Section 4: Statistical down-scaling for NAEFS ensemble forecasts

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Statistical down-scaling method has been applied to NCEP global ensemble from 1.0 degree to National Digital Guidance Database (NDGD-5km) resolution. There are four variables (2-meter temperature, surface pressure, 10-meter u and v) for this application in current NCEP operation. Statistical down-scaling method could be explained as following three main steps.

1). True or reference: High resolution analysis, such as Northern American Real Time Meso-scale Analysis (RTMA) at National Digital Forecast Database (NDFD) grid (5km), could be one of the references for statistical down-scaling.

2). Down-scaling vector (DV): In order to get DV, GDAS analysis at 5km resolution need to be generated from 1*1 degree resolution by using bilinear interpolation.

$$DV^{5km}(t_0) = (1-w)DV^{5km}(t_{-1}) + w(GDAS^{5km}(t_0) - RTMA^{5km}(t_0))$$

Where w is the weight to be used as decaying average (see the figure):

DECAYING AVERAGE WEIGHTING
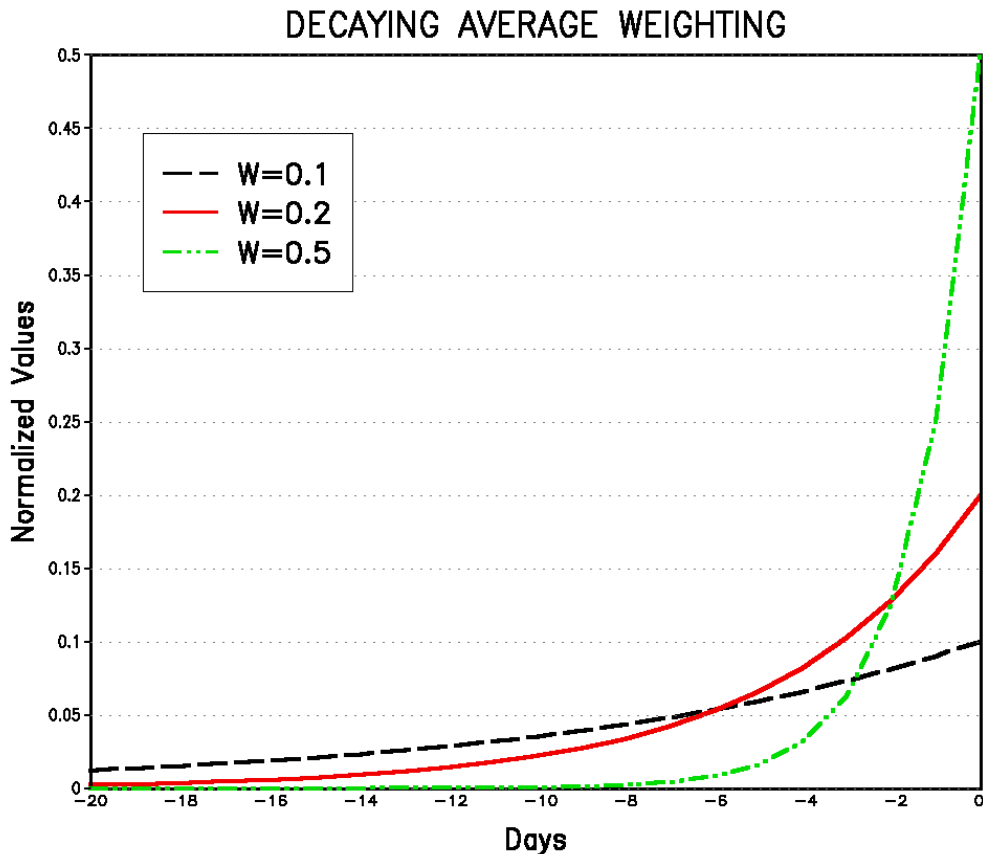
3). Down-scaled Forecasts (DF): In order to get DF, bias corrected ensemble forecasts (BF) (or 10%, ensemble mode, and 90% probabilistic forecasts) at 5km resolution need to be generated by using bilinear interpolation. Then:

$$DF^{5km}(t) = BF^{5km}(t) - DV^{5km}(t_0)$$

Where t_0 is initial time of forecast, t is forecast lead-time. There are 4 *DVs* available for valid time ($t_0 + t$) at 00UTC, 06UTC, 12UTC and 18UTC.

4). Example of Down-scaling performance: There is a example of 24-hour 2-meter temperature down-scaling forecast for NCEP GEFS mean to compare with NDFD 12-hour forecast, and GFS-MOS 24-hours forecast (Figures are provided by MDL/OST). There are more statistics which will be posted on web-page.