Extreme low tropopause temperature and tropical mesoscale convection activity over Bay of Bengal and Arabian sea region. A relative study.

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Background:

➢The height structure of the tropopause region plays an important role in stratosphere-troposphere exchange (STE) as it tends to inhibit such exchange.

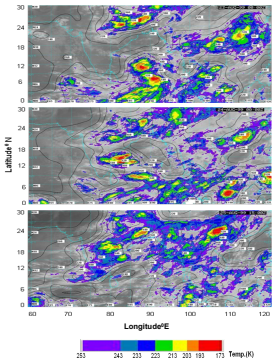
➢Recent observations over the eastern coastal stations of India and over the Bay of Bengal during summer monsoon season have shown that extreme cold tropopause temperature occur over northern eastern India, North central Bay of Bengal, Bangladesh, Northern Myanmar area. Similar features are noticed over Arabian Sea and adjoining areas.

➢The tropics being the source region of the tropical convection and cyclone systems it influence the characteristics of the tropical tropopause region and thus play an important role in STE. Tropical mesoscale convection systems (TMCS) are generally considered as one of the causative mechanism for the appearance of such cold tropopause temperature.

Results and Discussions:

Fig.1 Contour maps of OLR (Wm^{-2}) and CTT maps (^0K).
(a)23rd August 1999, 00 GMT
(b) 24th August 1999, 00 GMT
(c) 25th August 1999, 15 GMT

This figure and other similar cases show that areas of low OLR are embedded with high altitude clouds with top temperature which are sometimes as low as ≤ 193K with cloud top at height corresponding to the levels ≤ 100 hPa. These observations indicate deep penetrating convection occurs quite frequently over the Indian tropics.



Objective:

➢ The above mentioned studies have focused on the **Bay of Bengal** and the adjacent areas. In the present work these studies are extended to the **Arabian sea** region. Association between monsoon associated convection activity and occurrence of Low tropopause temperature (LTT) over these areas is also examined.

Data Base:

➢Monthly mean OLR observations from INSAT-1D satellite and ECMWF reanalysis (ERA-40) of temperature at 100hPa level are examined for summer monsoon months i.e. June – September for the years 1994-2001, the latitude range of 0-30^{0}N and the longitude range of 40-120^0 E. This region includes the Arabian Sea, Bay of Bengal and adjoining areas.

Year to year variation

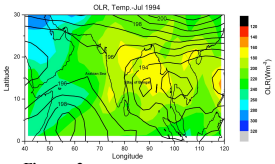


Figure 2a. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of July 1994.

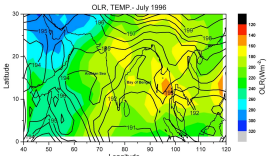


Figure 2b. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of July 1996.

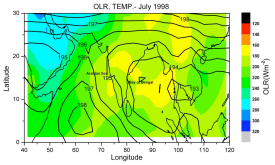


Figure 2c. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of July 1998.

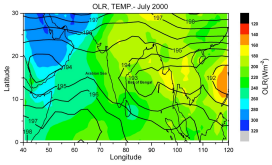


Figure 2d. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of July 2000.

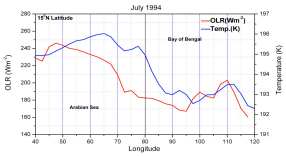


Figure 3a. Monthly mean OLR(Wm^{-2}) and corresponding monthly mean temperature(^{0}K) at 100hPa corresponding to 15^0 North latitude.

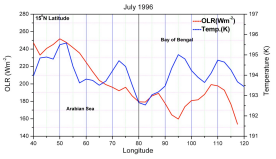


Figure 3b. Monthly mean OLR(Wm^{-2}) and corresponding monthly mean temperature(^{0}K) at 100hPa corresponding to 15^0 North latitude.

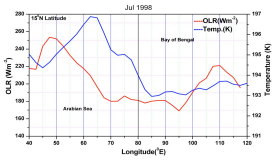


Figure 3c. Monthly mean OLR(Wm^{-2}) and corresponding monthly mean temperature(^{0}K) at 100hPa corresponding to 15^0 North latitude.

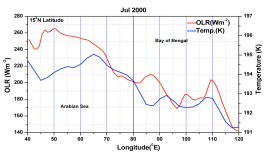


Figure 3d. Monthly mean OLR(Wm^{-2}) and corresponding monthly mean temperature(^{0}K) at 100hPa corresponding to 15^0 North latitude.

Seasonal Variation

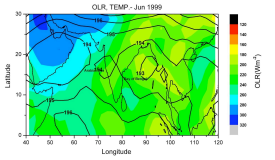


Figure 4a. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of Jun 1999.

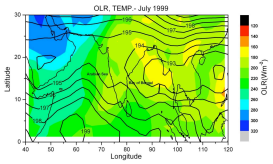


Figure 4b. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of July 1999.

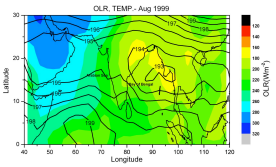


Figure 4c. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of Aug 1999.

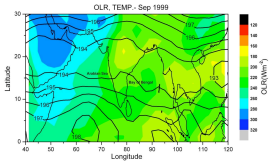


Figure 4d. Contour map of OLR (Wm^{-2}) and ECMWF reanalysis of monthly mean temperature (K) at 100 hPa level for the month of Sep. 1999.

Highlights:

➢Present analysis has revealed that during monsoon season, spatial distribution of the monthly mean OLR and 100hPa temperature show an excellent correlation with both parameters showing lower values over the Bay of Bengal as compared to the values of both parameters over the Arabian Sea. This provides a clear evidence of the role of mesoscale convection in producing low tropopause temperature.

➢These observation are consistent with higher sea surface temperature (SST) and enhanced convection over the Bay of Bengal. This shows deep penetration of ocean atmospheric interaction.

➢This phenomenon appears more prominently in the month of July which is the most active monsoon month.

Acknowledgements:

We are thankful to India Meteorological department for providing the OLR data for this study. ERA-40 model is used for ECMWF re-analysis. This work is supported by CAWSES – India program sponsored by ISRO/DOS.