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Influence of Sea breeze and Land breeze over Kharagpur region and Variations in Monthly vertical velocity profile

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Abstract - *This study was aimed to evaluate the sea breeze and land breeze over Kharagpur sub urban region were dramatically changes in weather climate within day and night as well as the pollutant levels were The ECMWF meteorological data shown for vertical profile of wind in vertical changes in other hand measured wind rose diagram shown for the resultant of the U and V wind component over Kharagpur The ECMWF vertical velocity component shows the up draft and down draft of the wind direction from that at the months (March-May)of the sea breeze effect and the wind rose shown winds are blown from sea to land direction seen in summer season were as land breeze seen in Twinter season*.

Key Words: **Sea breeze, Land breeze, Vertical profile, Wind rose, ECMWF**

1. INTRODUCTION

Atmosphere aerosol changes with altitude and its concentration the climate change variation of aerosol number density is found to be steady in the convective boundary layer above that the aerosol concentration is found to decrease in concentration [13]. The meteorological profiles showed [12] that the altitude of maximum convection rapidly. The micrometeorological study shown the surface layer becomes turbulent when the mechanical turbulence dominates due to high wind speed during the thunderstorm [10]. The Observed during SWmonsoon of 2011 coincides with the presence of positive Indian Ocean Dipole. Waves during the Premonsoon and SWmonsoon season are influenced by sea breeze [9]. The good agreement between observed surface data and SODAR data shown in [8] wind turbulence and surface heat flux.

1.1 Literature Review

In-situ measurements of vertical structure of ozone during the solar eclipse of 15 January 2010 carried out [2] it has shown that the A systematic decrease in the ozone concentration observed in the stratosphere and our observation is consistent with the observed stratospheric temperature cooling by 4°–5 °C. The occurrence of thunderstorms and the probability of severe discussed varies stages [16] according to the events Most of the events associated with wind gusts during strong flow situations reveal the downward transport of momentum as a very important factor shown in the thunderstorms. Sounding parameters in reported events were derived from daily high-resolution ECMWF (European Centre for Medium-range Weather Forecasts) analyses. large-scale operational analyses was done by [15] were the numerical simulation was simulations show systematic discrepancies with the measurements at the stations and the model captures the essential features of the sea-breeze pattern in plain. Complex terrain effects on sea breeze variation was discussed in [3] were shown that the sea breeze shown is well in during the months of February, March and April due to the presence of tropical conditions. Sea breeze day and non-sea breeze day as comparison shown decrease in Temperature and increase humidity levels at surface levels. Large transfer of pollutants and trace gases from ocean to land during sea breeze period may create hazardous episodes over nearby coastal regions to adverse climate condition. The marine breezes and their impact on the wave field around Mallorca Island was carried out by [14] it is study on wave field condition on sea breeze effect and the local orography problem in sea breeze and coarse resolution is the problem in accuracy in wind field. Change in temperature range in Bangladesh during the time 1961–2008 was carried out [1] it is shown that mean minimum and mean maximum temperatures of Bangladesh have increased significantly at a rate of 0.15 °C/decade and 0.11°C /decade, respectively. Seasonal DTR trends show a decrease in winter and pre-monsoon. The all four seasonal ventilation coefficient is estimated [5]. It shows that the assimilative capacity high during the afternoon and is less during the evening and morning in all the seasons. Monsoon and post-monsoon have the poorest assimilative capacity throughout the day. Ventilation coefficient provide a broad indication of the dispersion potential (low, medium or high) of the atmosphere. it can be enhanced by proper scheduling of activities related to source emission parameters. Sea dust transport pathways identified by [6] highest values of dust were found the Omani coast and in the entrance to the Gulf of Oman. Dust levels were generally lower in summer than the other seasons, sea Salt aerosol opposite pattern to dust, sea salt levels were exceedingly high during the summer monsoon, The high sea salt aerosols during the summer months may be impacting on the strong aerosol reactance and absorbance signals over the Arabian Sea that are detected by satellite each year campaign at the coastline of the Saronic Gulf during the summer of 1992 are presented by [7] the sea breeze based on the analysis off-shore or shore-parallel flows are more probable to create a strong or weak front. The intensity of the circulation and the prevalence of the sea breeze. The rotation of the wind hodograph is analyzed in terms of the background flow direction. Transport and diffusion of Air pollutants generated in coastal areas, the effective zone of sea/land breeze in a coastal area shown in [11] Strong land breeze

was observed around 6 a.m. just before sunrise and it was neutralized between 9 a.m.–10 a.m.

2. SAMPLE LOCATION AND METHODOLOGY

2.1 Sample Site

The aerosol optical properties carried over the East Indian location semiurban (KHARAGPUR) the station located in east IGP (Indo-Gangetic Plain) region. Kolkata (22.57 ° N, 88.42 ° E), is the capital city of west Bengal and industrially developed area in East Indian regions. The Kharagpur (22.19 ° N, 87.419 ° E) (Chart-1)region distance from kolkata is 138.5 km via NH16 an important industrial town in Paschim Medinipur district of West Bengal and residential area and small factories located.

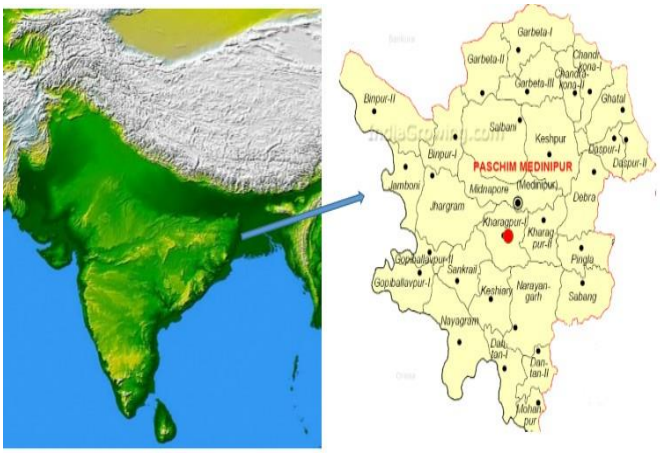

Chart -1: study location Kharagpur region

2.2 Methodology

The Identification of land and sea breeze effect over kharagpur region observation ECMWF meteorological data used in this study monthly variation of vertical wind flux all the important in sea breeze activation analysis and the wind rose diagram shown for the dominant wind direction for study region the monthly study analysis shown throughout the coastal region.in the same sense weather the sea breeze effecting the Kharagpur region in monthly based study was carried out this study. The spatial distribution of ECMWF data were used the FERRET (open source) source codes.

3. RESULTS AND DISCUSSION

In order to evaluate the sea breeze activity at Kharagpur. The wind direction is calculated as per meteorological convention whereby a wind from the north has a direction of 0^0, from the east a direction of 90^0, from the south a direction of 180^0, and from the west a direction of 270^0. The temporal evolution of the wind direction indicating. The direction of wind lying between 110^0 and 210^0 indicates the sea breeze activity and that between 260^0 and 340^0 indicates the land breeze activity. Higher intensity of sea-breeze in Tsummer and Summer seasons than in other seasons is expected because of relatively higher surface temperature during Tsummer and summer seasons than that during rest of the seasons. The surface temperature at Kharagpur in Summer being higher by in summer than in the winter season. The SB activity is also seen to be prevalent throughout the day and night hours during most of the days of summer season. The frequency of wind direction lying between 260^0 and 340^0.We also examine the sea breeze activity along the east coast of India through analysis the wind fields data obtained from ECMWF.

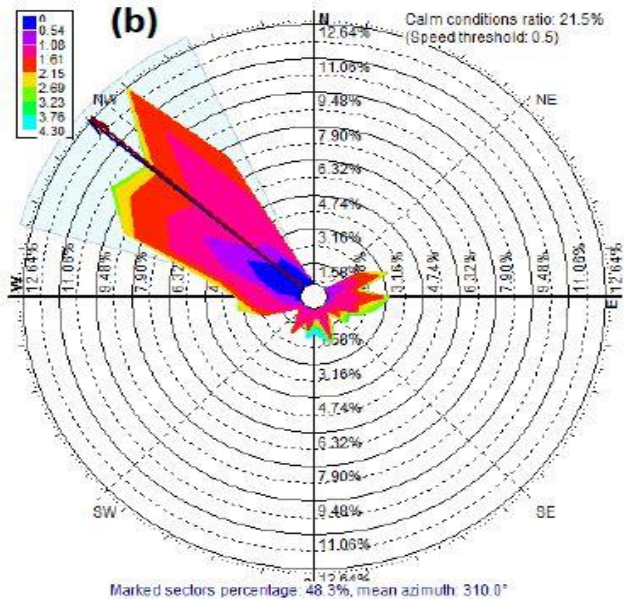

Chart -2: wind rose pattern for Kharagpur Twinter

The Surface mass concentration and from the Log normal size distribution we seen the fine particles are dominating over the KGP regions. These all monthly mean wind directions are seen over the KGP regions at surface level resultant U and V components. Vertical up draft and down draft velocity profiles also seen from sea breeze effect. From below fig arrow marks topographical graphs show the resultant vector of the U and V components. Data from the ECMWF (European Center for Medium-range Weather Forecasting) it high resolution gridded base data in huge storage data set. We are analyzed the monthly wind direction of the day morning (GMT 00:00 hr) time and night time evening (GMT 12:00 hr).

Temporal evolution of half-hourly wind direction data on a day in March for Kharagpur is shown This Figure shows the prevalence of SB activity after 17:00 LT till 22:00 LT and that of LB activity during late night and early morning hours (01:00–05:30 LT). the wind speed and direction of the sub urban location (Kharagpur) every month is changing. These months are arranged in seasonal order (Monsoon, Twinter, Winter, NEmonsoon, Tsummer and Summer) those are shaded topographical graphs shows that the vertical velocity

component depending on it direction like the up draft of wind seen (Chart -4) the blue (negative value) in legend. Down draft of wind shows the positive value.

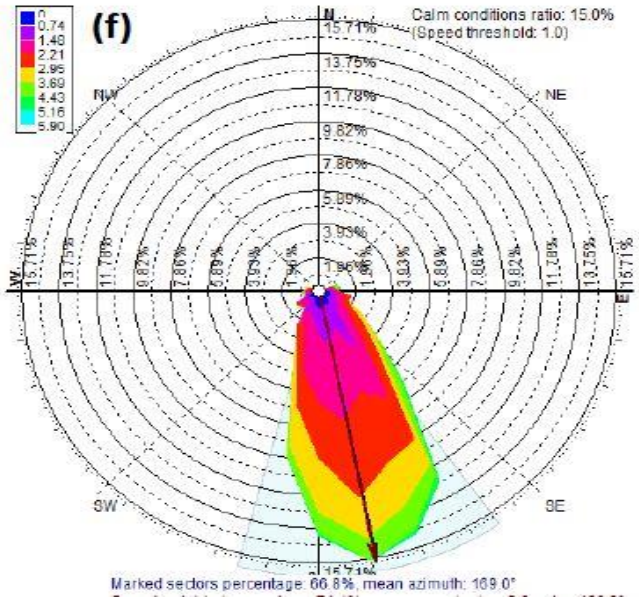

Chart -3: wind rose pattern for Kharagpur Summer

The variation of mass concentration will change due to wind from the wind rose analysis shows the seasonal wind speed and resultant vector of the all seasonal variation we analysis done at KGP station. Monthly average low wind speed in December month (1-0.64) m/s and Higher in April (2.4 - 1.02) it is the origin site location. The wind graphs Tsummer and Summer seasons are more winds are coming from south region (Bay of Bengal (BOB)) from wind rose we say that the 82% of the wind from 166 deg is resultant vector shown in fig red colour line. Seasonal values are monsoon (172 deg, 52%) Twinter (295deg, 38%), Winter(290 deg, 42%), NEmonsoon(241deg, 23%), Tsummer(172 deg, 57%), Summer(166 deg, 82%) The above fig shows the wind rose diagrams from that we can say that wind direction and its frequency of percent and claim condition at origin point from seasonal wind data Monsoon

Season start with the June month winds direction from Bay of Bengal (BOB) follows the coastal regions in day and night hour, as well as from the vertical wind profile at KGP there is the neutral grids are in these months not uniform motion of air mass all over the coastal region in monsoon season. The south Indian regions land breeze effect in start from June month and follows the July, August and September months specially monsoon season

KGP is located in coastal region for every season the wind parameter will be changing season to season in Twinter(OCT) season wind direction from east India to Bay of Bengal this path is continued from winter(Nov,Dec) to till NEmonsoon season (Jan,Feb). Land breeze start from month of winter (Nov,Dec) season in fig the yellow grids shown the down draft of wind the air mas moment from land to sea regions difference of temperature and pressure variation. From November, December topographical graphs we seen that land breeze effect is happen in November and December months these wind direction from east Indian region to Bay of Bengal.

Over the KGP location sudden change in Tsummer season (March) the sea breeze effect seen at the coastal regions the wind direction from Bay of Bengal towards the KGP Location at evening time due to up draft of wind in land region with respect down draft of wind in sea regions. The other months of summer season (March,April)wind followed same path from BOB to east Indian regions Monthly Average wind speed higher shown in Summer season(2.2-1.04m/s) in this season we seen from CWT analysis Elevated levels are long range transport of dust aerosols from Africa regions and lower average wind speed in Winter season (1.1-0.64m/s)from trajectory analysis all the trajectory's are coming from IGP region with high concentration shown at KGP location in surface mass concentration. The other seasons Monsoon, Twinter, NEmonsoon and Tsummer average wind speeds are (1.8-1.18m/s) (1.3-0.76m/s) (1.2-0.71m/s)and (2-1.1m/s) respectively.

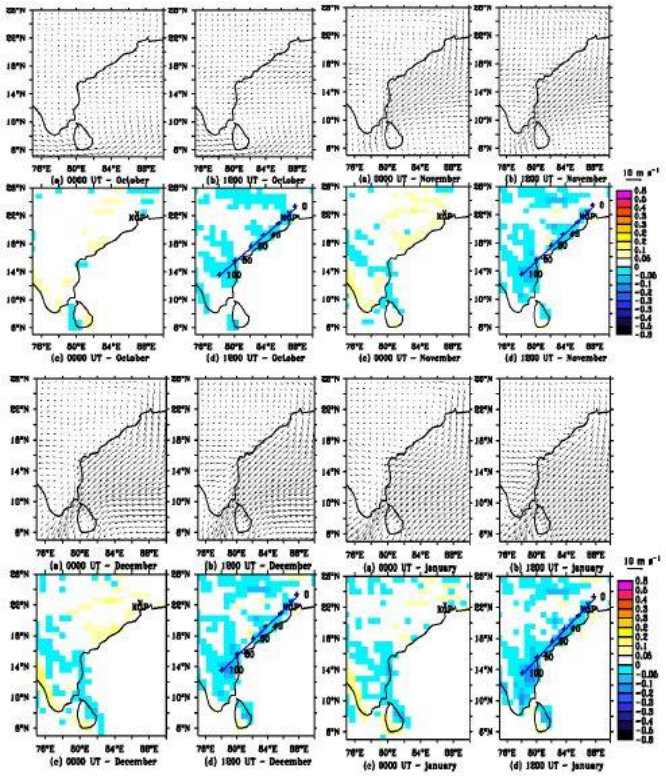

Chart -4: Monthly Spatial distribution of vertical velocity components over Kharagpur

The spatial distribution of monthly mean vertical wind velocity from ECMWF during March at 00:00 UT (time of Land breeze activity) and 12:00 UT (time of intense sea breeze activity in ECMWF data) shows a positive(indicating downdraft of air mass) or a slightly neutral value of mean

vertical wind velocity at 00:00 UT compared to their negative value (indicating downdraft.

The above spatial distribution graphs are shows the wind directions. Arrow line length shows the magnitude of speed. The max size of the wind is 10 m/s. From ECMWF data analysis we say that is The coastal region will effect in the Tsummer and summer seasons as the month of March, April and May months we seen the sea breeze effect over the KGP location The (Chart -5) march month show that momentum air from sea to land in vertical wind profile air mass up draft taking place at the time (GMT 18:00 hr) evening hours.

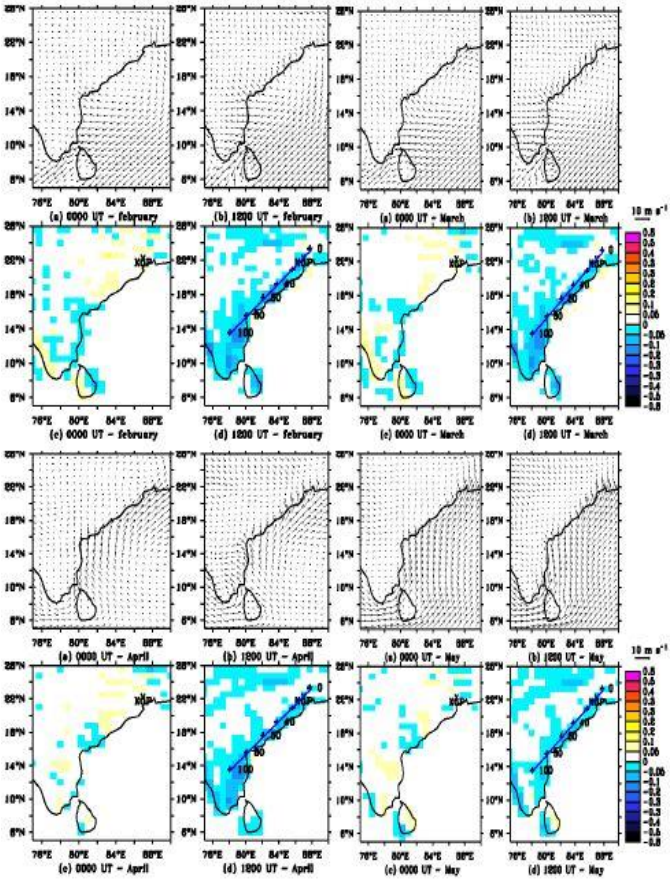

Chart -5: Monthly Spatial distribution of vertical velocity components over Kharagpur

Due to sea breeze effect. A sea breeze or onshore breeze is a gentle wind that develops over bodies of water near land due to differences in air pressure created by their different heat capacity. It is a common occurrence along coasts during the morning as solar radiation heats the land more quickly than the water.

3. CONCLUSION

A land breeze or offshore breeze is the reverse effect, caused by land cooling more quickly than water in the evening. The sea breeze dissipates and the wind flows from the land towards the sea. Both are important factors in coastal regions prevailing winds. Offshore wind refers more generally to any wind over open water. Offshore wind farms take advantage of the higher wind speeds available over the sea, but are usually placed near coasts to reduce costs and to take advantage of daily flows of sea and land breezes. Near shore wind farms are those closest to land, while others are further out to sea. The sea breeze effect due to pressure and temperature change air mass moving from sea to land the higher pressure air will move towards to lower pressure. The greatest temperature and pressure contrasts exist. Sea breeze dies down at sunset when air temperature and pressure once again become similar across the two surfaces. The air rising in the thermal low. This localized airflow system is called sea breeze. Sea breeze usually begins in day time and reaches its maximum strength in the later afternoon in this study we measured in morning and afternoon hours. These sea breeze happens at the nearby coastal regions.

From this study we seen the ECMWF vertical velocity component shows the up draft and down draft of the wind direction from that at the months (March-May)of the sea breeze effect and the wind rose shown winds are blown from sea to land direction seen in summer season were as land breeze seen in Twinter season. The wind rose rose pattern all so observed the wind changes in all seasons with respective land and sea breezes.

REFERENCES

[1] Shamsuddin Shahid., Sobri Bin Harun., Ayob Katimon., 2012.Changes in diurnal temperature range in Bangladesh during the time period 1961–2008 Atmospheric Research. 118, 260 – 270.

[2] R.K. Manchanda., P.R. Sinha., S. Sreenivasan., D.B. Trivedi., B.V.N. Kapardhi., B. Suneel Kumar., P.R. Kumar., U. Satyaprakash., V.N. Rao., 2012. In-situ measurements of vertical structure of ozone during the solar eclipse of 15 January 2010 Journal of Atmospheric and Solar-Terrestrial Physics. 84-85, 88 – 100.

[3] P.R. Sinha., R.K. Manchanda., J.V. Subbarao., U.C. Dumka., S. Sreenivasan., S. Suresh Babu., K. Krishna Moorthy., 2011. Spatial distribution and vertical structure of the MABL aerosols over Bay of Bengal during winter: Results from W-ICARB experiment Journal of Atmospheric and Solar-Terrestrial Physics. 73, 430 – 438.

[4] C.V. Srinivas., R. Venkatesan., A. Bagavath Singh., 2007. Sensitivity of mesoscale simulations of land–sea breeze to boundary layer turbulence parameterization Atmospheric Environment. 41, 2534 – 2548.

[5] S.K. Goyal., C.V. Chalapati Rao., 2007. Assessment of atmospheric assimilation potential for industrial

development in an urban environment: Kochi (India) Science of The Total Environment. 376, 27 – 39.

[6] N.W. Tindale., P.P. Pease., 1999. Aerosols over the Arabian Sea: Atmospheric transport pathways and concentrations of dust and sea salt Deep Sea Research Part II: Topical Studies in Oceanography. 46, 1577 - 1595.

[7] C.G. Helmis., K.H. Papadopoulos., J.A. Kalogiros., A.T. Soilemes., D.N. Asimakopoulos., 1995. Influence of background flow on evolution of saronic gulf sea breeze Atmospheric Environment. 29, 3689 – 3701.

[8] R. Venkatesan., V. Sitaraman., M. Manju., 1995. Estimation of the atmospheric surface layer parameters and comparison with SODAR observations Atmospheric Environment. 29, 3325 – 3331.

[9] Johnson Glejin., V. Sanil Kumar., T.M. Balakrishnan Nair., 2013. Monsoon and cyclone induced wave climate over the near shore waters off Puduchery, south western Bay of Bengal Ocean Engineering. 72, 277 – 286.

[10] S. Chaudhuri., A. Middey., 2013. Study of near surface boundary layer characteristics during pre-monsoon seasons using micrometeorological tower observations Atmósfera. 26, 125 – 144.

[11] Rajib Pokhrel., Heekwan Lee., 2011. Estimation of the effective zone of sea/land breeze in a coastal area Atmospheric Pollution Research. 2, 106 – 115.

[12] S. Suresh Babu., V. Sreekanth., K. Krishna Moorthy., Mannil Mohan., N.V.P. Kirankumar., D. Bala Subrahamanyam., Mukunda M. Gogoi., Sobhan Kumar Kompalli., Naseema Beegum., Jai Prakash Chaubey., V.H. Arun Kumar., Ravi K. Manchanda., 2011. Vertical profiles of aerosol black carbon in the atmospheric boundary layer over a tropical coastal station: Perturbations during an annular solar eclipse Atmospheric Research. 99, 471 – 478.

[13] P.R. Sinha., R.K. Manchanda., J.V. Subbarao., U.C. Dumka., S. Sreenivasan., S. Suresh Babu., K. Krishna Moorthy., 2011. Spatial distribution and vertical structure of the MABL aerosols over Bay of Bengal during winter: Results from W-ICARB experiment Journal of Atmospheric and Solar-Terrestrial Physics. 73, 430 – 438.

[14] S. Ponce de León and A. Orfila., 2013. Numerical study of the marine breeze around Mallorca Island Applied Ocean Research. 40, 26 – 34.