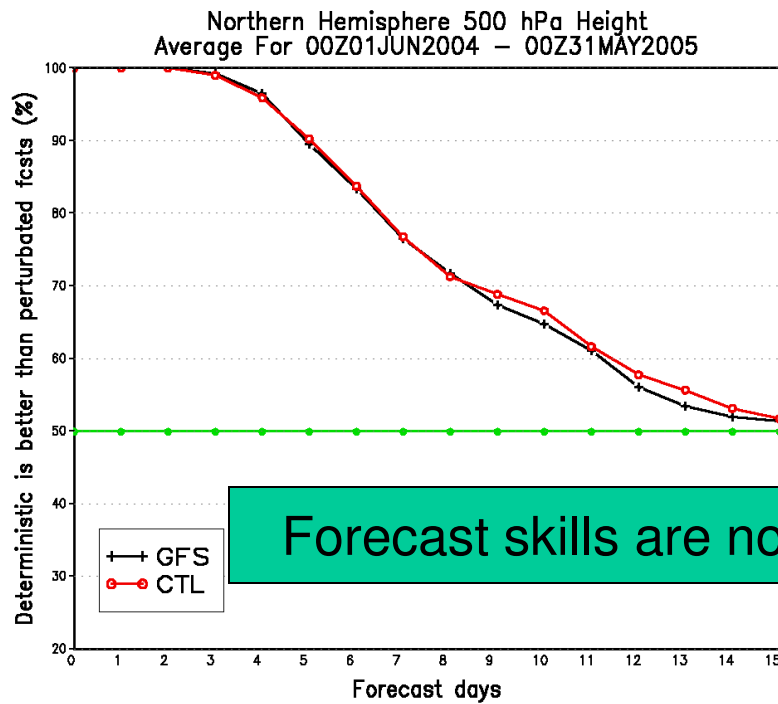
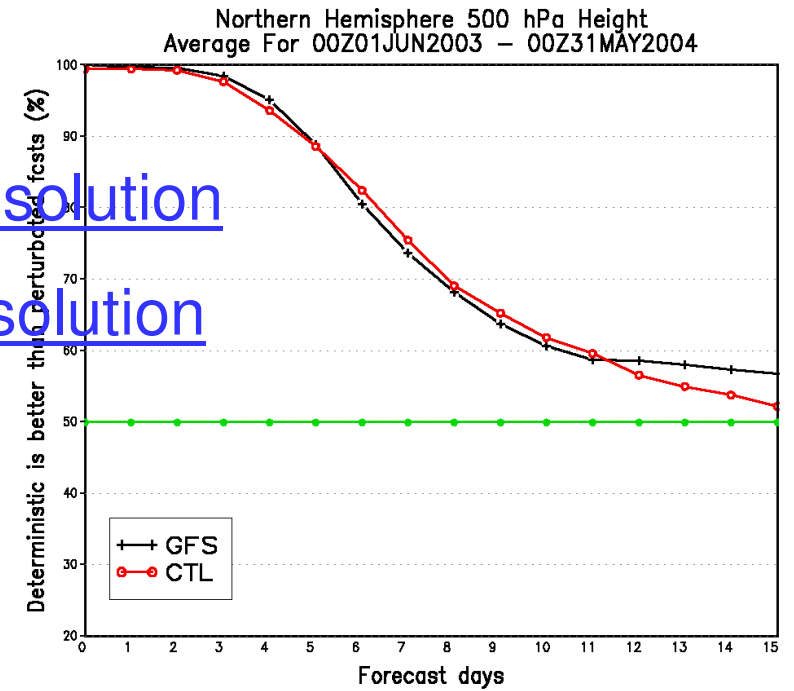
*--differences between 28 and 64 levels show up much more in coupled mode*

Question: Is this for T62 or T126?



GFS – high resolution

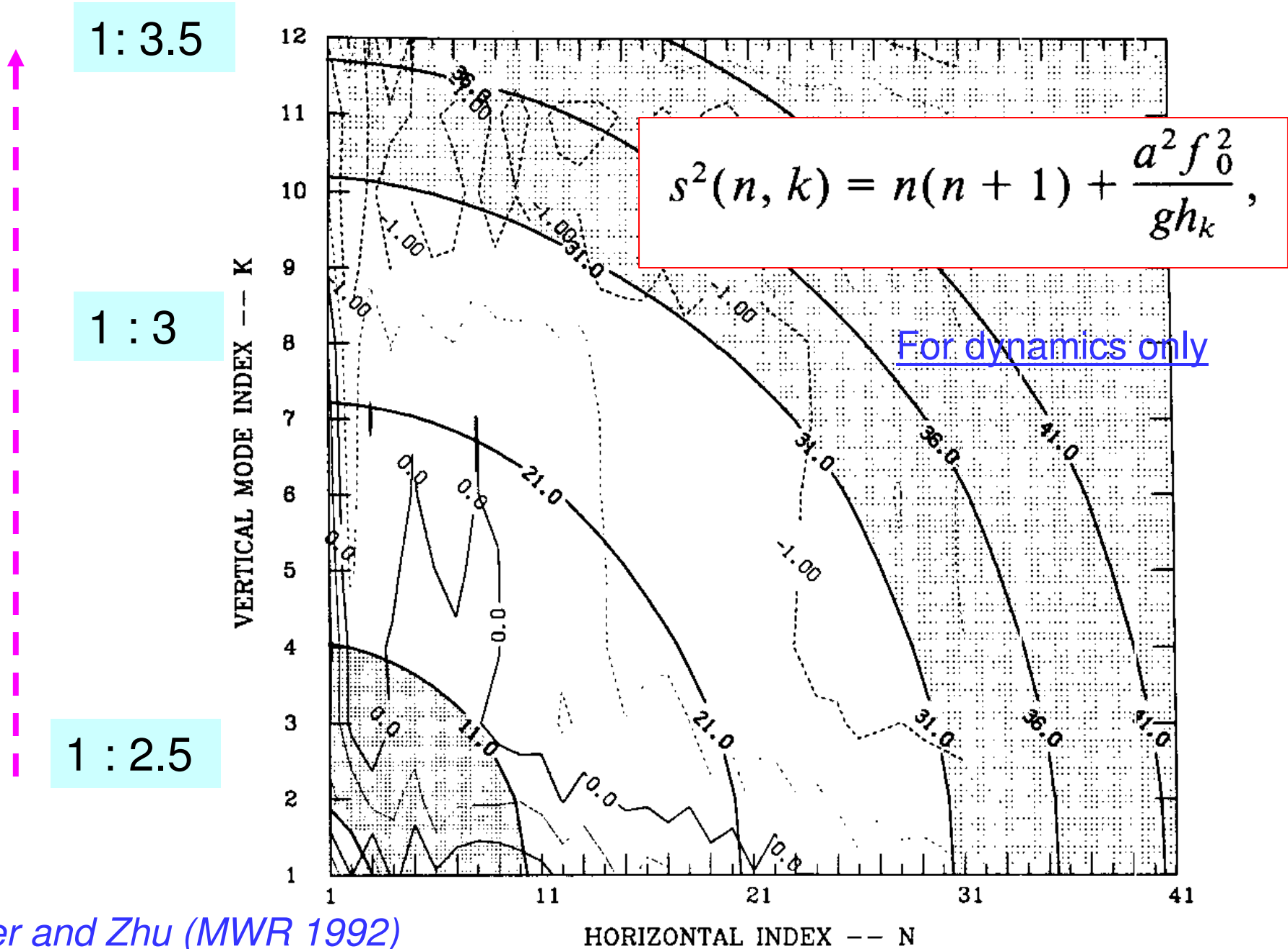
CTL – low resolution



Forecast skills are not depended on resolution after 5-d



What is the optimal vertical resolution corresponds to horizontal? <sup>25</sup>



[Baer and Zhu \(MWR 1992\)](#)

WHERE TO GO?



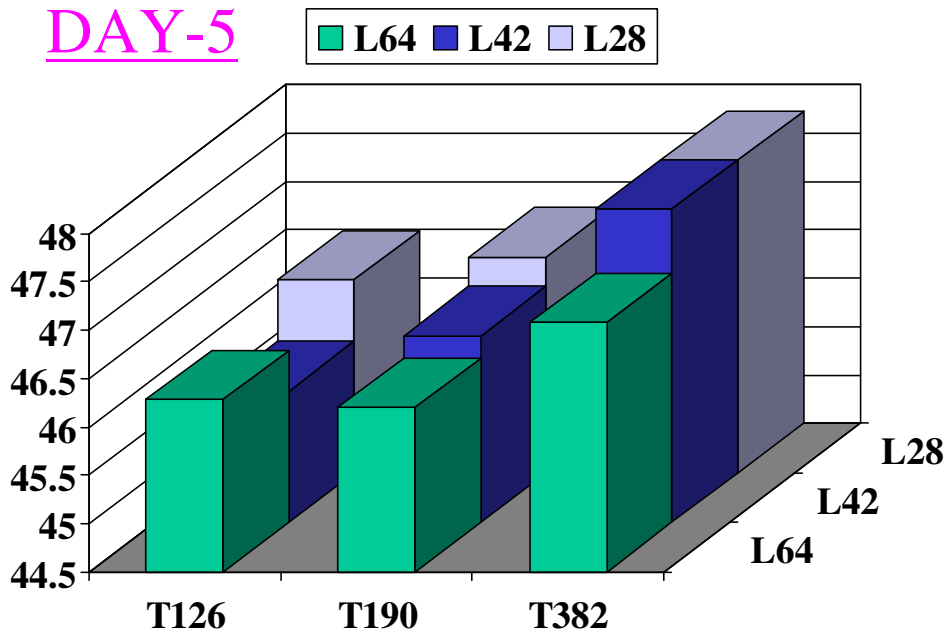
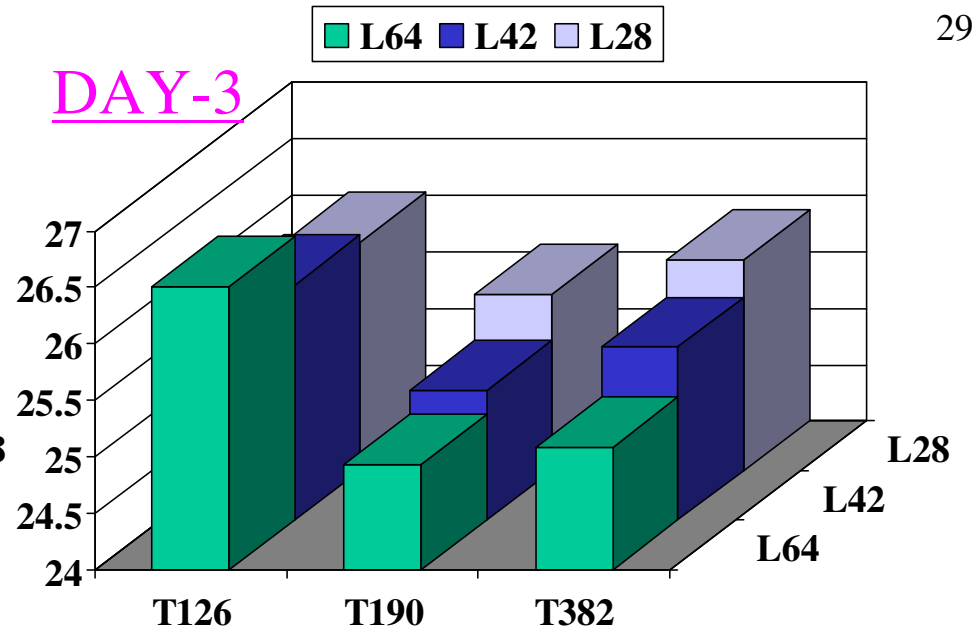
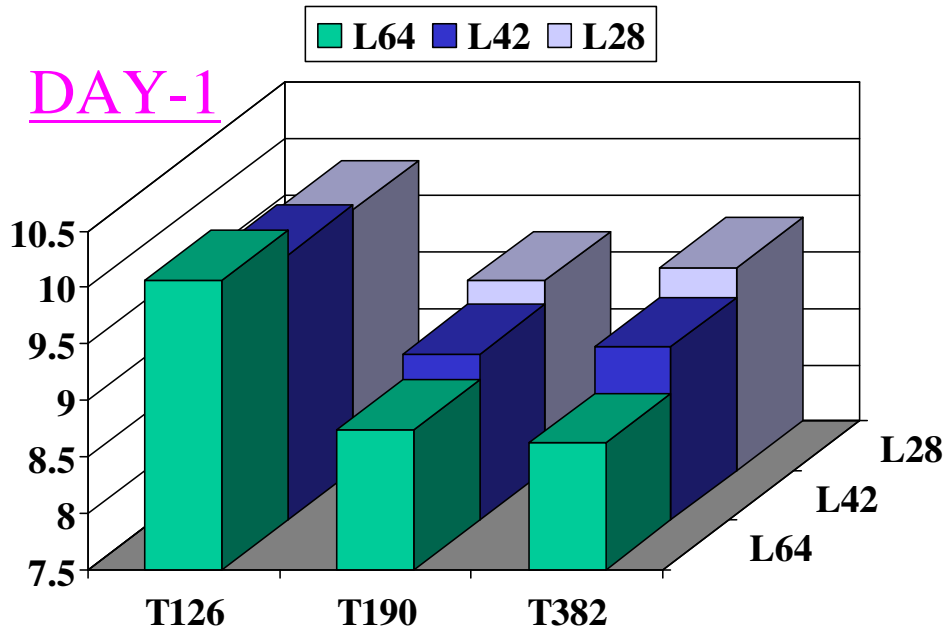
# Full comparison

May 2<sup>nd</sup>-31<sup>st</sup> and November 1<sup>st</sup>-30<sup>th</sup>

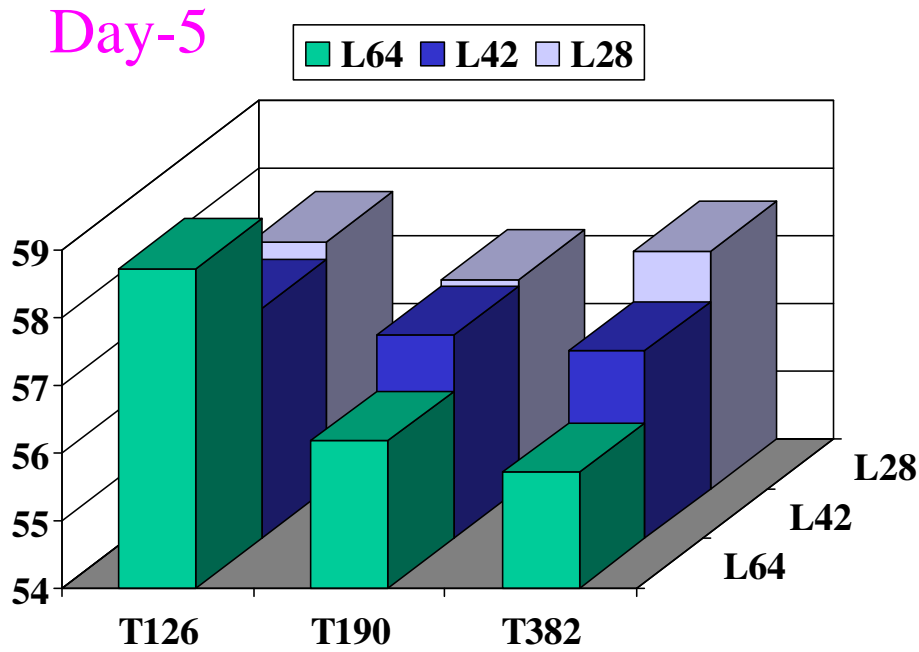
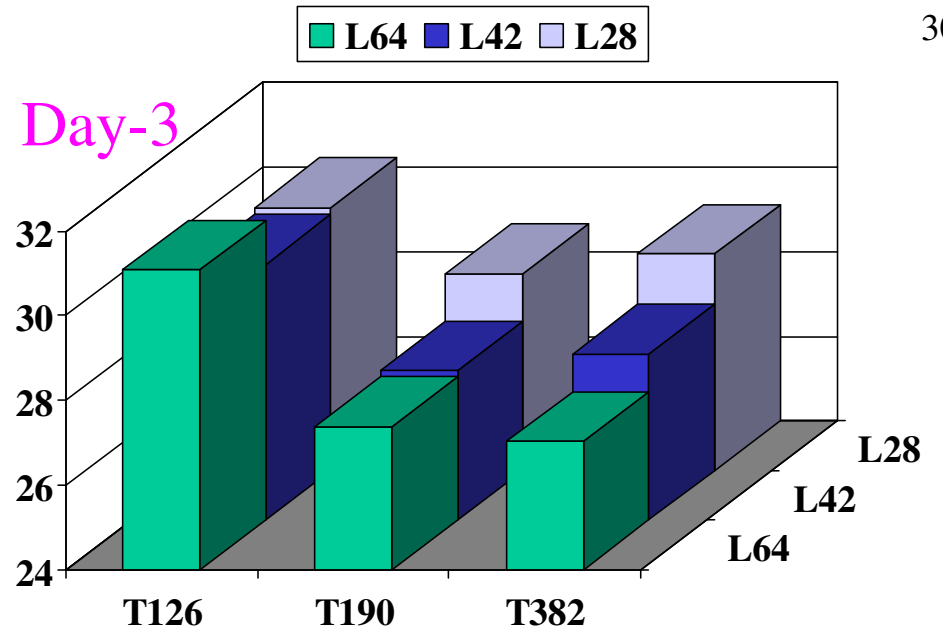
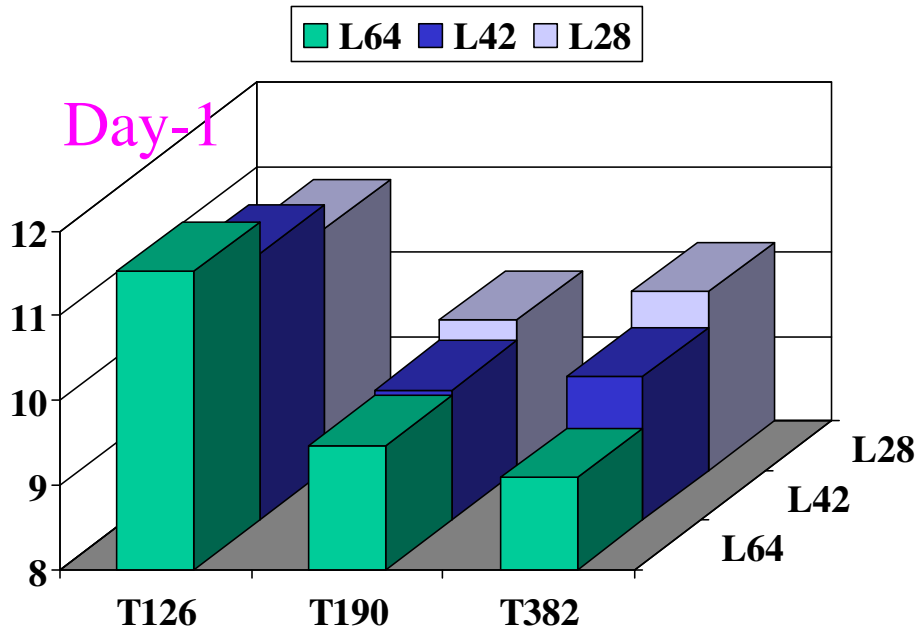
T382L64, T382L42, T382L28

T190L64, T190L42, T190L28

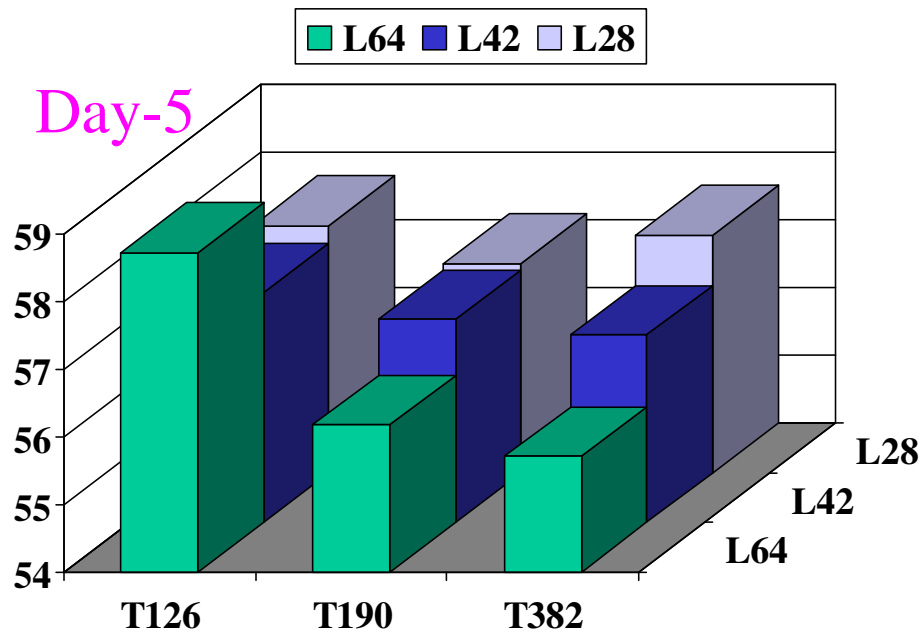
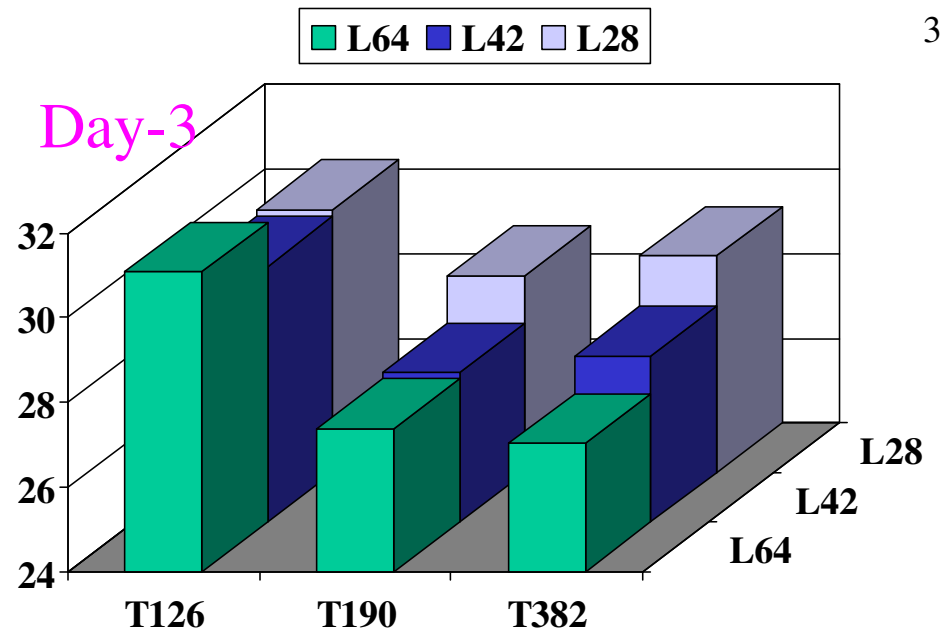
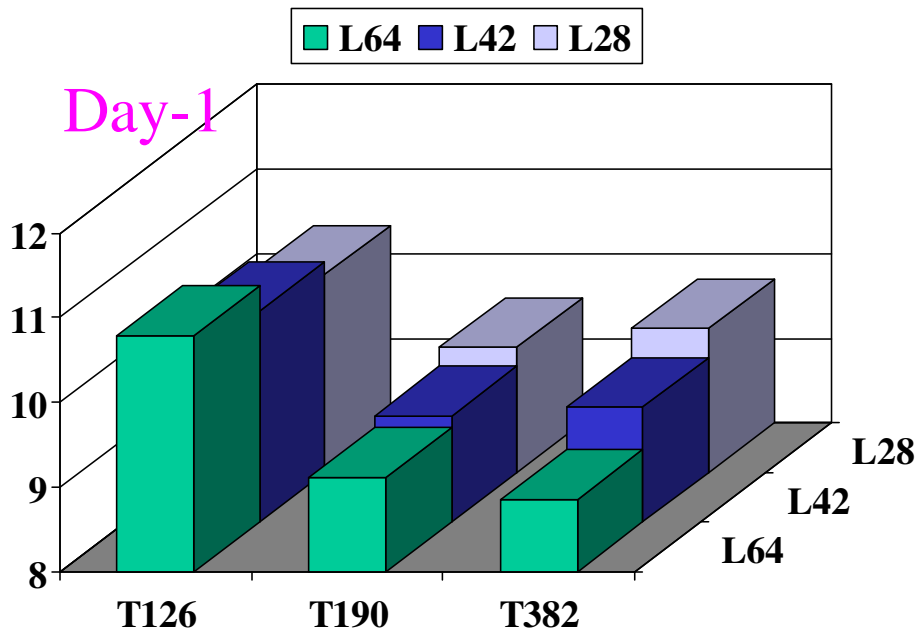
T126L64, T126L42, T126L28



May 2007



Nov. 2007



May and Nov. 2007

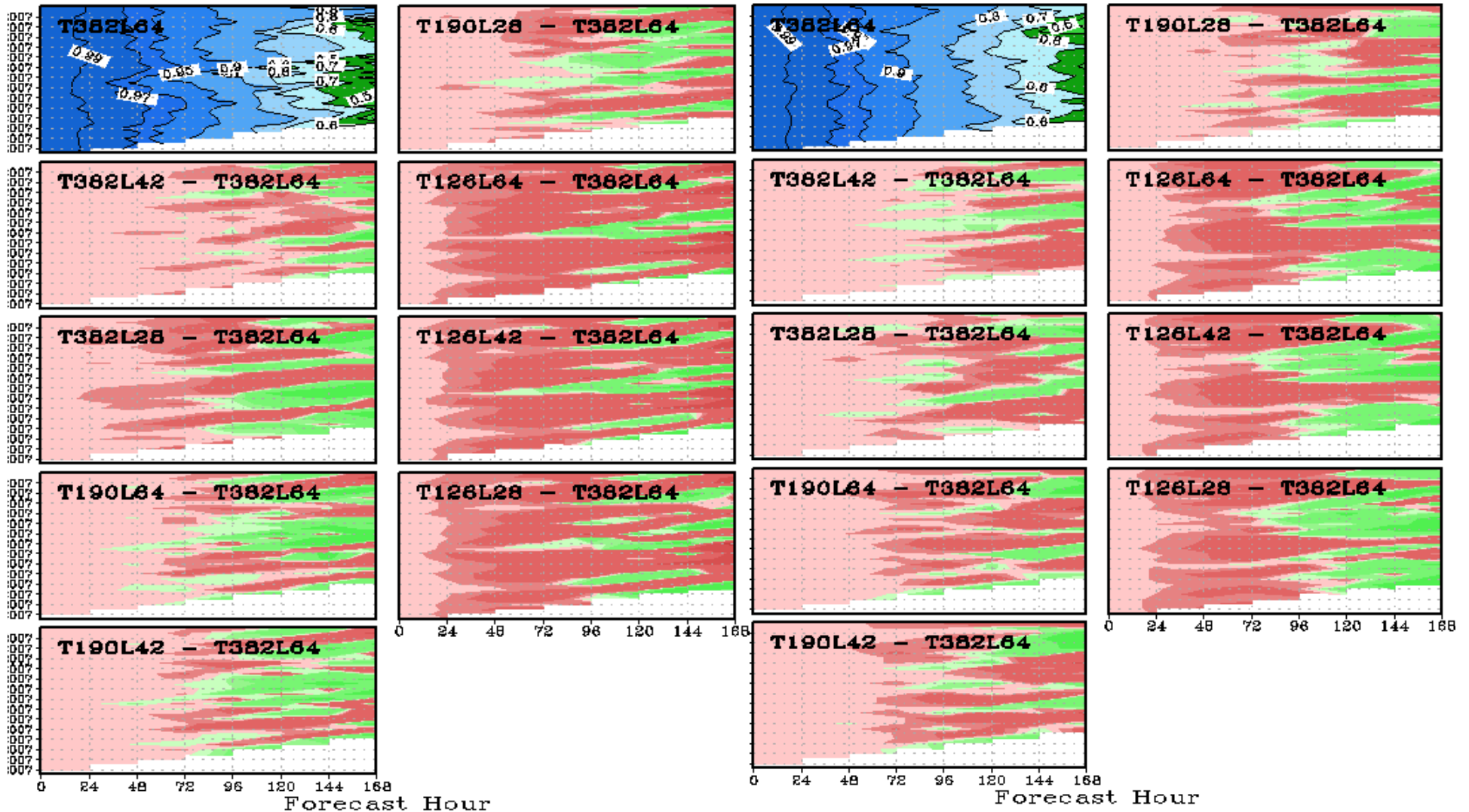
# May 2007 1000hPa height

## Northern Hemisphere

## Global

Anomaly Correlation: HGT P1000 G2/NHX 00Z

Anomaly Correlation: HGT P1000 G2 00Z



Thanks Fanglin Yang for these plots!



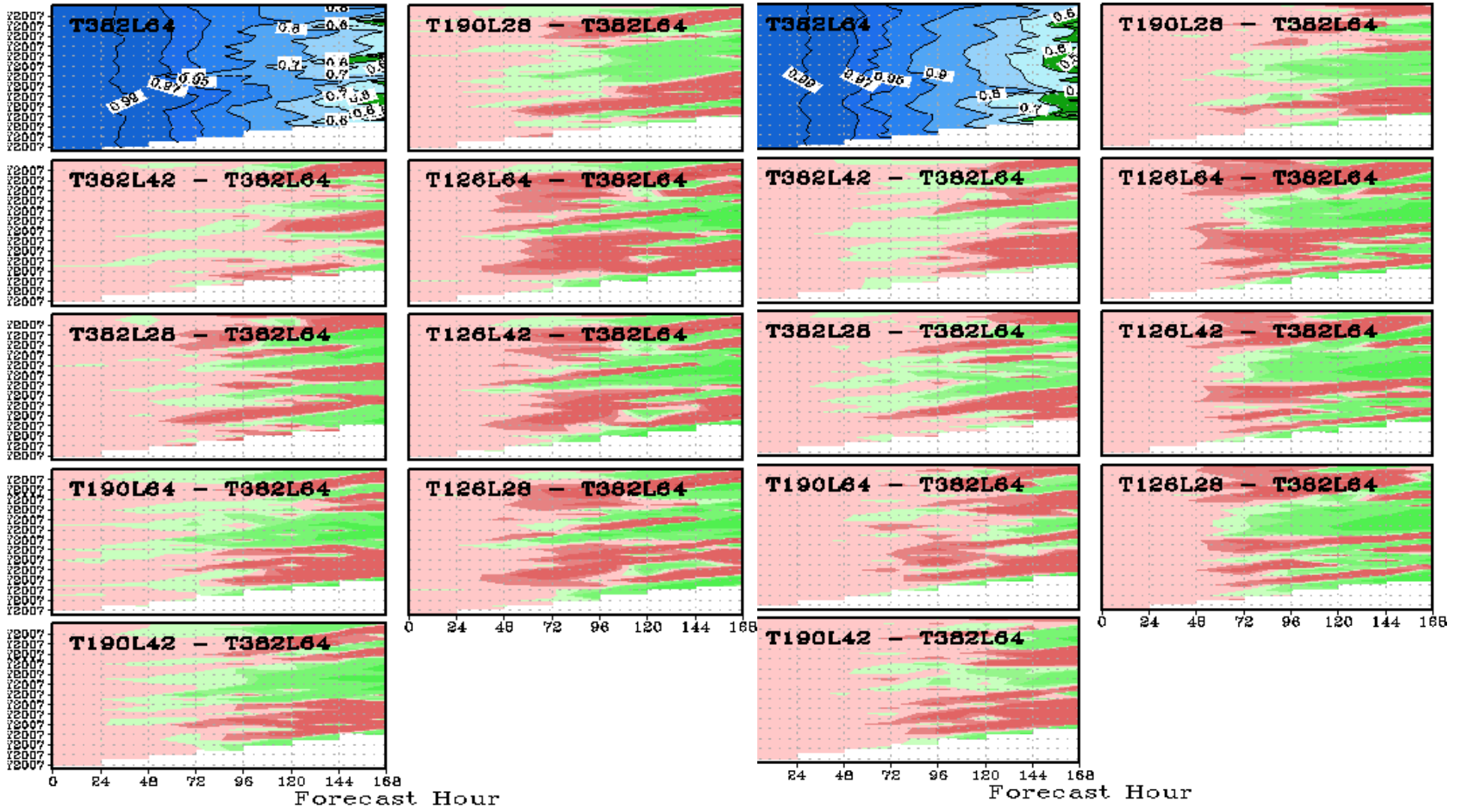
# May 2007 250hPa height

## Northern Hemisphere

## Global

Anomaly Correlation: HGT P250 G2/NHX 00Z

Anomaly Correlation: HGT P250 G2 00Z



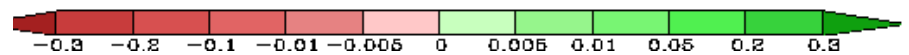
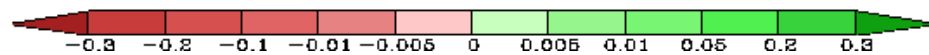
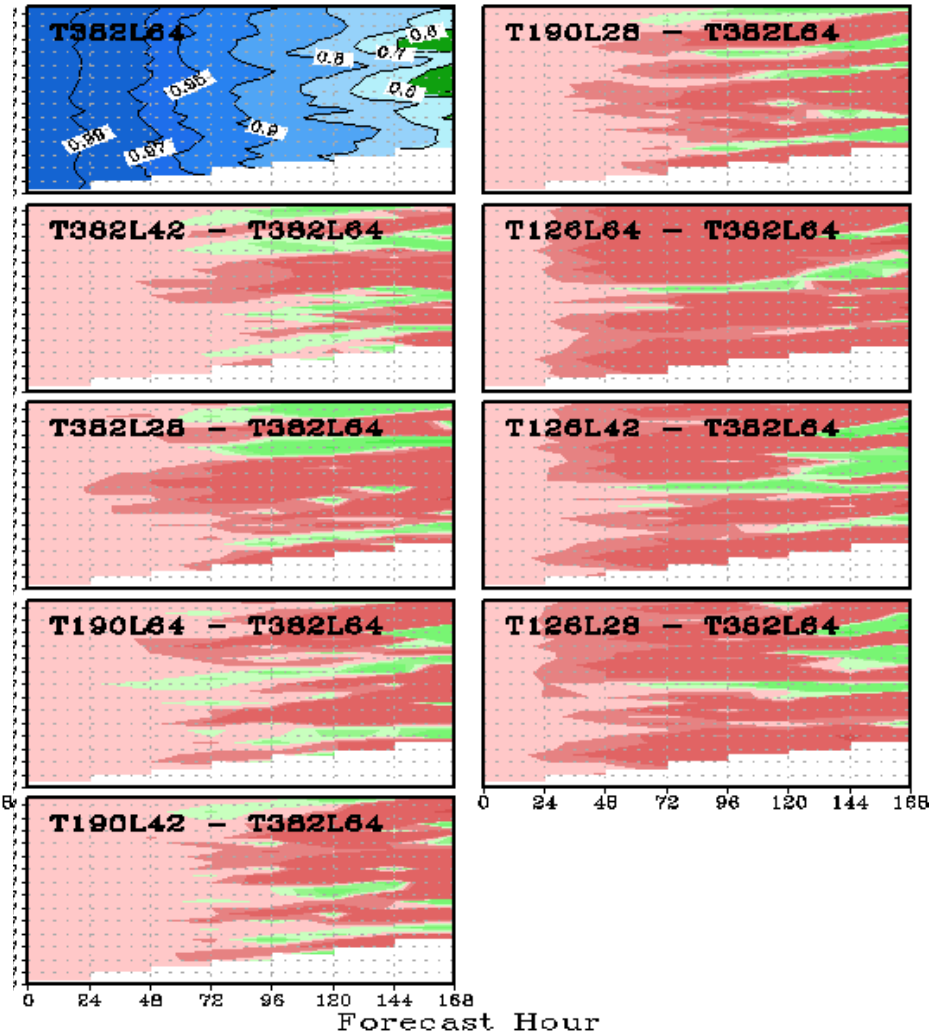
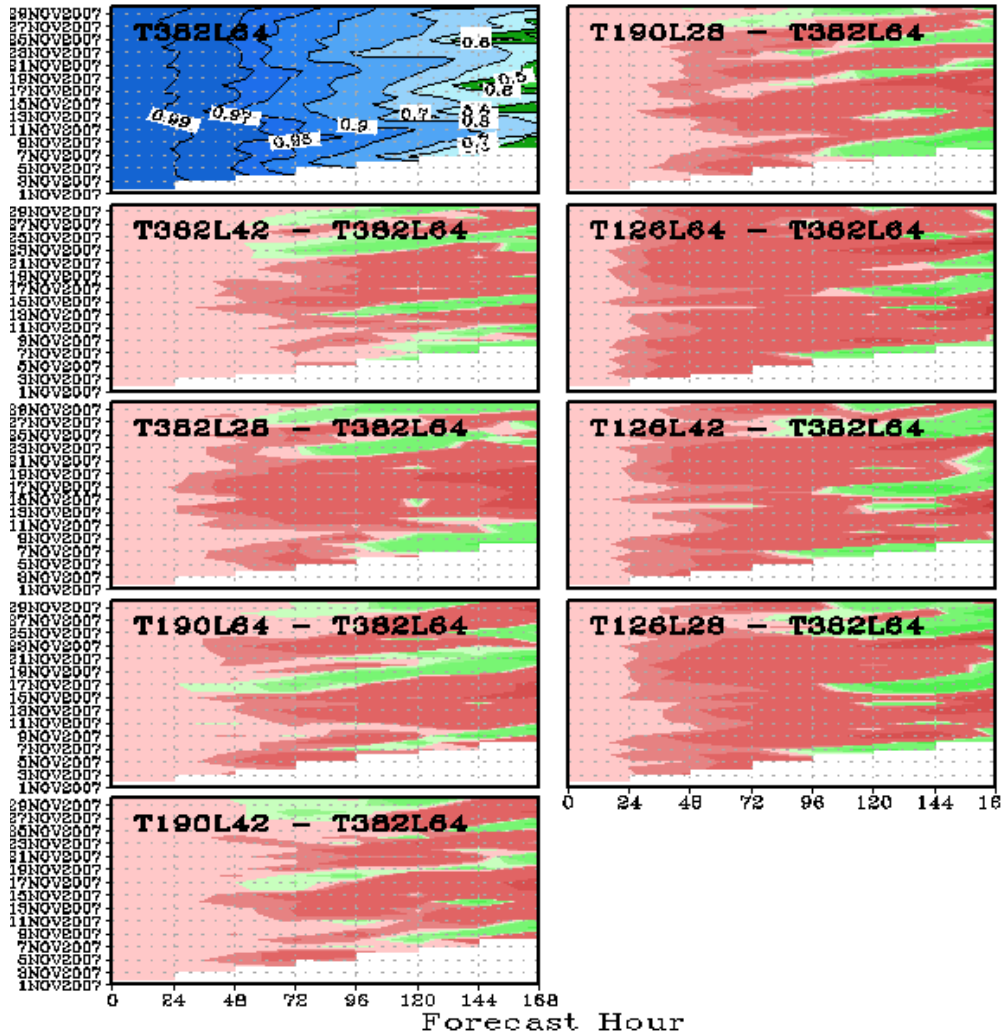
# November 2007 1000hPa height

## Northern Hemisphere

## Global

Anomaly Correlation: HGT P1000 G2/NHX 00Z

Anomaly Correlation: HGT P1000 G2 00Z



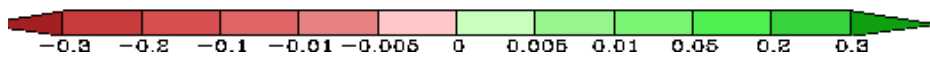
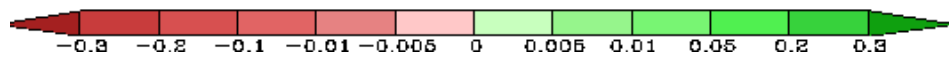
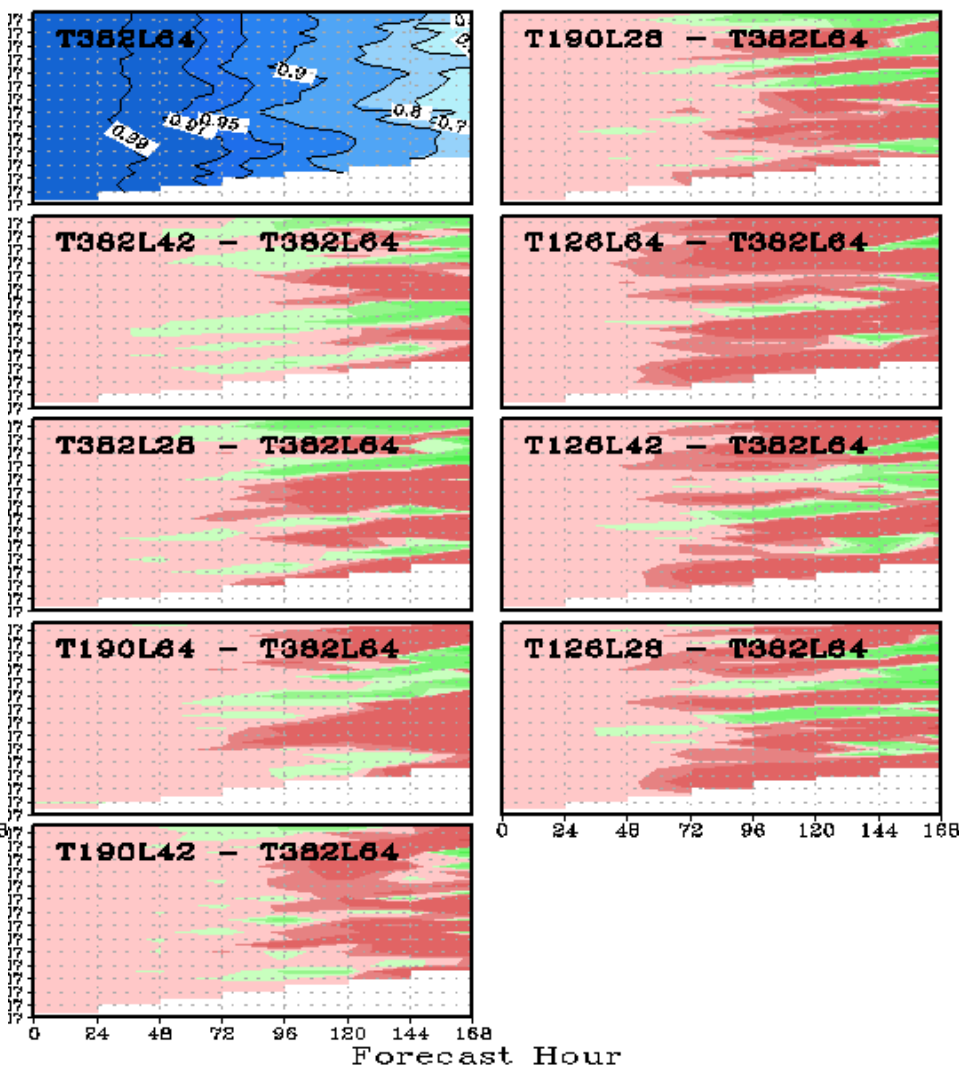
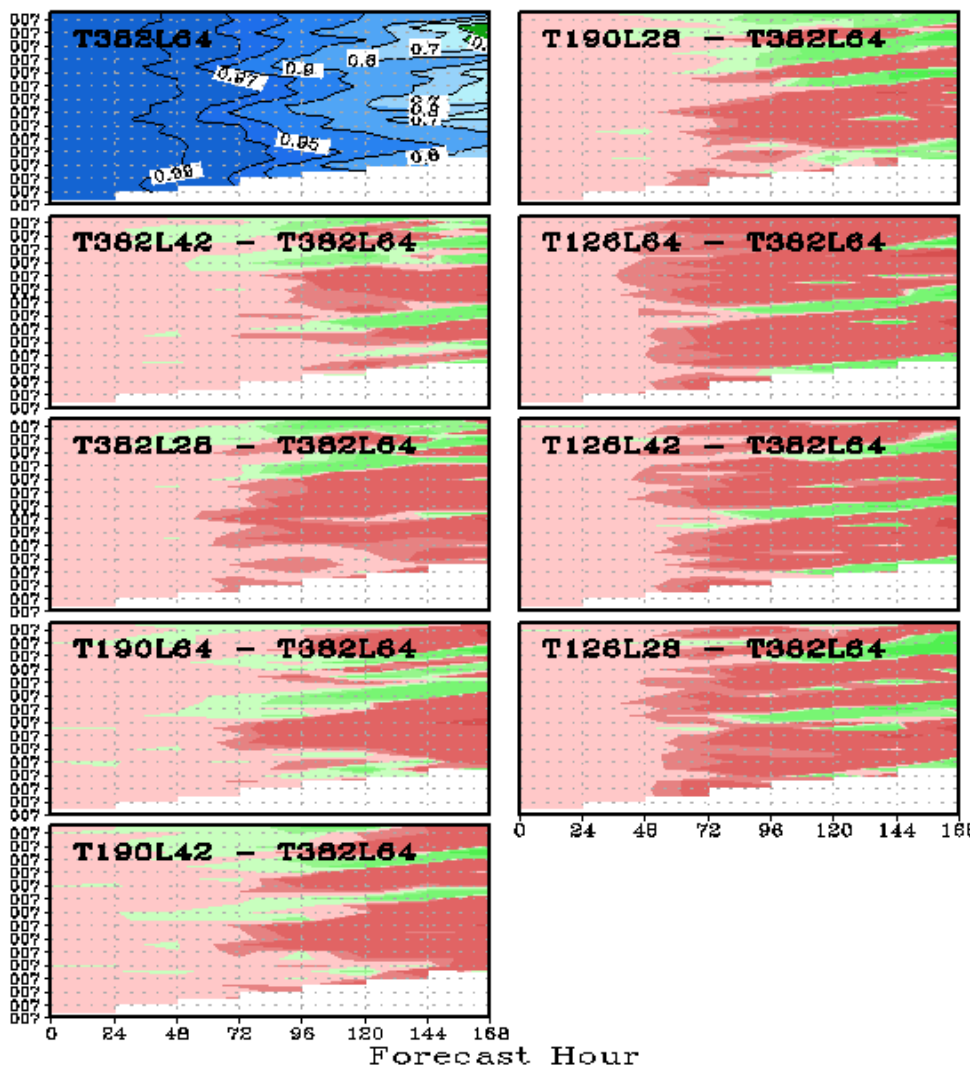
# November 2007 250hPa height

## Northern Hemisphere

## Global

Anomaly Correlation: HGT P250 G2/NHX 00Z

Anomaly Correlation: HGT P250 G2 00Z



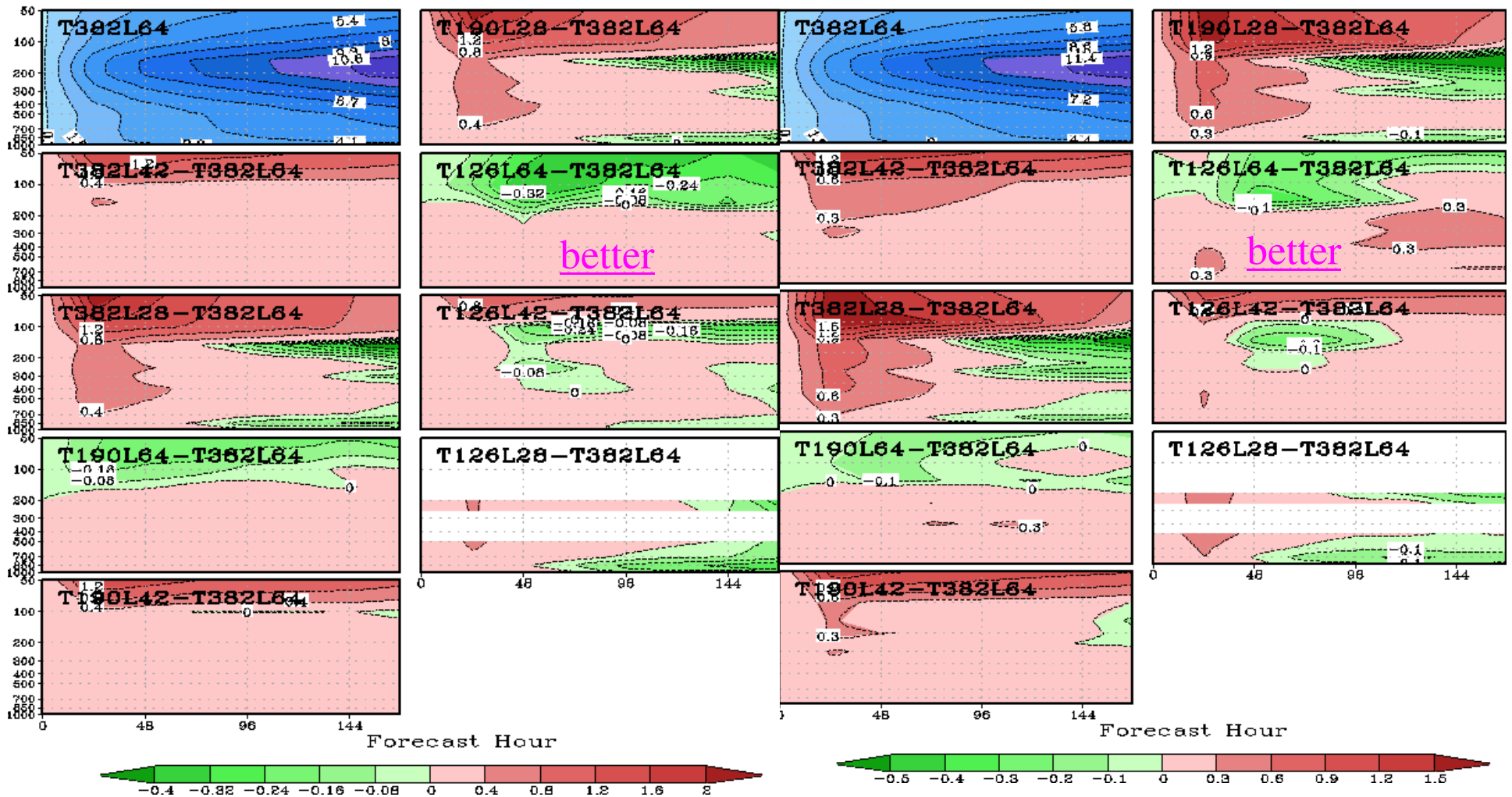
# RMS errors for wind vector (Tropical region)

Monthly mean for May 2007

Monthly mean for November 2007

RMS: 20070502-20070531 Mean for WIND G2/TRO 00Z

RMS: 20071101-20071130 Mean for WIND G2/TRO 00Z



## More Experiments: August and December 2007

Forecasts up to 384 hours (16-d)

For

T126L28, T126L64, T190L28 and T382L64

Only

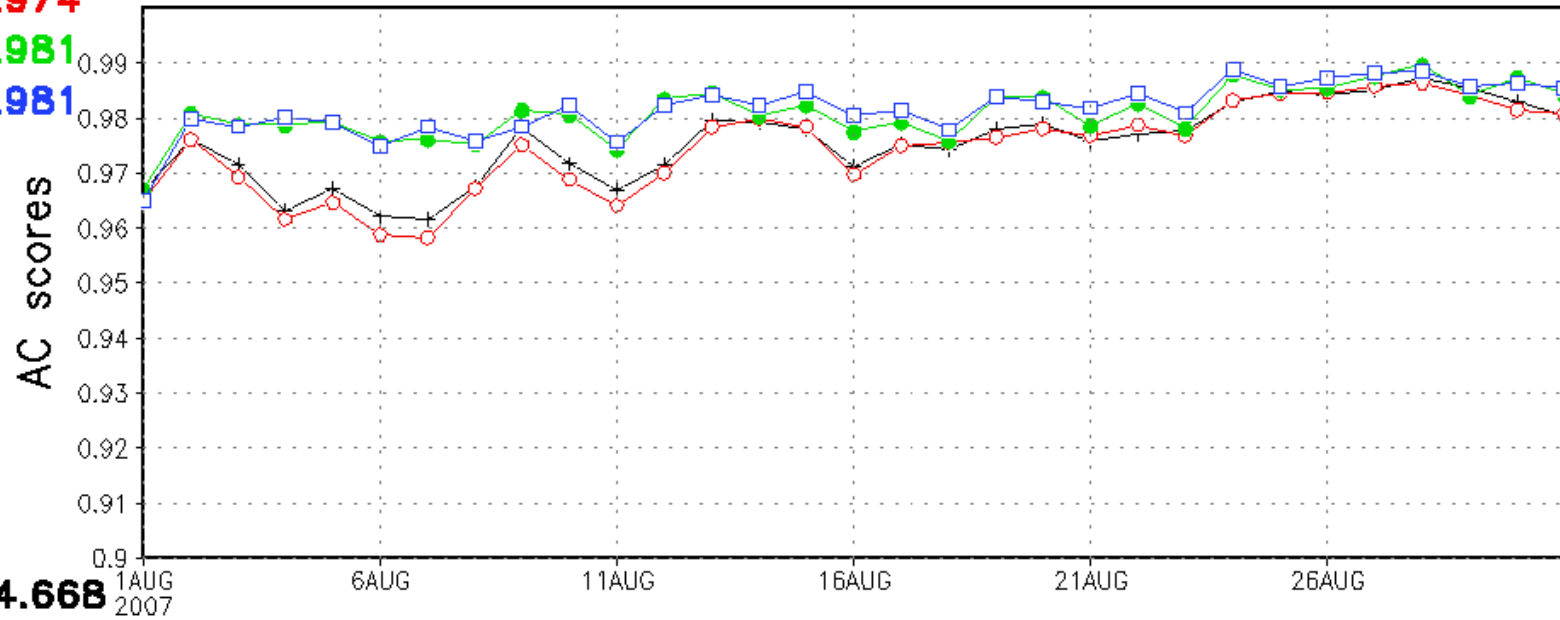
# NH 500 hPa Geopotential Height at day 2 for 00Z01AUG2007 – 00Z31AUG2007

**126:28=0.975**

**126:64=0.974**

**190:28=0.981**

**382:64=0.981**

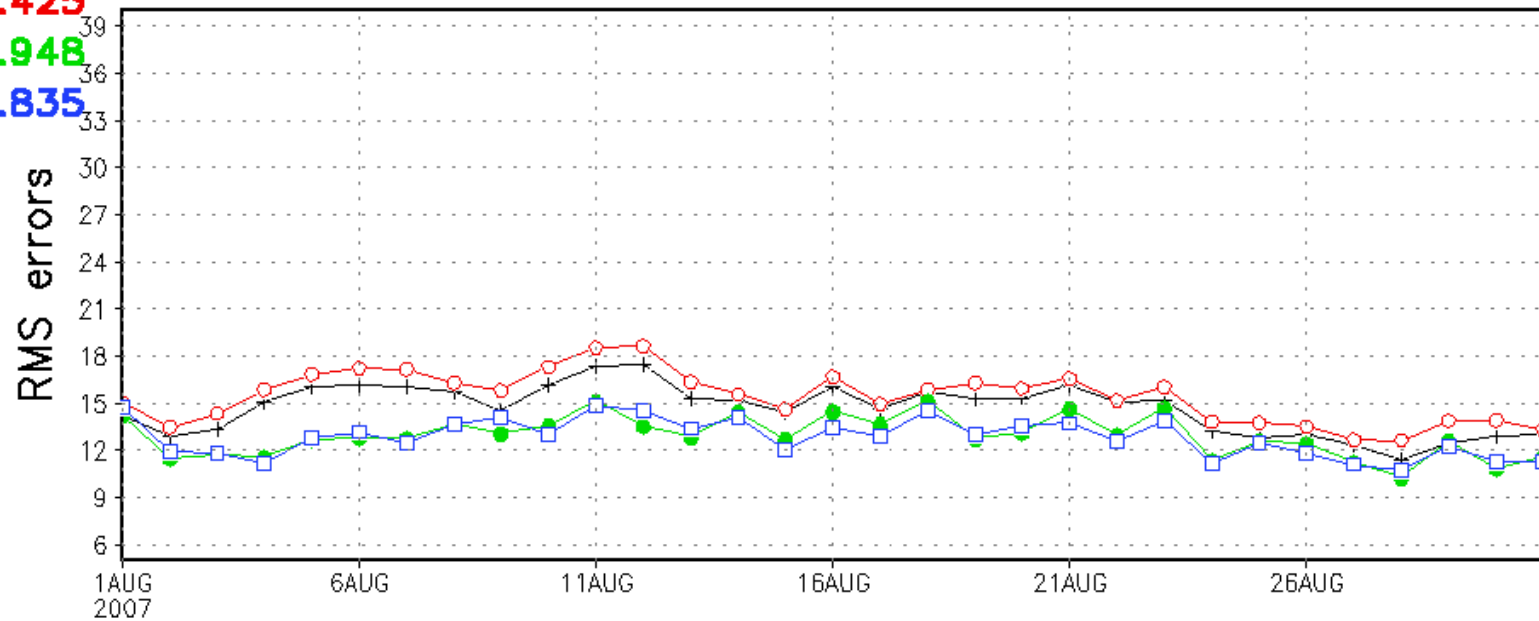


**126:28=14.668**

**126:64=15.425**

**190:28=12.948**

**382:64=12.835**



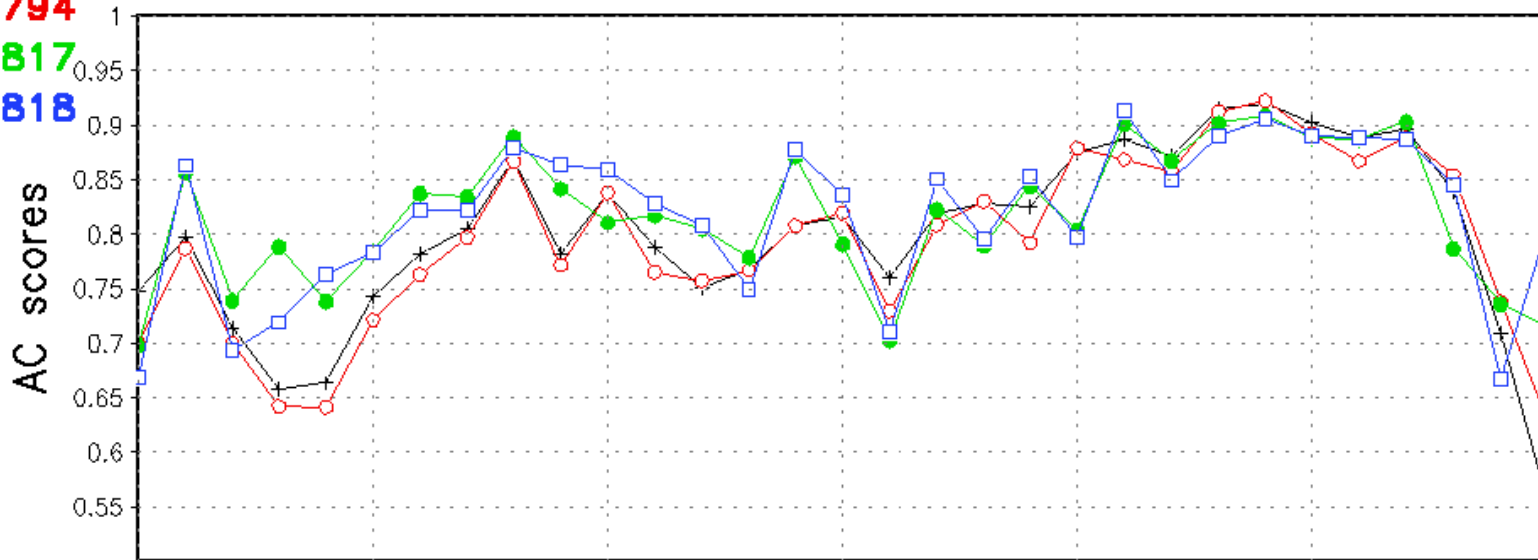
### NH 500 hPa Geopotential Height at day 5 for 00Z01AUG2007 – 00Z31AUG2007

**126:28=0.800**

**126:64=0.794**

**190:28=0.817**

**382:64=0.818**

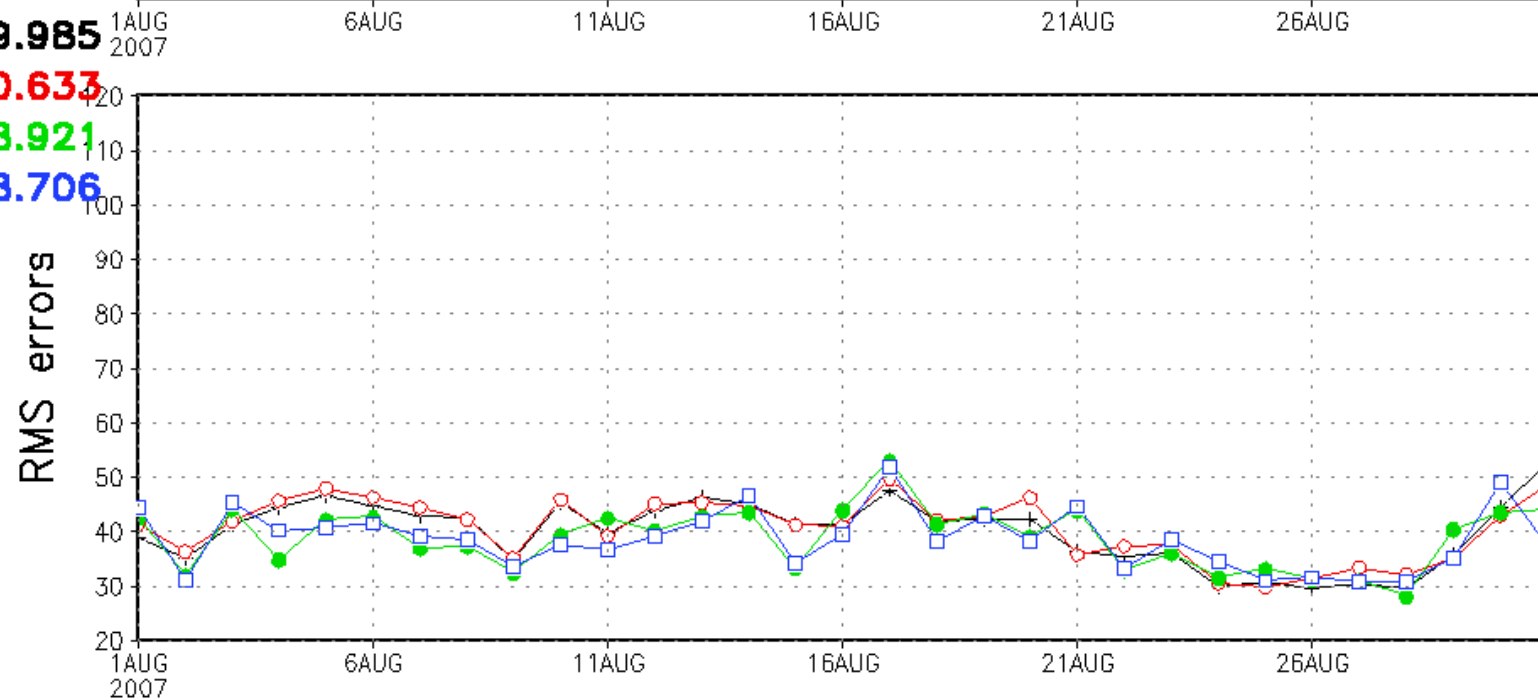


**126:28=39.985**

**126:64=40.633**

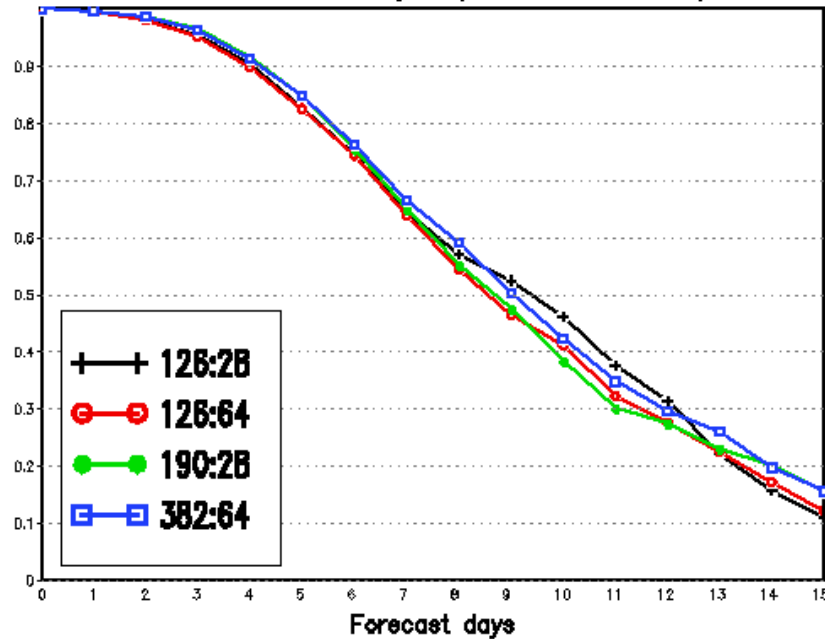
**190:28=38.921**

**382:64=38.706**

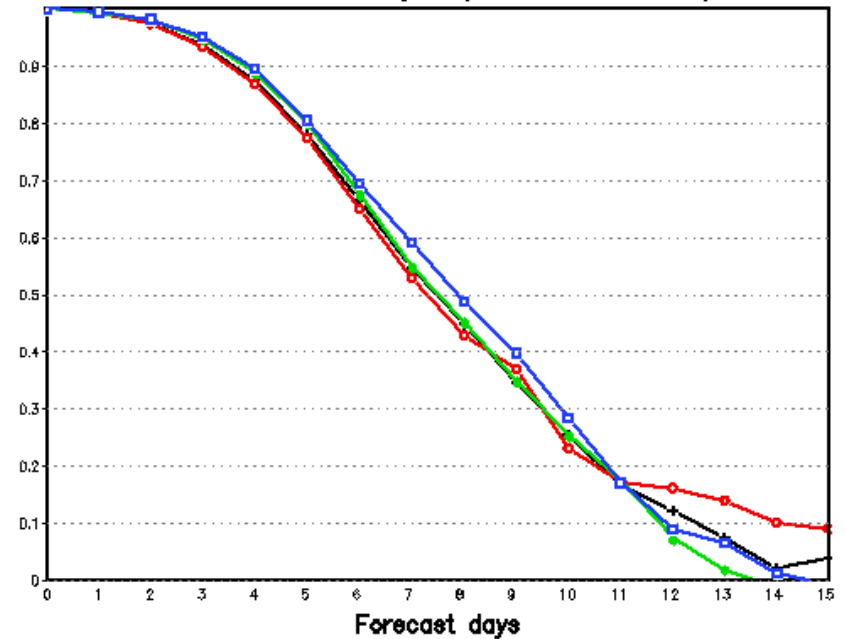


# AVERAGE FOR 00Z01AUG2007 – 00Z31AUG2007

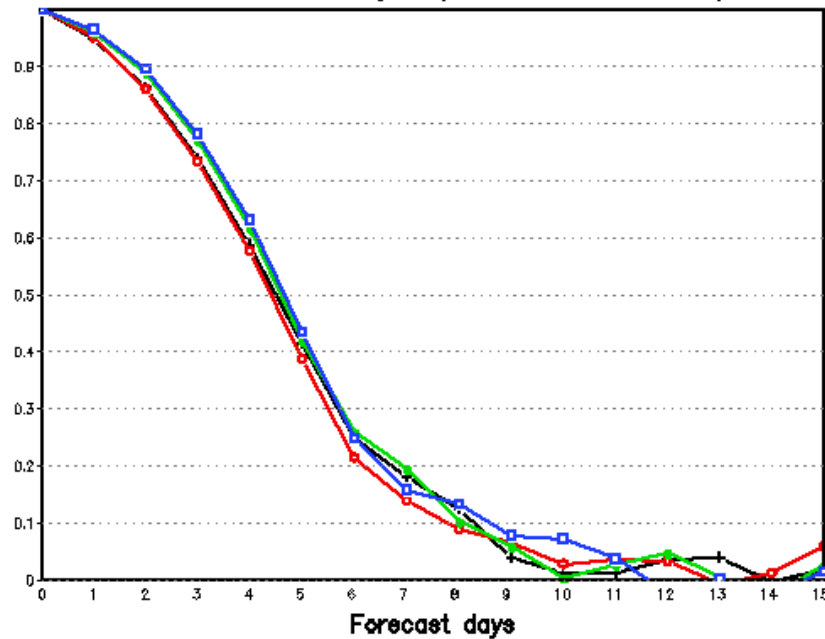
## NH 500 mb Height ( wave 1–3 AC )



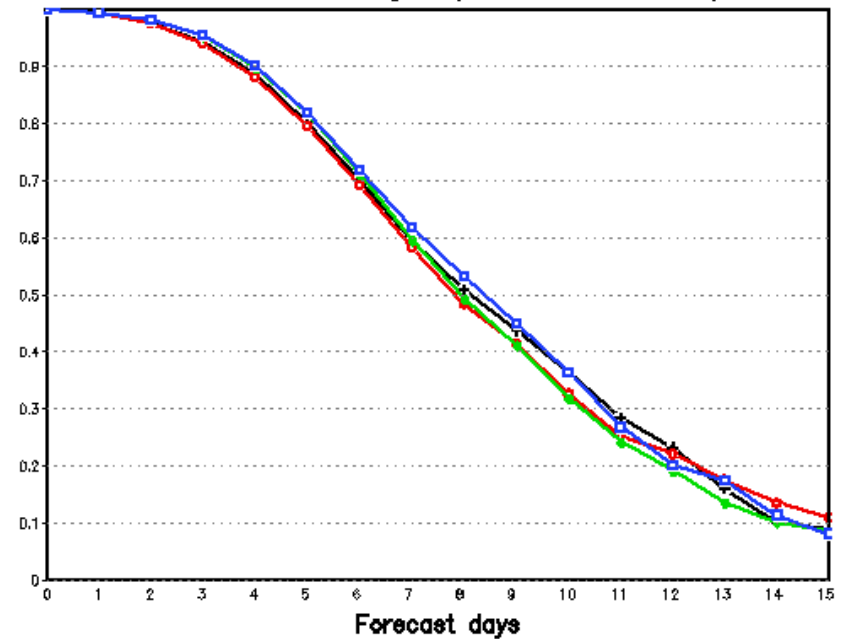
## NH 500 mb Height ( wave 4–9 AC )



## NH 500 mb Height ( wave 10–20 AC )



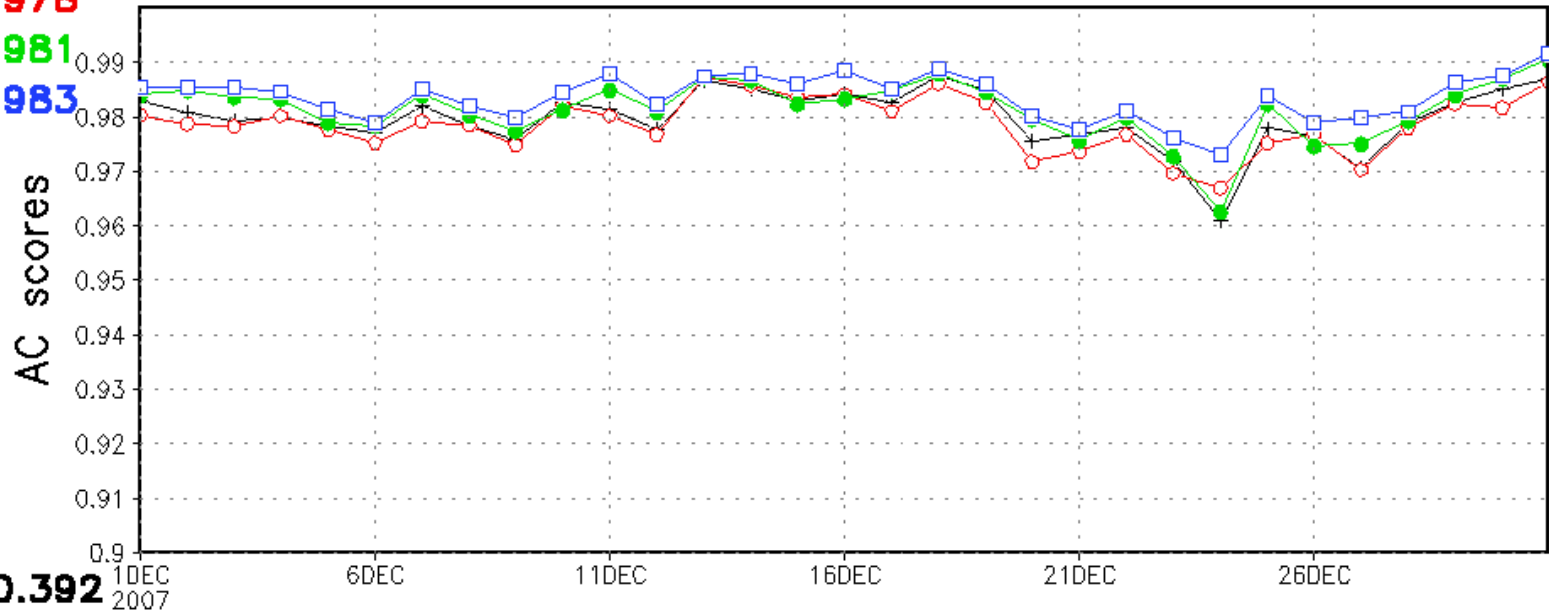
## NH 500 mb Height ( wave 1–20 AC )



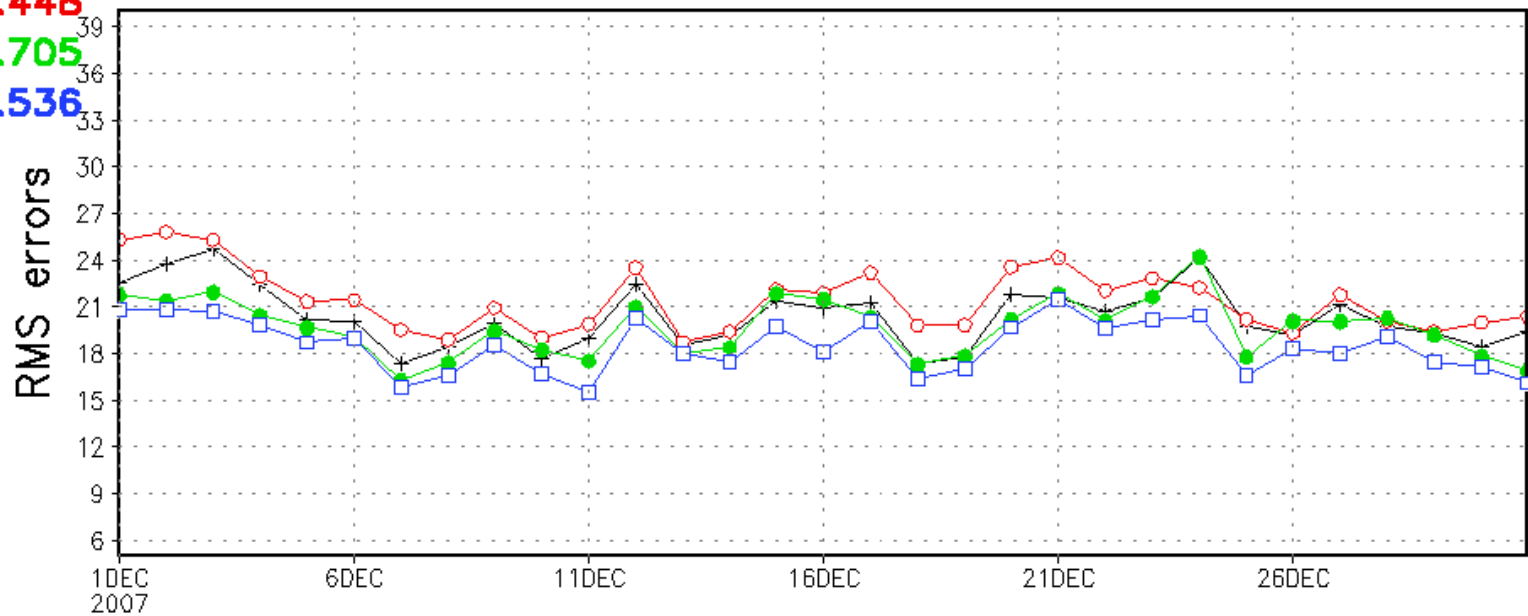


### NH 500 hPa Geopotential Height at day 2 for 00Z01DEC2007 – 00Z31DEC2007

**126:28=0.979**  
**126:64=0.978**  
**190:28=0.981**  
**382:64=0.983**



**126:28=20.392**  
**126:64=21.448**  
**190:28=19.705**  
**382:64=18.536**



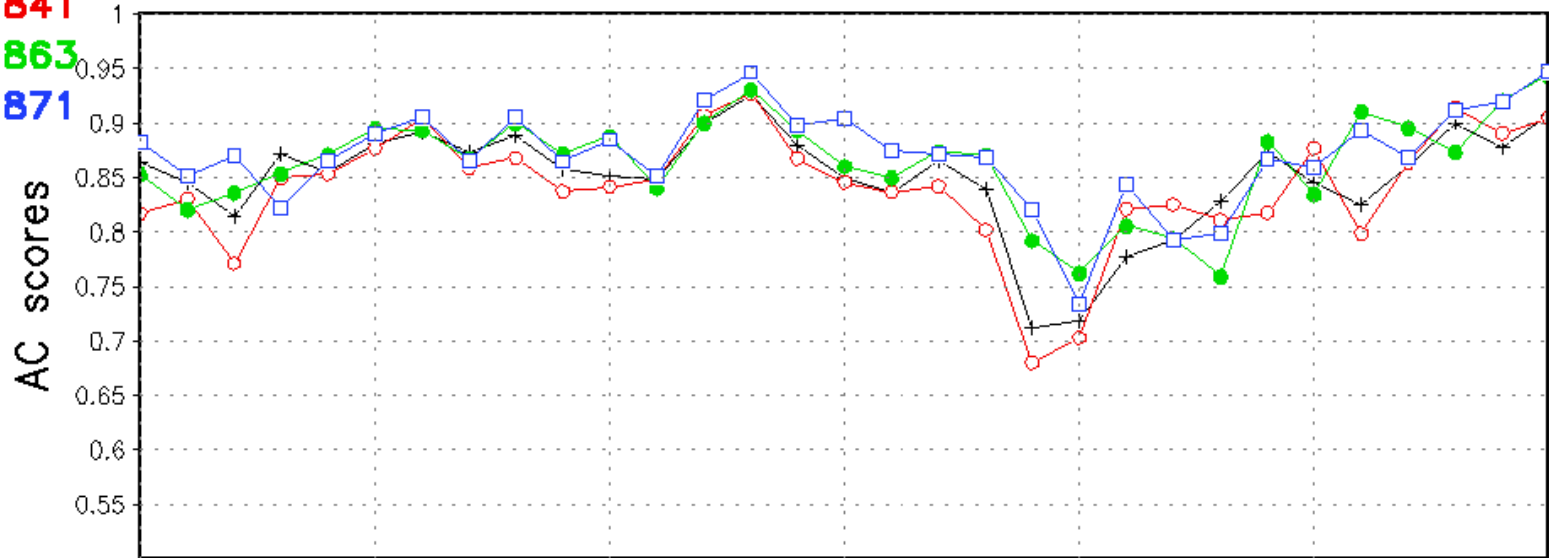
### NH 500 hPa Geopotential Height at day 5 for 00Z01DEC2007 – 00Z31DEC2007

**126:28=0.850**

**126:64=0.841**

**190:28=0.863**

**382:64=0.871**

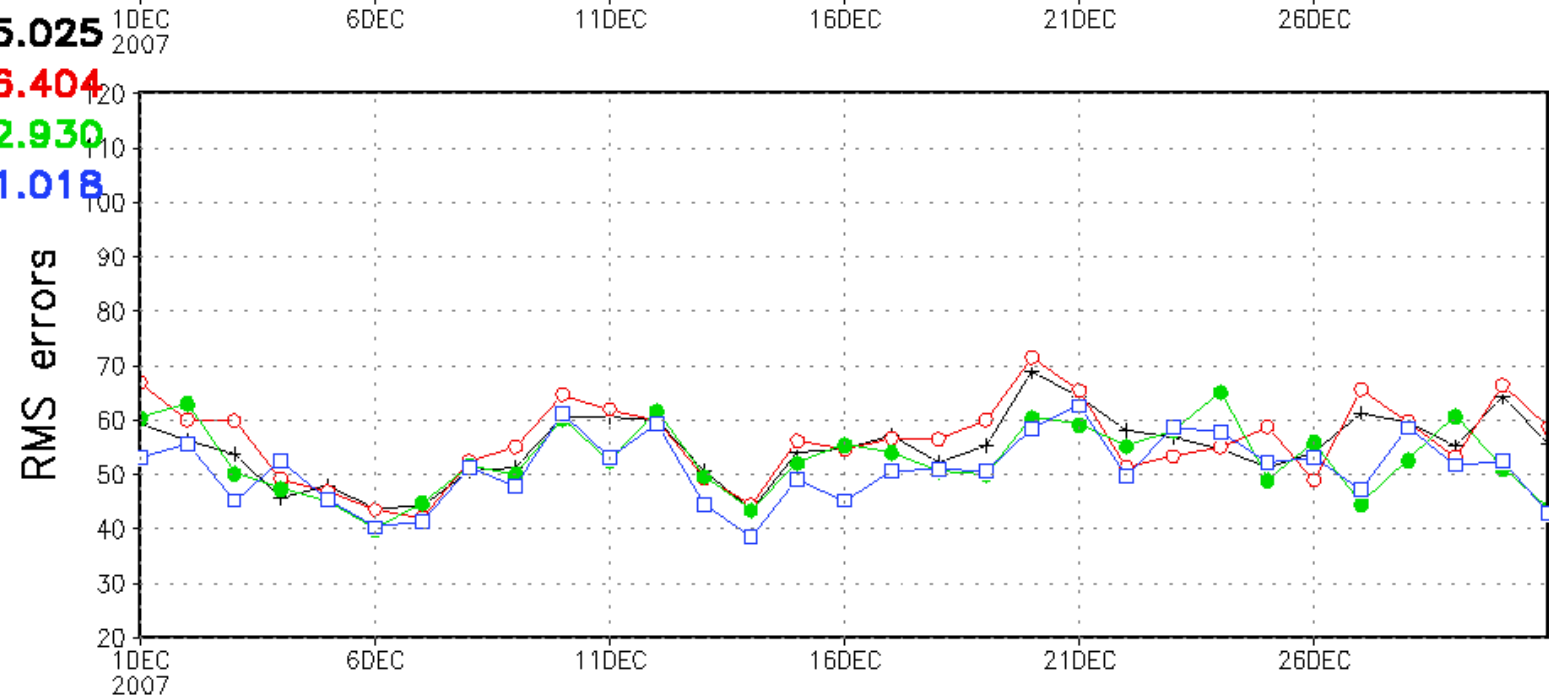


**126:28=55.025**

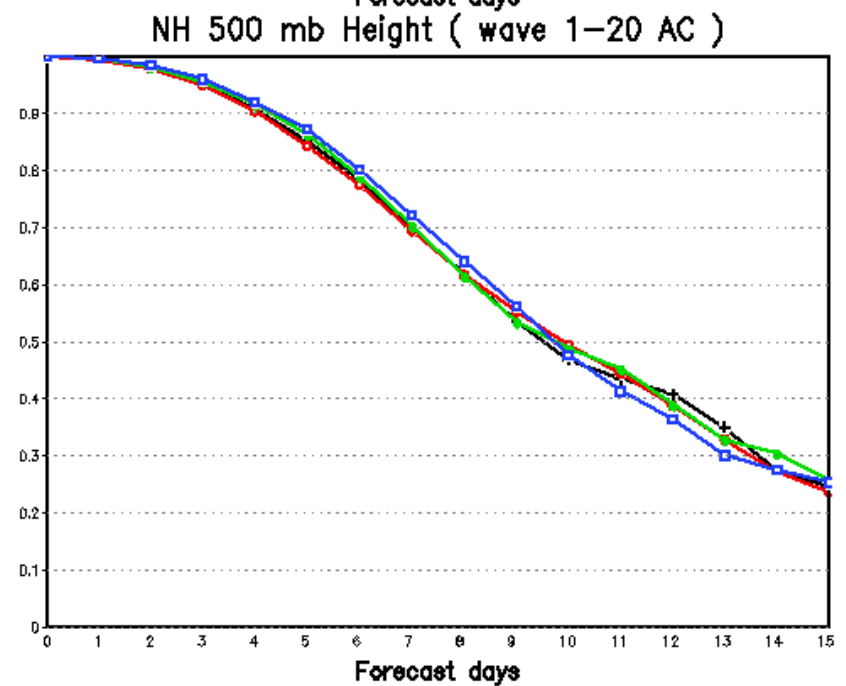
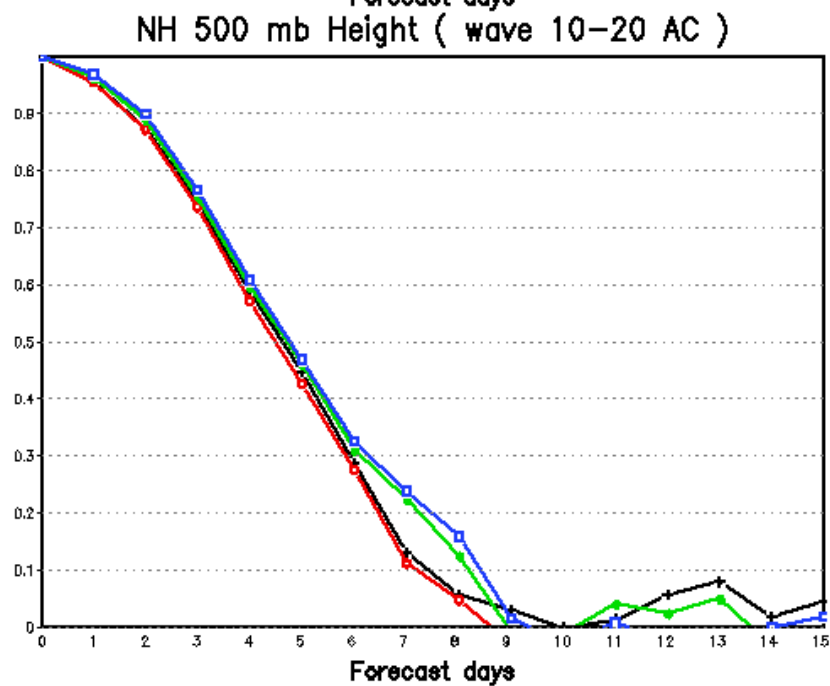
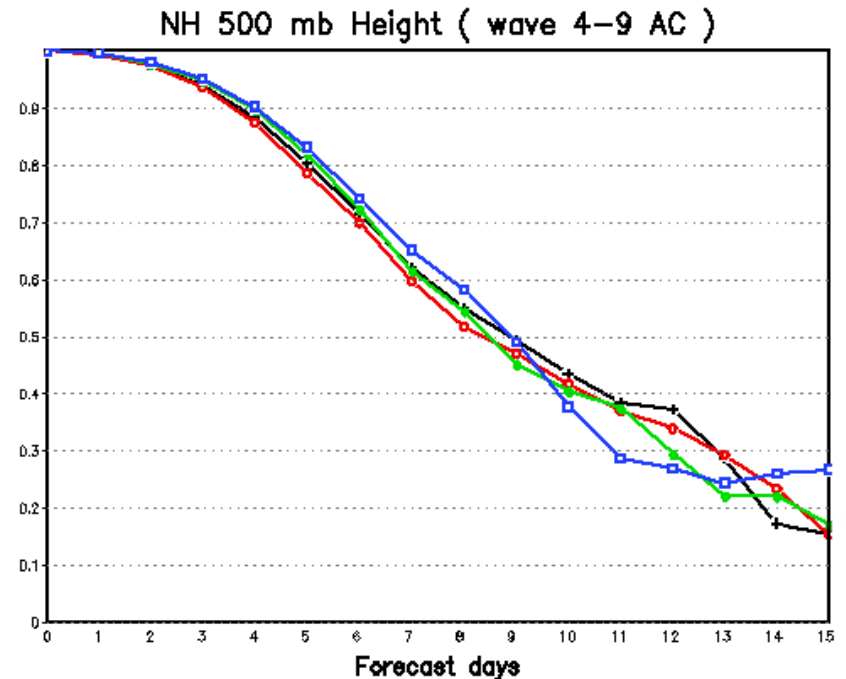
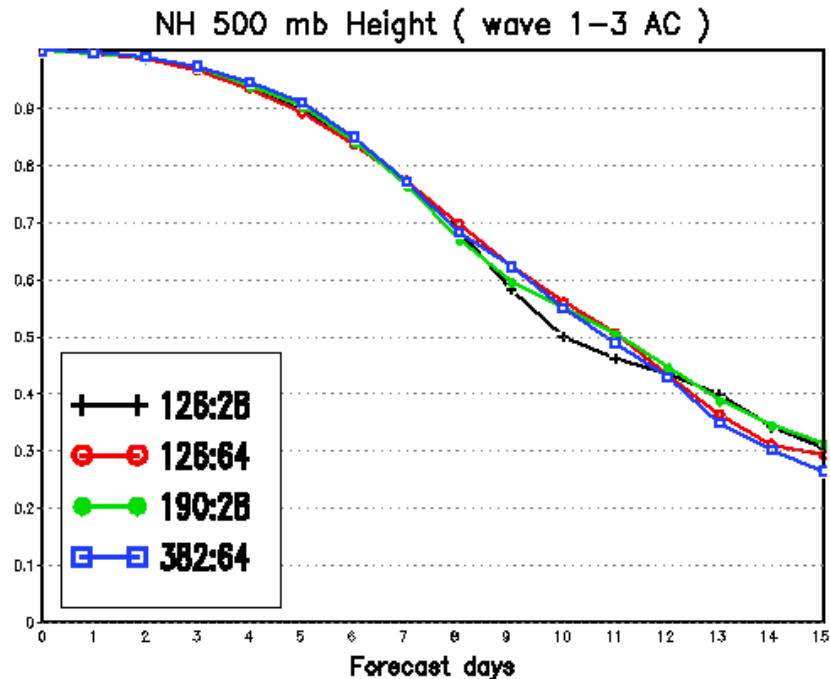
**126:64=56.404**

**190:28=52.930**

**382:64=51.018**



# AVERAGE FOR 00Z01DEC2007 – 00Z31DEC2007



**ALL STATISTICS ARE POSTED AT**

[http://wwwt.emc.ncep.noaa.gov/gmb/yzhu/exp/T126Lnn\\_200705/VRFY.html](http://wwwt.emc.ncep.noaa.gov/gmb/yzhu/exp/T126Lnn_200705/VRFY.html)

# Preliminary Conclusions

- Overall, T382L64 consistently perform best
  - Short lead time (d1-3), confirmed
  - Medium-range (d5), depends on season
- T190L28 has very comparable results to T382L64
  - For troposphere
- T126L64 has much improved tropical wind
  - For stratosphere
- Overall, T190L28 is better than T126L64
  - This may due to:
    - Increasing horizontal resolution
    - Dynamical balance for optimum horizontal and vertical resolution
    - Horizontal diffusion scheme
      - 4<sup>th</sup> order for T126 and 8<sup>th</sup> order for T190