Validation of Reanalysis Products with Vaisala RS 92 SGP Radiosonde

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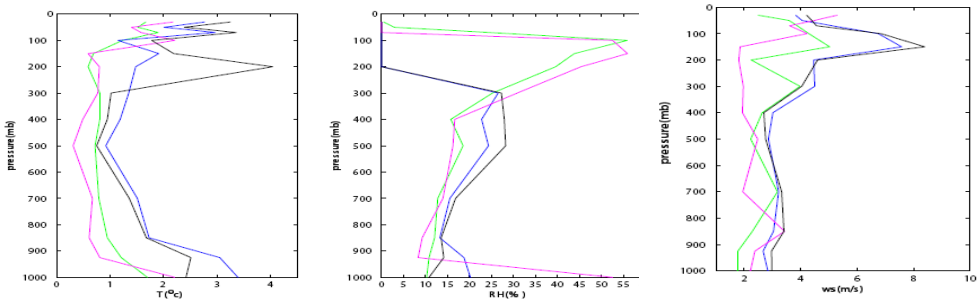
The values of temperature, humidity, velocity and direction of wind vary with altitude in the atmosphere and are also subject to seasonal and diurnal variations. Data regarding these are of enormous value for weather forecasting. Data from global reanalysis are mainly used as initial and boundary conditions for numerical weather prediction modeling. Realizing the importance of upper atmospheric processes in oceanography, a vaisala radio sonde facility has been established at NIO, Goa in 2008 and made it operational to study the intra-seasonal and seasonal variations of wind, temperature and humidity profiles. An attempt is made here to compare the trends of the above parameters from the reanalysis products such as ECMWF, NCEP, and NCMRWF with the Vaisala RS 92 SGP radiosonde profiles in the troposphere and lower stratosphere during 2009. A comparison is done with Vaisala RS 92 SGP radiosonde data with the IMD radio sonde data and also with three most prominent reanalysis products such as ECMWF, NCEP and NCMRWF at various pressure levels. The aim of this exercise is to find out the most realistic reanalysis product by comparing with vaisala sonde profiles. A total of 60 ascend sent so far have been used for the present analysis. The lower troposphere (level-1; 1000-850 mb), middle troposphere (level-2; 850 to 400 mb), upper troposphere (level-3; 400 to 100 mb) and lower stratosphere (level-4; 100 to 30 mb) are selected to compare air temperature, relative humidity and wind speed. The air temperature is best reproduced by NCMRWF with a correlation coefficient of 0.97 - 0.99 in all the four levels closely followed by IMD-radio sonde. ECMWF and NCEP are the next two options. The error analysis also shows the worthiness of NCMRWF among all four at least in the lower two levels. The upper two levels projects ECMWF data ahead of NCMRWF. Bias seems to be least in the case of NCMRWF followed by ECMWF except for the fact that the former tend to over estimate the vaisala while the later under estimate. NCMRWF is again ahead of other products in reproducing relative humidity especially in the lower levels with minimum RMS error and ECMWF is a better bet in the upper levels. However the NCMRWF-bias seems to be the least in the lowest level and the maximum in the 300 mb level. In the case of wind speed the ECMWF and NCMRWF exhibits very low correlation in the boundary layer with relatively low RMS error. However the correlation improves substantially at higher levels with sustained low RMS error for both ECMWF and NCMRWF products. In brief the NCMRWF data product is closely following the vaisala trends in the lower and middle troposphere followed by ECMWF for all three parameters. But in the upper troposphere and lower stratosphere all three reanalysis products (and IMD sonde) exhibited substantial error especially for relative humidity.



a) b)

c)

Fig.1. RMS error plots for a) temperature b) humidity c) wind speed