EFFECT OF THE CONVECTIVE BOUNDARY LAYER ON RADIOSONDE FLIGHT PATH OVER BAGHDAD AIRPORT STATION (CASE STUDY)

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ABSTRACT

This research was aimed to investigate effect of the convection conditions resulted from surface heating at different weather condition on movement track of radiosonde. Data used in this study divided to surface local weather from Baghdad airport station and reanalysis weather surface data from European center medium weather forecast (ECMWF) that contain also advance parameter parameters such as sensible heat flux and boundary layer height and other, all have large accurate spatial distribution inside and outside Baghdad province. Third type data from radiosonde used to observed atmospheric upper layer through selected days from winter season (January month) and summer season (July month) all at time 12AM. Software installed in radiosonde used to recoded wind speed, temperature and other parameter such as global position system (GPS) all plotted and represented by ArcGISpro. Results show different in the radiosone path at convection and nonconventional conditions. Convection constraint movement of radiosonde path (wind speed profiles very low don't reach to 30m/s in upper layer, this is opposite to nonconventional case, it reach to more than 65m/s) because turbulent and random in different directions, this case is opposite to the nonconventional condition there is large free movement, where balloon reach to large and upper distance in nonconventional (Jan. cases).

Key words: Win9000, GPS, convection, nonconventional conditions, ECMWF.

تأثير الطبقة المحاددة الحملية على مسار رحلة المسبار الراديوي فوق محطة مطار بغداد

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المستخلص

يهدف هذا البحث إلى معرفة تأثير ظروف الحمل الحراري الناتجة عن تسخين السطح في ظروف مناخية مختلفة على مسار حركة المسبار اللاسلكي. البيانات المستخدمة في هذه الدراسة مقسمة إلى الطقس المحلي السطحي من محطة مطار بغداد وبيانات تم اعادة تحليلها تمثل بيانات سطحية للطقس من المركز الأوروبي لتنبؤات الطقس المتوسط (ECMWF) التي تحتوي أيضًا على معاملات متقدمة مثل تدفق الحرارة المحسوس وارتفاع الطبقة المحاددة وغيرها ، وجميعها ذات دقة توزيع مكاني كبيرة داخل وخارج محافظة بغداد. بيانات النوع الثالث من المسبار اللاسلكي المستخدم في الطبقة العليا الجوية المرصودة خلال أيام مختارة من فصل الشتاء (شهر يناير) وموسم الصيف (شهر يوليو) كلها في الساعة 12 صباحا. تم تثبيت برامج Win999 في المسبار اللاسلكي المستخدم في إعادة تمثيل سرعة الرياح ودرجة الحرارة والمعلمات الأخرى مثل نظام تحديد المواقع العالمي (GPS) والتي تم رسمها وتمثيلها بواسطة ArcGISpro. النتائج بينت هنالك اختلاف في مسار الراديوسوند في ظروف الحمل الحراري وغير الحملية. الحمل الحراري يقيد حركة مسار المسبار اللاسلكي (مقطع العمودي لسرعة الرياح منخفض جدًا لا تصل إلى 30 م/ ث في الطبقة العليا، وهذا عكس الحالة الغير حملية، حيث تصل إلى أكثر من 65 م / ث) بسبب الاضطراب والعشوائية في اتجاهات مختلفة في الظروف الحملية، بينما في الظروف الغير حملية هناك حركة حرة كبيرة، حيث يصل البالون إلى مسافة كبيرة وأعلى في الحالات غير التقليدية (حالات يناير).

الكلمات المفتاحية: Win9000، GPS، الحمل الحراري، الظروف غير حملية، ECMWF.

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INTRODUCTION

Convection consider one of essential to atmospheric energetics and general circulation, thus most of energy source for Earth's atmosphere comes from the Sun and directly deposited at the surface. Convection rearranges the energy by conveying it from the surface upward into the atmosphere, and balancing atmospheric by driving large-scale circulation (12). Convection also moves momentum, moisture, and chemically important trace constituents from the planetary boundary layer to the free troposphere (upper troposphere and lower stratosphere) (19). A large number of current global climate models concerning to cumulus parameterization schemes are based on the concept of convective mass flux (defined as the product of air density, convective cloud coverage, and vertical velocity).The most challenging part for obtaining convective mass flux is estimating the vertical air motions inside deep convective clouds. The most direct observational approach to determine convective mass flux is to fly instrumented aircraft into deep convective cloud to measure the vertical air velocity and other updraft/downdraft core properties (26). The urban area substantially enhances surface heat flux and also vertical compound profile of turbulent, the enhanced urban vertical turbulent intensities extend through the urban boundary layer (14). The effect of urban roughness on boundary layer structure are observed to be small in comparison with effect of urban heating for the light wind cases, overall this will effect on radiosonde fly path in urban area and different from rural area (11, 17).There are many local studies concern with radiosonde data (wind speed and temperature vertical atmospheric profile) for example, Al-Shamary (2006), used radiosonde to study the convective mixing height through the boundary layer at daytime and nighttime to 6000m, results show that wind shear is large near the earth surface but it decreases to zero at large heights. There is large changes for temperature with height at 250m, but at daytime and larger height this change decreases and become nearly dry adiabatic, study state that intensity of inversion became large at months summer and autumn to reach 9-8.5C^0 between ground earth and surface layer (5). Al –Hassnuwi also used wind speed and temperature from radiosonde at year 1987 in Baghdad station to study radix layer and uniform layer in convective mixed layer, the results of this study show that similarity equations in surface layer failed to describe wind speed profile in whole convective mixed layer (2). Ahmed F. Hassoon used radiosonde data at surface layer recorded at 1990 to comparison with predicted wind profile by used power law, this method included frequency distribution at any height within surface layer. Results show that there is large frequency of wind speed in range between 6-10m/s at height between 50-200m and there is possibility to installing turbine in this heights to generate electricity (8).This research aimed to study effect of convective boundary layer and its vertical profile on radiosonde movement flight by used GPS system installing in sounder. Study also included comparsion between atmospheric conditions at convection and at nonconventional conditions through 14 cases releases radiosonde represent two different months in weather conditions.

Location

Study area placed at International Baghdad Airport, the geographical coordinates have latitude 33.27° N and longitude 44.24° E this is consider as point source of radiosonde released. Area of airport show in green color, also center and province Baghdad, (Figure 1). This station located in a suburban area about 16 km west of downtown Baghdad from the Baghdad province (3).

Data and Tools

Upper atmospheric condition largely determine by ground surface state and synoptic conditions (7). Two types data used in this study, first, atmospheric surface layer data from local surface weather stations, such as Baghdad airport weather station belong to Iraqi meteorological organization and seismology (IMOS) (see location paragraph). Surface data parameters from metrological airport station, include temperature, wind speed, relative humidity and other atmospheric elements (18).

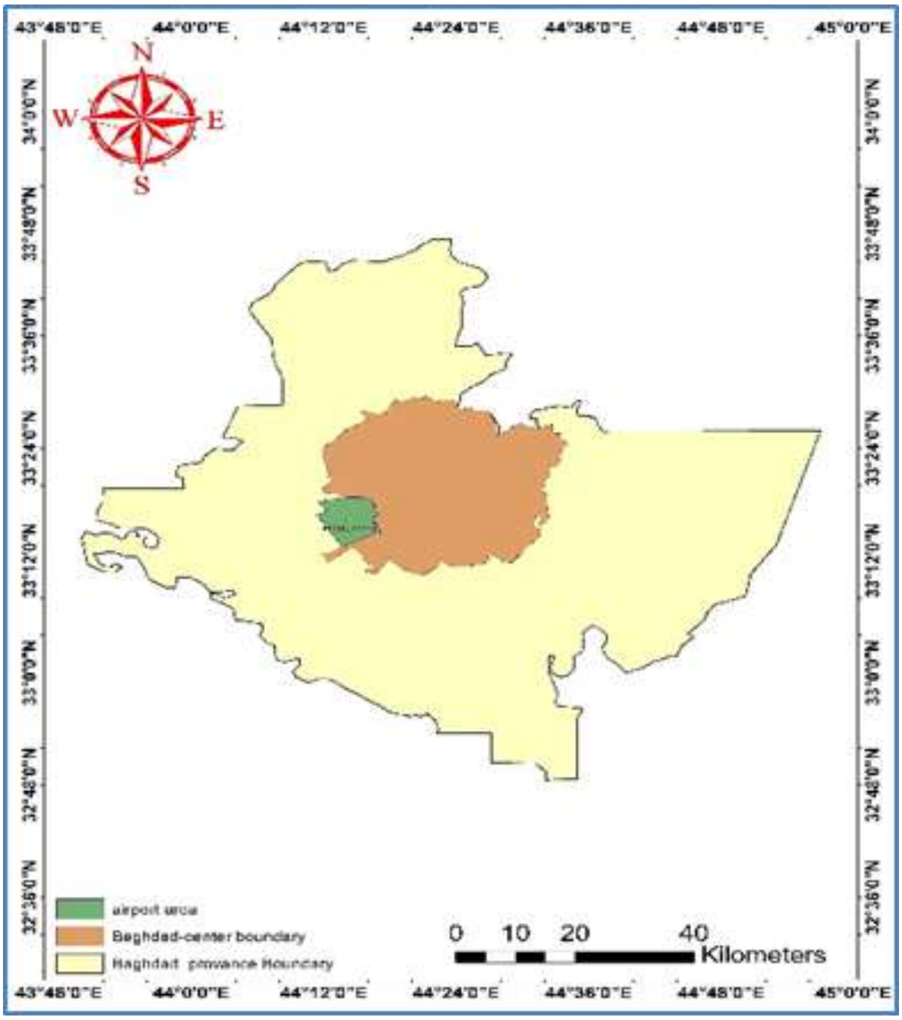


Figure 1. Study area show the Baghdad province boundary, Baghdad city center, and Baghdad airport area

Unfortunately IMOS does not have other surface weather stations in side Baghdad province can be used to obtain surface weather condition, this data in other location very important to track balloon in upper layer. This problem overcome by used European Center Medium Weather Forecast (ECMWF), this center consider one of the largest centers for meteorological data archives in the world, data in this center treated as reanalysis data (resulted from modeling and observed satellite) (21). Data for weather surface condition inside and outside Baghdad province (32.78°N-33.78°N, 43.75°E-45°E) through 99 point stations, in local resolution about $0.1^0\times0.1^0$ degree, as grid mesh used to obtain wind speed and direction, sensible heat flux and other parameters, for area around Baghdad station (10). ECMWF data used to overcame scarcity problem in representation spatial and temporal data. Comparison and calibration with available surface weather data done to correct and obtain new atmospheric parameters. The second type of data used in this study was atmospheric upper layer data resulted from radiosonde, this data obtained by used software Win9000 have GPS to track radiosonde movement. Upper data is scarce and don't make routinely because it's expansive and radiosonde balloon finally loses. This study selected only two months (Jan. represent winter and July represent summer) from 2014, from these two month's only seven days(1,5,10,15,20,25,30) at 12pm taken as a cases study. Data have been provided to us in the form of variable levels and has been processed and tabulated on a daily basis for the purpose of this work on this model. Upper Data profile contains observation for air temperature, pressure, height, dew temperature, humidity and wind speed with its direction. Weather Conditions at these period conditions compared with atmospheric surface condition also, to known which active elements effected on radiosonde direction movement. There are many tools used to processes data such as ArcGISpro and Origin9, in ArcGISpro spatial distribution and interpolation by IDW used to represented ECMWF data weather stations (Inverse distance weighted (IDW) was interpolation explicitly makes the assumption that things are close to one another are more alike than those that are farther apart. To predict a value for any unmeasured location, IDW uses the measured values surrounding the prediction location. The measured values closest to the prediction location have more influence on the predicted value than those farther away (16). IDW gives greater weights to points closest to the prediction location, and the weights diminish as a function of distance. In other hand software origin9 used in data analysis and graphing software have high-performance 3D graphing, data filtering and floating graphs among other new features software. This software used in plotted surface and upper atmospheric data.

MATERIAIS AND METHODS

Radiosonde and Win9000

Radiosondes provide continuous, accurate profiles of temperature, humidity and wind from the ground up to the altitude about 35 km. This information is central input to Numerical Weather Prediction (NWP) models. In addition, radiosondes have an important role in forecasting, model validation, climatology, atmospheric research, and validation of remote sensing instruments. These applications demand high accuracy and consistency of the measurement. However, the quality of the sensor measurements can affect the radiosonde's capability to correctly detect important details, such as temperature inversions, cloud layers, and ice formation layers, which are all essential for weather prediction (23). Win9000 is a software program that provides for user a friendly means of acquiring, processing, viewing, analyzing, and archiving meteorological data transmitted by radiosonde. Win9000 runs on a system computer with the Windows 98 or higher operating system and interfaces with the Processing System ground station through an RS-232 serial port. Win9000 can track multiple radiosonde flights from multiple ground stations simultaneously. The system receives raw pressure, temperature and humidity data and Global Positioning System (GPS) transmitted from flight radiosondes. Local GPS antenna connected to system can acquire differential GPS data for highly accurate radiosonde tracking and wind speed and direction calculations (20,6). All data are sorted in the system computer processed and put in different displaced screen, see (Figure 2), show some of screen displaced in Win9000 software.

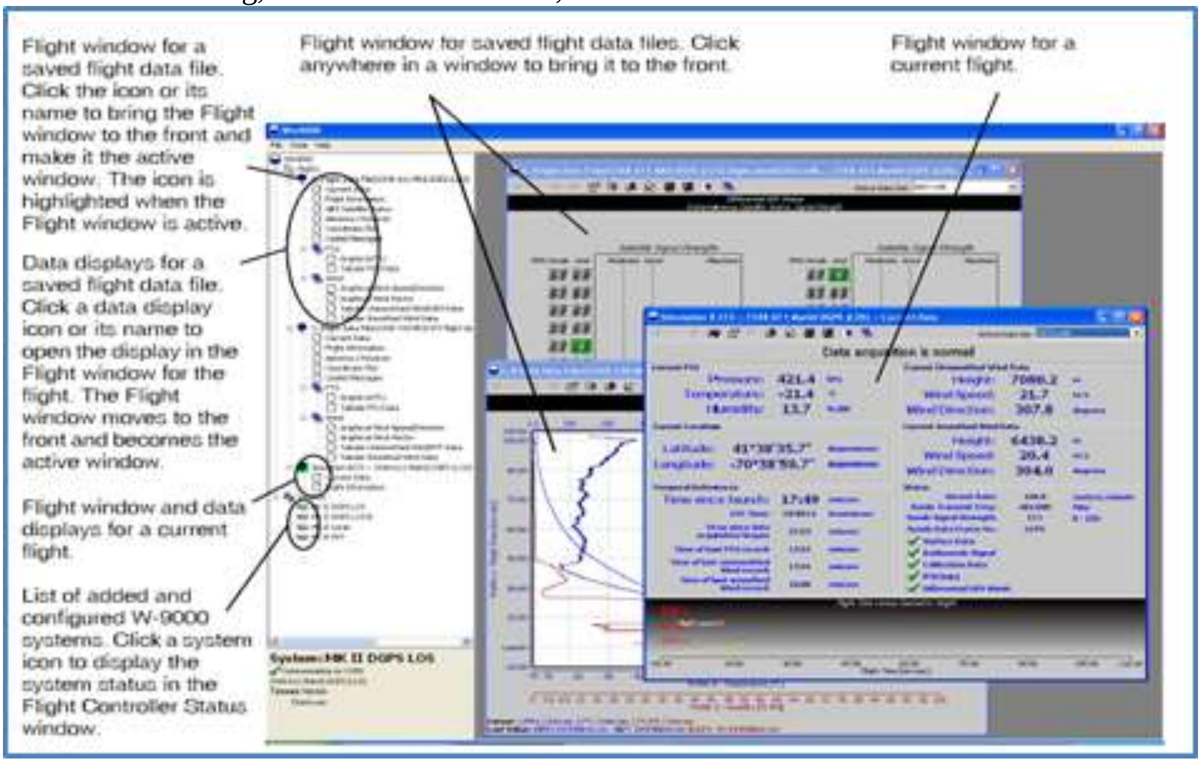


Figure 2. Multiple open flight windows in Win9000 software

Atmospheric Convection

Transfer of heat, moisture and momentum from the surface to the overlying boundary layer is accomplished to a large extent by discrete convective elements called thermals. Thermals are buoyant parcels or plumes 50 to 1000 m in diameter that develop above a surface which is considerably warmer than the overlying air. Thermals transport heat, momentum, moisture and turbulence energy from near the surface up into the overlying mixed layer (15). For calm sunny conditions, turbulence is created by thermals of warm air rising due to their buoyancy. Change land used land cover very important in change of convective condition (13).The resulting convective circulations cause so much stirring of the air that the Atmospheric Boundary Layer (ABL) becomes a well-Mixed Layer (ML). For this situation, you can use:

$$F_H = b_H W_B(\theta_{sfs} - \theta_{ML}) \qquad (1)$$

$$F_H = a_H W_*(\theta_{sfs} - \theta_{ML}) \qquad (2)$$

Where a_H= 0.0063, is a dimensionless empirical mixed-layer transport coefficient, and b_H $5x10^{-4}$ is called a convective transport coefficient. θ_{ML} is the mid-mixed-layer potential temperature (at height 500 m for a ML that is 1 km thick). W_* is active at free convection and consider as vertical scale velocity for turbulent motions called Deardorff velocity, given as (22):

$$W_* = \left[\frac{|g|.z_i}{T_v}\left(\overline{w'\theta'_{vsfs}}\right)\right]^{\frac{1}{3}} \qquad (3)$$

Convective transport can give also as, W_B in eq. 1, called the buoyancy velocity scale (m s^{-1}):

$$W_B = \left[\frac{|g|.z_i}{T_v}(\theta_{vsfs} - \theta_{vML})\right]^{\frac{1}{2}} \qquad (4)$$

For a ML of depth z_i, and using gravitational acceleration $|g|$ = 9.8 m s^{-2}. parameters θ_{vsfc}, θ_{vML} are virtual potential temperatures of the surface skin and mid-mixed layer, and T_v absolute virtual temperature (Kelvins) in the mid mixed layer (19,24). Convection velocities resulted from the thermal and heat flux can be very effected on radiosonde flight.

RESULTS AND DISCUSSION

Atmospheric Surface Layer Conditions

Earth surface very important to know the convection action and turbulent, in this study two different surface weather conditions cases selected, one at January month where there is a decreases in the solar radiation reached earth surface and have small angle solar height. Second case was at July month, where surface heating very large and atmospheric weather conditions unstable be domain (4). "Figure 3a, b", show atmospheric parameters surface pressure, wind speed at height 10m, temperature, dew point and relative humidity observed in Baghdad airport station at (a) Jan. and (b) July through 2014. During January high pressure is domain and have range from 1009.3mb to 1027.1mb. Since cold air concentrated in this month, thus there is large values of relative humidity in range (36-100) %. Stability in this month connected to wind speed activity, thus its relatively recoded decreases, especially in some synoptic situations at days (27-28) Jan., where wind speed reach to values 12m/s, see "figure 3a". In January there is a weak in creation of buoyancy plume air parcel, (25) because cold air temperature near earth surface in range 2.5-20.5C°, this opposite dew point values 0.2-14C° it's large because large relative humidity, "figure 3a". Through July, environment air temperature rises to large values (25-46) C° because surface heating by large rate of solar downfallen flux, there is large masses of plume rising from air surface bounded ground surface and rises to upper layer in atmosphere. Overall air is light and surface air pressure decreases to 992-1007mb at this month, relative humidity recorded low values because warm and dry air. these atmospheric conditions responsible for unstable air and turbulent and the activity and gust sometime in wind speed, reach to 12m/s and average monthly wind about 4.1m/s. Thus there is large relationship between air temperature and wind speed. You can notes also reduces in relative humidity effected on dew point to -7.5C° specifically at days 1-July, see (Figure 3b). Wind speed and direction very important to know and test movement radiosonde. Wind direction can be display and denoted as wind rose, (Figure 4), show wind speed frequency and direction domain, represent observed direction at two months (Jan. and July) where there is lunch and released radiosonde at days 1,5,10,15,20,25,30 at these months. In (Figure 4a) domain wind speed direction is SSE, less rate at NNW where there is large wind speed about 10m/s. In some observed wind speed record in SSE less than about 4-6 m/s. Overall at this month there is large rate of calm wind (less than 0.2m/s) about 45 frequency a count, from total observed 225 count. Most large frequency wind speed range concentrated at 0.2-2.2 m/s, (Figure 4a). In July, wind speed and direction very fluctuating because convective turbulent and unstable in the atmosphere. Number Frequency of calm wind speed largely decreases to 9 from total 220 direction observed. The domain wind direction is constrained between SE to south and the most frequency rate of wind speed concentrated between 2.2-6.2m/s, see (Figure 4b) and also review reference for comparison (1, 8).

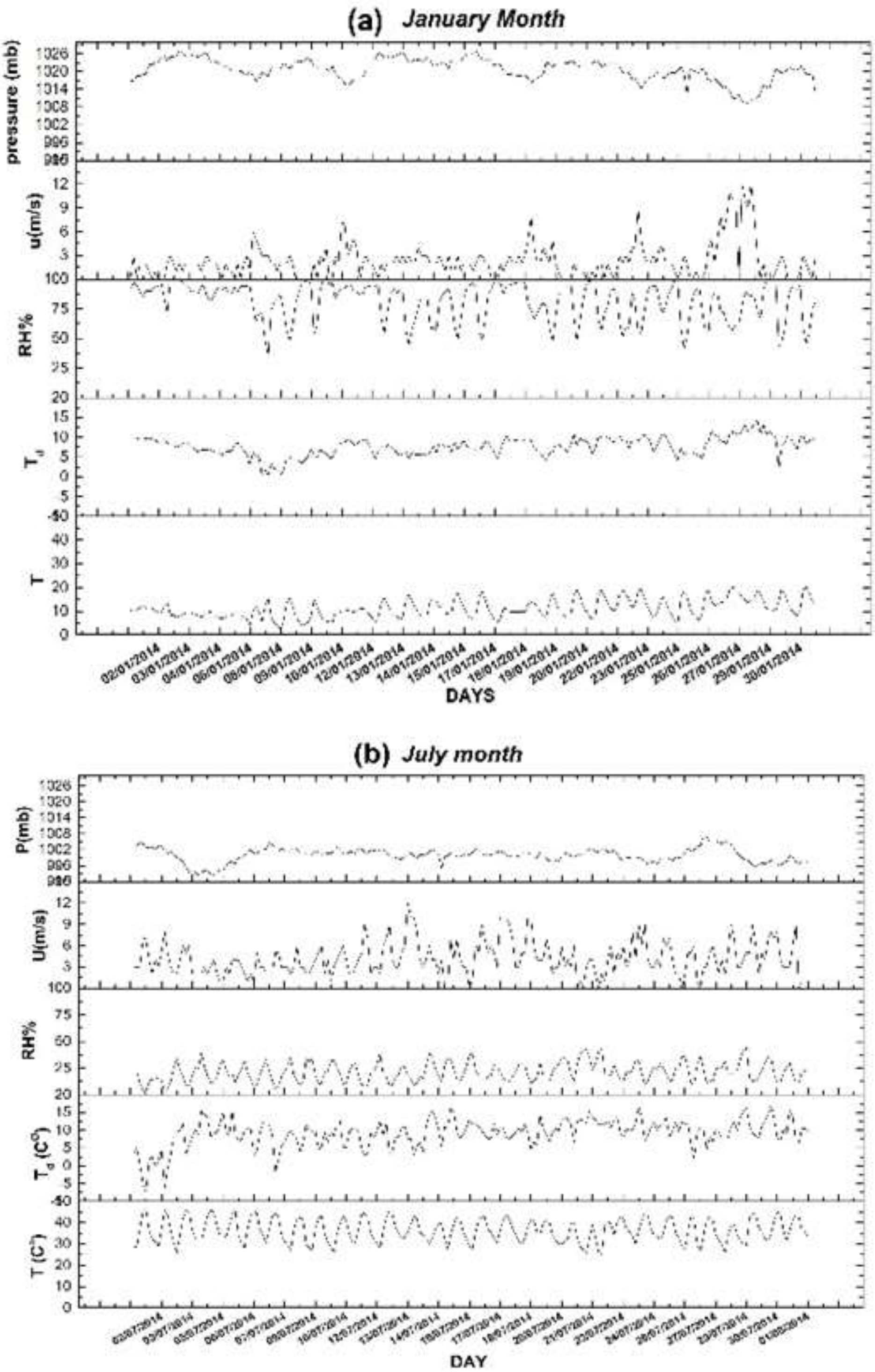


Figure 3. atmospheric surface layer conditions (temperature, dew point, wind speed, pressure, relative humidity) in Baghdad atmospheric weather station through months (a) Jan. (b) July at 2014

There is also practical wind speed at 10.2-12.2 m/s in section bounded between south to south-east. Surface layer wind direction at Baghdad airport can be compared with the direction in upper layer over 15000meter to test what is the effect of direction at surface on both radiosonde and upper air layer.

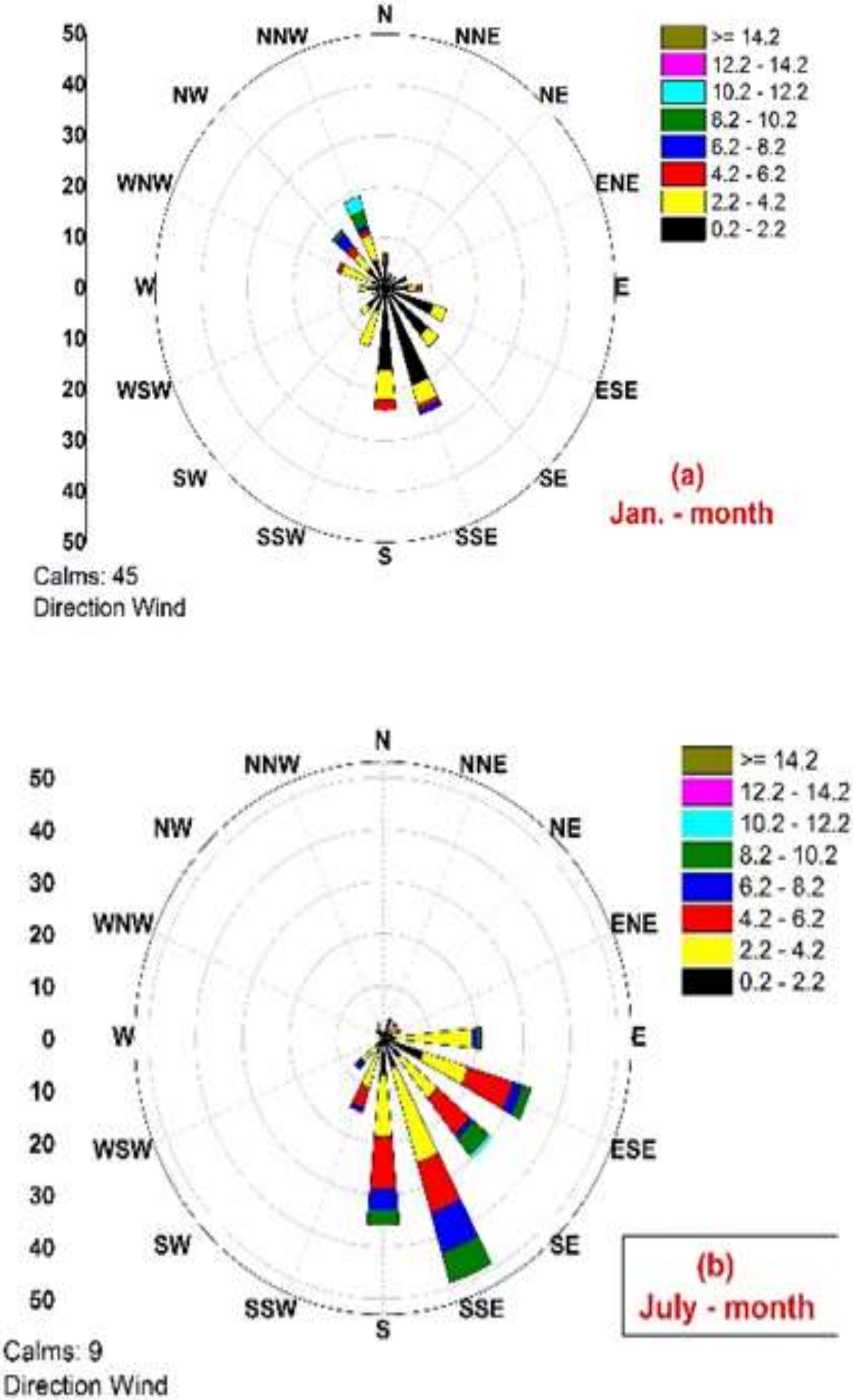


Figure 4. Wind speed and direction in Baghdad airport weather station through months (a) Jan. (b) July

Atmospheric Surface Layer Conditions by ECMWF Data: When radisonde movement in horizontally and vertically direction through its fly, known weather condition in path very important because, it's determined their direction. This weather conditions information can obtain from medium range weather forecasts, ECMWF consider as grid mesh. From used ECMWF data about 99 grid point distributed spatially inside and outside Baghdad province used to exhibited weather condition through 14 daily cases study test (in days 1,5,10,15,20,25,30 form months Jan. and July). These grid points mesh extended from 32.78°N to 33.78°S as latitude, and from 43.75°E to 45°E as longitude with spatial resolution about (0.1×0.1) degree in latitude and longitude (4). Most these data used to test convection effect on balloon raised in air, such as temperature, wind speed, direction and also sensible heat flux and boundary layer height. sensible heat flux consider one of very important index for turbulent and convective instability, all these atmospheric parameters can be obtain every 3hours in times (03,06,09,12,15,18…) UMT, from selected days in Jan. and Jul. Case study concentrated on 12PM because its represented after morning, where convection is active and also most radisonde lunched at this time. (Figure 5), show spatial distribution of sensible heat flux at 12pm from 5-Jan and July, Sensible heat flux between these stations is interpolated through IDW techniques by implemented ArcGISpro as tool program. From 99 station, there is one station located near from Baghdad Airport weather station at latitude 33.25°N degree and longitude 44.27°E, data. Data in this station (from ECMWF) calibrated with airport station to test its accuracies with respect to surface weather station. Calibration parameters in two stations by used statistical index such as linear fit for data in Jan. and July show by (Figure 6). Results of correlation coefficient refer to 0.8 for wind speed and temperature. Wind speed and temperature consider as very important index for mechanical and convective turbulent, where the accurate values for ECMWF data sensible heat flux and mixed layer height is depend in the analysis and results to determine trajectory for radiosonde, this sensible heat flux can be used to calculate vertical convective wind speed that is consider very important index to rise balloon and tracked its movement in addition to mixed layer that inter as variable in convective vertical equation, see equation from 1 to 4. Sensible heat flux represent the transfer of heat between the Earth's surface and the atmosphere, effects on turbulent air motion (but excluding any heat transfer resulting from condensation or evaporation). The magnitude of the sensible heat flux is governed by the difference in temperature between the surface and the overlying atmosphere, wind speed and the surface roughness. For example, cold air overlying a warm surface would produce a sensible heat flux from the land (or ocean) into the atmosphere, in units joules per square meter ($J\ m^{-2}$), or watts per square meter (Wm^{-2}). Results of calibration hourly data refer to ability used ECMWF data to observed surface air layer conditions at region that balloon radiosonde passed through. One of the most important to activity for convection is the boundary layer height, this height refer to the mixed layer height at daytime. Figure 7, show time sires for boundary layer height at Jan and July months

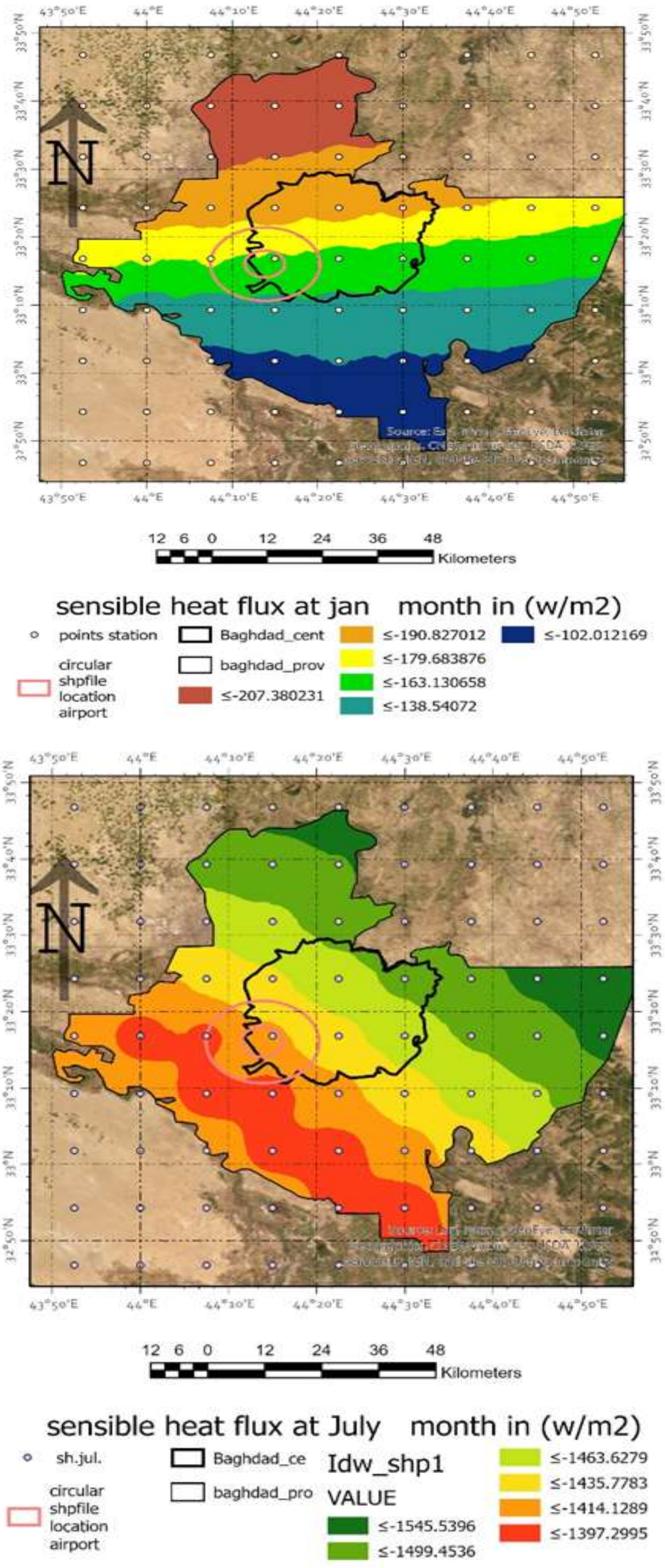


Figure 5. Surface spatial distribution of sensible heat flux at grad points from ECMWF, at (a) 5- Jan., (b) 5-July at 12pm time

Respectively. At January the action of vertical compounds by convection is weak and large values is at mid-daytime, see (Figure 7). Except at 18-Jan., Where there is equality in boundary layer height because low wind speed at Jan. see (Figure 3).

Atmospheric upper Layer Conditions

Weather atmosphere in the upper layers is significant in determining movement and direction of the radiosonde, and also GPS for balloon carrying transmitter. Approximately 14 study cases were employed, seven cases during the January and seven cases during July, due to the presence of a large difference in the air condition during the two periods despite hours was 12PM in all cases. Win9000 documented also atmospheric pressure, geo-potential height, dew point and other parameters but study focus only on the very important weather data, which is the rate of wind speed and direction with altitude up to more than 15000 meters. Information aforementioned (wind and direction) can accurately determine the path of the radiosonde and even its height and place of its fall as well, for example, the horizontal wind speed is included with it the vertical convective winds resulting from the buoyancy of air masses originating from the earth's surface due to differential heating of surface, as in the surface heat flux values (Figure 5) during the winter and during the summer. There is large difference in sensible heat flux in watt/m^2 at 5 Jan. and 5 July through 12PM, over Baghdad province, this will change vertical flux at two cases, and change wind speed (9).

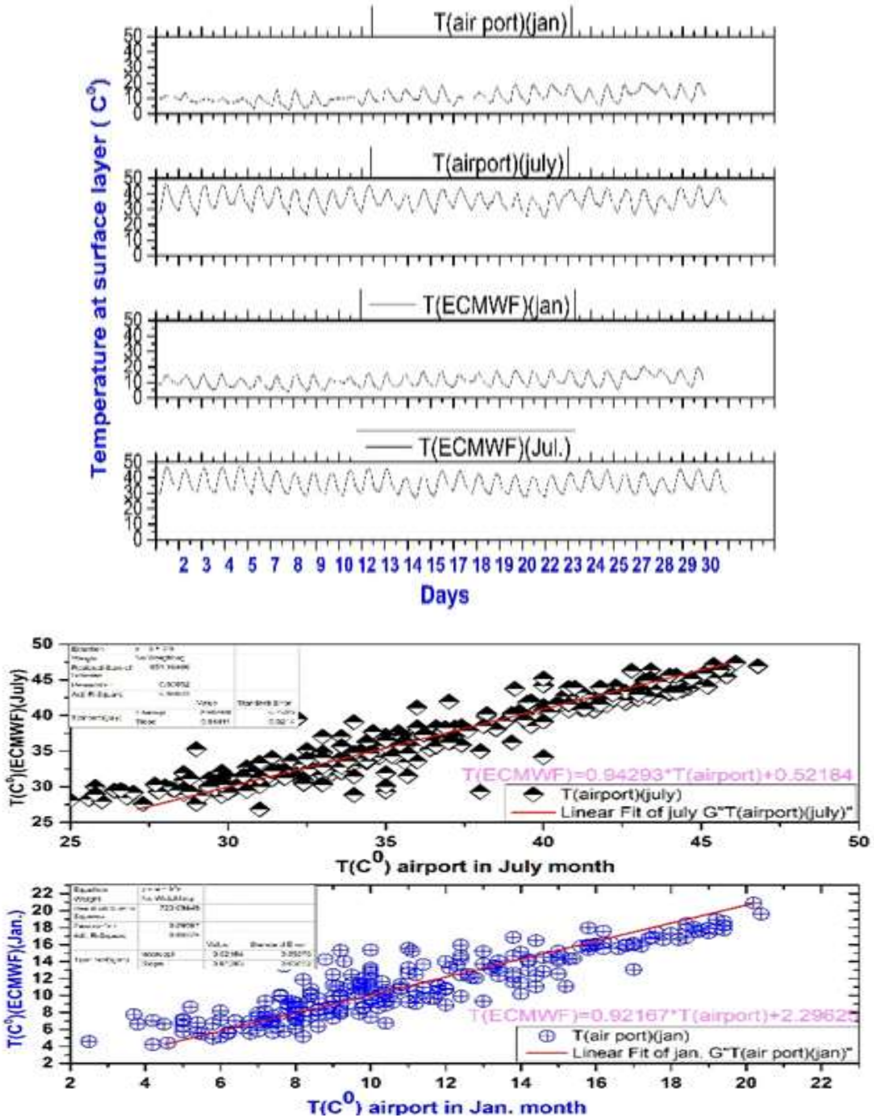


Figure 6. (a) Time series for temperature at two cases. (b) Calibration of wind speed and temperature at grad point (33.25°N, 44.27°E) from ECMWF and airport station at Jan and July from 2014

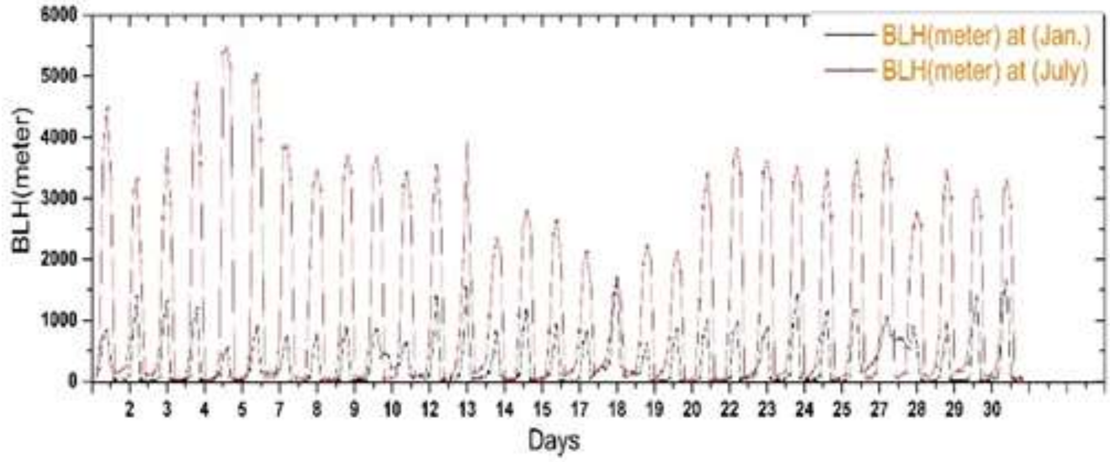
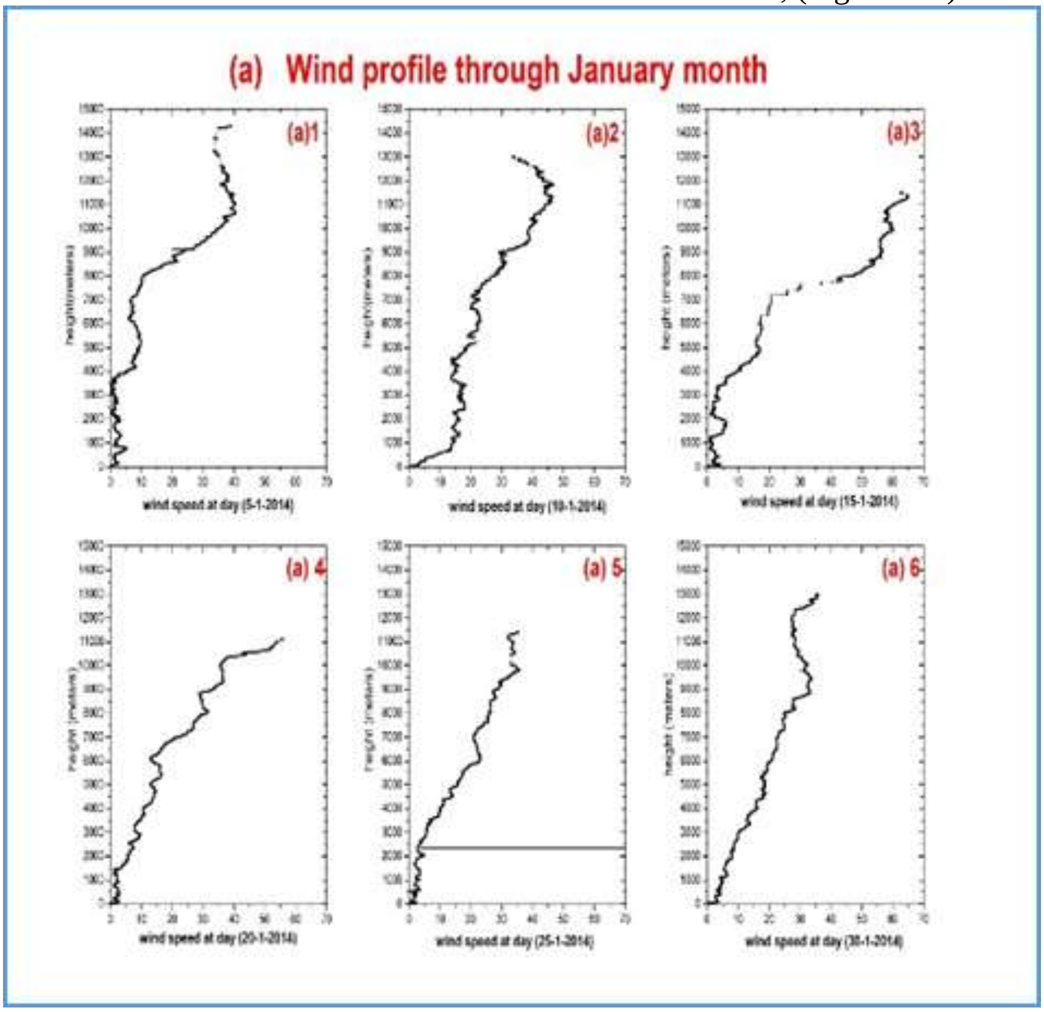


Figure 7. Boundary layer height at Jan. and July at grad point (33.25°N, 44.27°E**) near to airport station from ECMWF at 2014.**

(Figure 8) show the observed cases of horizontal wind speed with altitude plotted during 6 days at January and July from 2014, the observed case on 1-January was not plotted in (Figure 8a,b), but this case is analysis and represent in all conclusion. The wind speed in January increases slowly after the surface layer, which reaches a height of 100 meters. At altitude between 3000 to 5000 meters, there is a significant increase in wind speed with altitude due to the escaping from roughness and the absence of strong heat load during this month. For example, on January 5, (Figure 8a1) wind speed at a height of 4000 meter to 5000 meter reaches 10 m/s, while after an altitude of 7000 meters there is an increase in speed of up to 40m/s at the height of 10500 meters. After rising 10,000 meters, there is a stabilization of the speed and a decline in wind speed from 40m/s to lower values. In the case of 10-January, there is an increase in wind speed with an increase in altitude to 1000metres. At this height, the wind speed was 14 m/s and after this height there is a direct increase in speed with the rise to very large ranges that reached 11000m, where the speed reached approximately 45m/s, after this height the speed begins to slowly decrease with the height until the device falls at a height more than 13,000 meters, where wind speed at this level about 30 meters per second, (Figure 8a2). Regarding the case, 15-January, wind speed at the surface is about 4m/s, as the wind speed continues to fluctuate around this amount of speed until reaches height 3500 meters. More than 65m/s, overlapping within this altitude ranges in which fluctuations in large spikes of speed, for example during the altitude of 7500 meters, there is a sudden increase in speed from 20 to 50 meters per second, (Figure 8a3). In the case of 20-January, there is a weak in wind speed when the radiosonde is launched from the surface of the earth (32m) within a speed range between (1 to 2.5) m/s, then the wind speed begins to increase to large values after 1500 meters until the speed reaches more 50 m/s at a height of 11,000 meters, which is the height radiosonde falls. The balloon ascent period is accompanied by fluctuations in speed and an increase in velocity gradient with altitude in some cases and a weakness in velocity gradient with altitude with periods where there is a negative gradient of velocity with altitude, but it is very few and at altitudes of 8000 meters and 9000 meters, note (Figure 8a4). The case of the radiosonde take-off on 25-January is very similar to the case of the radiosonde on 15 and 20-January, with a slight difference where the speed is low, about 1m/s up to a height of one meter and not to a height of 1500 as on 20-January and 3500 on 15-January, Note (Figure 8a5). In the case of 30-January, wind speed at the surface or close to the surface was about 4 m/s, as in the case of 10-January, with a difference from the aforementioned case, since the gradient wind speed is almost constant with the height of about 10 meters per second for every 1000 meters up to the height of 9000 meters, where there is a change in Relatively negative wind speed with height at levels confined between 9000 to 12000 meters, then the slope returns positive and large to wind speed with height up to 13000 meters, (Figure 8a6), which is the height radiosonde fall to ground. The vertical wind speed profile in July very different from, what is found in January, despite the fact that the radiosonde starting in the same hour during the two months. The wind speed included in wind profile don't large in this month, (Figure 8b). Note the observations, wind speed in the seven cases study does not exceed in the best cases and at upper high altitudes more than 30 m/s. The existing conditions can be attributed to the increase in the convective force, which works in the vertical direction, and this force hinders the horizontal movement of the air and makes the speed of the air masses decline to large values, in addition to the weakness of the pressure systems and the air column according to the surface pressure values recorded during the January and July cases, (Figure 3a,b). The height of the monitoring device does not reach high altitudes in most of the case studies about 8000 meters in most cases, due to the presence of severe atmospheric turbulence during this case and the vibration perhaps of balloon and the lack of movement in a soft way that could lead to this situation, but there is Other factors and lateral forces can be included in the calculations, such as the movement of the descending air due to the presence of atmospheric high pressure and the movement with the clockwise. Through the analysis of the seven study cases to understand the behavior of wind or wind segment during those periods of weather conditions. It is possible to take the behavior of the case for the selected days of 5-July, and the case in general is a regular and small increase in the speed of wind registration with the height of 12 km, where the speed reaches 30m/s, (Figure 8b1). As for the case on 10-July, the speed was less than 15 m/s up to 7000 meters and then increased to 18 m/s at higher altitudes until the balloon or the transmitter fell. This is the only case study in which the monitoring device reached a height of more than 15,000 meters, (Figure 8b2). Regarding the other cases from the 15th and 30th, the wind speed in the convective layer of mixing at a height of 2000 meters is much less than 10 m/s, and the speed increased significantly to 30 m/s, as in the case of 25-July, while the speed remained low even at higher altitudes to range 8000 meters in the rest of the other cases, Note the (Figure 8b5). One of the most important indicators of knowledge the direction of the radiosonde movement, is by determining the domain direction of the prevailing winds at this height. Convective conditions and turbulence can be changing the path of the radiosonde movement according to the observed determined of atmospheric parameters. For example, in the case of 5-January, wind direction northeast at the moment of the radiosonde's take-off, then gradually shifted to southeasterly and change direction after that dramatically after an altitude level of 2000 meters to the northwestern direction once to the northeast again. Note the (Figure 9a1), this situation can be attributed to the presence of relatively low wind speeds. At this altitude, the wind speed drops dramatically, (Figure 9a1), so the sensor direction of the device is not fixed, and this leads to a major disturbance in determining the prevailing direction at this level of altitude, by Transmitter signal for the device. As for the case study on 10-January, there is a regular change in direction with the altitude from the earth surface in east direction to the northeast direction at the surface to the southwest direction, which is fixed with the increase of the prevailing winds to 30 m/s at the height of 7000 meters above the surface of the earth. The study case during 15-January is similar to the case for 5-January, where it was observed that there was fluctuation in the direction of the wind and stability with a significant increase in the prevailing wind speed, and with it the prevailing direction becomes the western to northwest direction up to 12000 meters and the connection to the radiosound great instability due to a decrease in wind speed and fluctuation significantly at the altitude level of 2000 meters. Note (Figures 8a3) and 9a3, but this fluctuation in the direction gradually returns to is cut off. The case studies on 20 and 30-January are almost equal in terms of the prevailing wind direction, which is northwest in the case of 20-January and southwest in the case of 30-January, and the case of 25-January also witnessed fluctuations in wind speed and direction, (figure 9a4,5,6). Regard to the wind direction at the upper levels during July, it is closely related to the wind speed during the same period. For example, during the study case on 5-July, Wind direction at the surface level from south to southwest, shifts at the height of 2000 meters to the south, and return to the south and southwest at The elevation level approximately 6500 meters and it continues in this prevailing trend until the end of the balloon's height level more than 12000 meters, (Figure 9b1). As for the case of 10-July, (Figure 9b2) direction change from west to northwest, from the surface level to a height of 7000 meters to turn to the western side till the end of the balloon's movement path with the stability of the prevailing wind speed at these levels, in wind speed more than 15m/s. Case study 20-July may differ from the two previous cases by the presence of a decrease in wind speed at higher levels at a height of more than 2000, and therefore it will be reflected in the direction of the prevailing winds, which is fluctuating and unclear as a result of the situation that was previously explained (Figure 9b3). Regarding the case study, during the day of 20-July, we noticed that there was stability in the direction of the prevailing winds in the western and northwestern direction from the surface level to a height of about 5000 meters, but the weakness of the wind speed at this level led to a change in the direction to the southwestern and southern direction at a height of more than 5000 meters meter, (Figure 9b4). The previous study case was almost repeated during the study case on 25-January, with the change of direction at the altitude level of more than 2000 meters as a result of an increase in speed and not a decrease in the speed level, where direction changes from northwest to south till the last levels of balloon arrival, (Figure 9b5). Regarding the case study on 30-July, wind speed begins to be large near the surface and reaches 10 meters per second, then begins to decrease to less than 2 meters per second at a height of 2000 meters. This decrease in speed leads to fluctuation and inconsistency in the recorded direction where it is northwest, At the surface and through the layers from 2000 meters to 3500 meters, it fluctuates, then the trend begins to remain stable at the northwest to the west at the highest recorded height of approximately more than 7000 meters, (Figure 9b6).



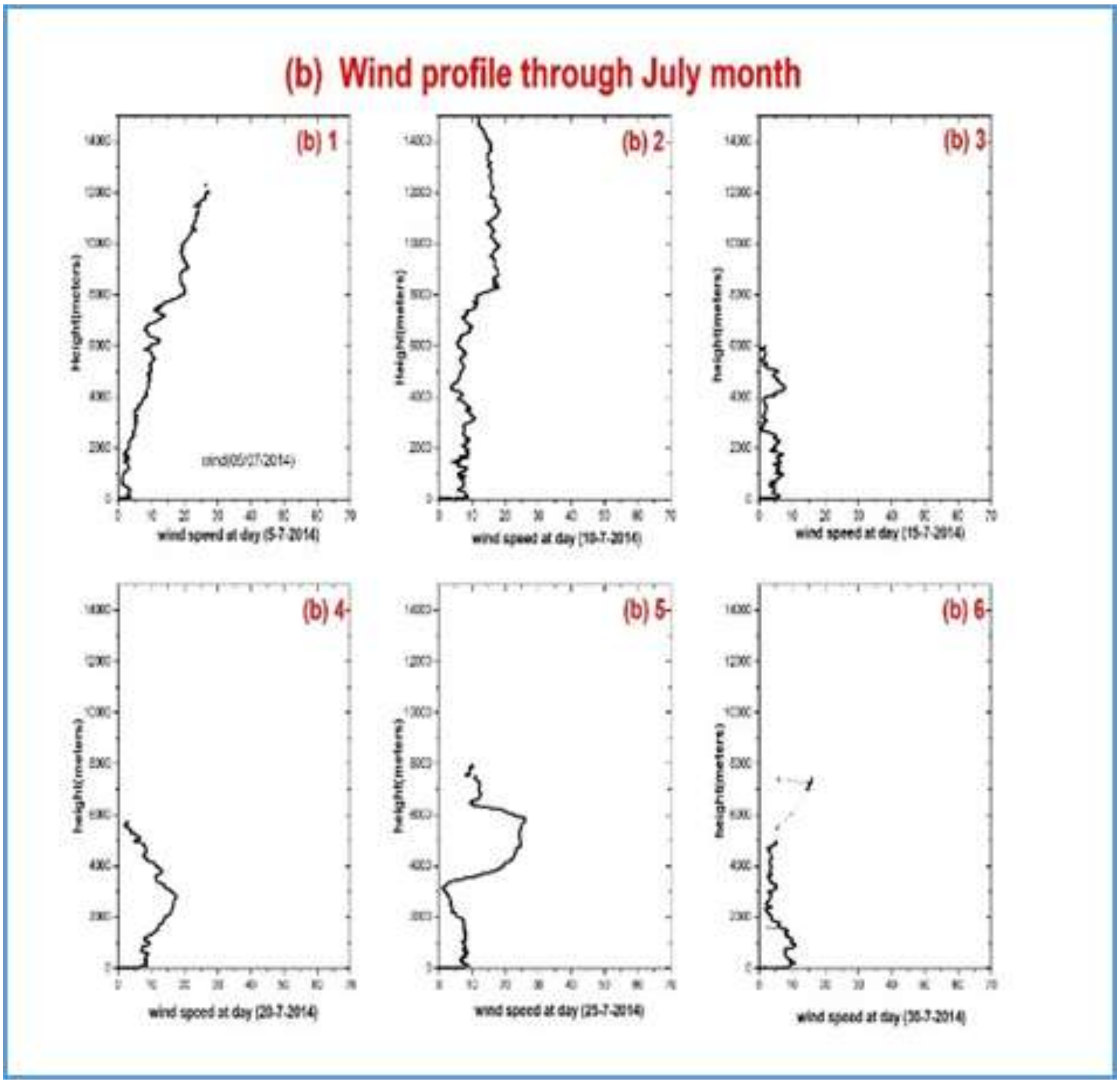


Figure 8. Behavior of wind speed profile at upper layers at days 5, 10, 15, 20, 25, 30 from months (a) Jan, (b) July

Effect of Convection on Radiosonde Path Movement by GPS: In this study, ArcGIS program used to track trajectory of the radiosonde movement, point state from Baghdad airport station, where the GPS values given from sensor transmitter device observed with data set weather factors, according to the software program Win9000. Effect of convection conditions on the trajectory of the radiosonde movement can be done from Comparison between the cases observed, on days considered to be within the days of cold winter (nonconsecutive) and compared with the cases observed during the summer days (convective days). (Figure 10), denotes a movement during the January observations, with the paths of the radiosonde movement in the (Figure 10). Distances that balloon moves were significantly greater than what found in the days of hot summer. Remarking that all the observations were made at 12PM which is a time for a standard observation, note (Figure 10a,b). In July observations, distance reaches tens of kilometers traveled by the balloon flight and at relatively high altitudes, as shown in (Figure 10a), which represent the speed and direction of observation of the balloon. As for the distances that the balloon covered in the July observations, they were short, and most of the distances it traveled are within or close to the airport's boundary, except for some observations, (Figure 10b). Thus, there was a movement of the balloon for a relatively large distance. As for the direction of the balloon's path, it was mostly East to Southeast, according to the prevailing wind speed, which was northwest to west with respect to the month of January, except for a specific case there, Where the path of the balloon was initially northerly and then turned to the northeast.

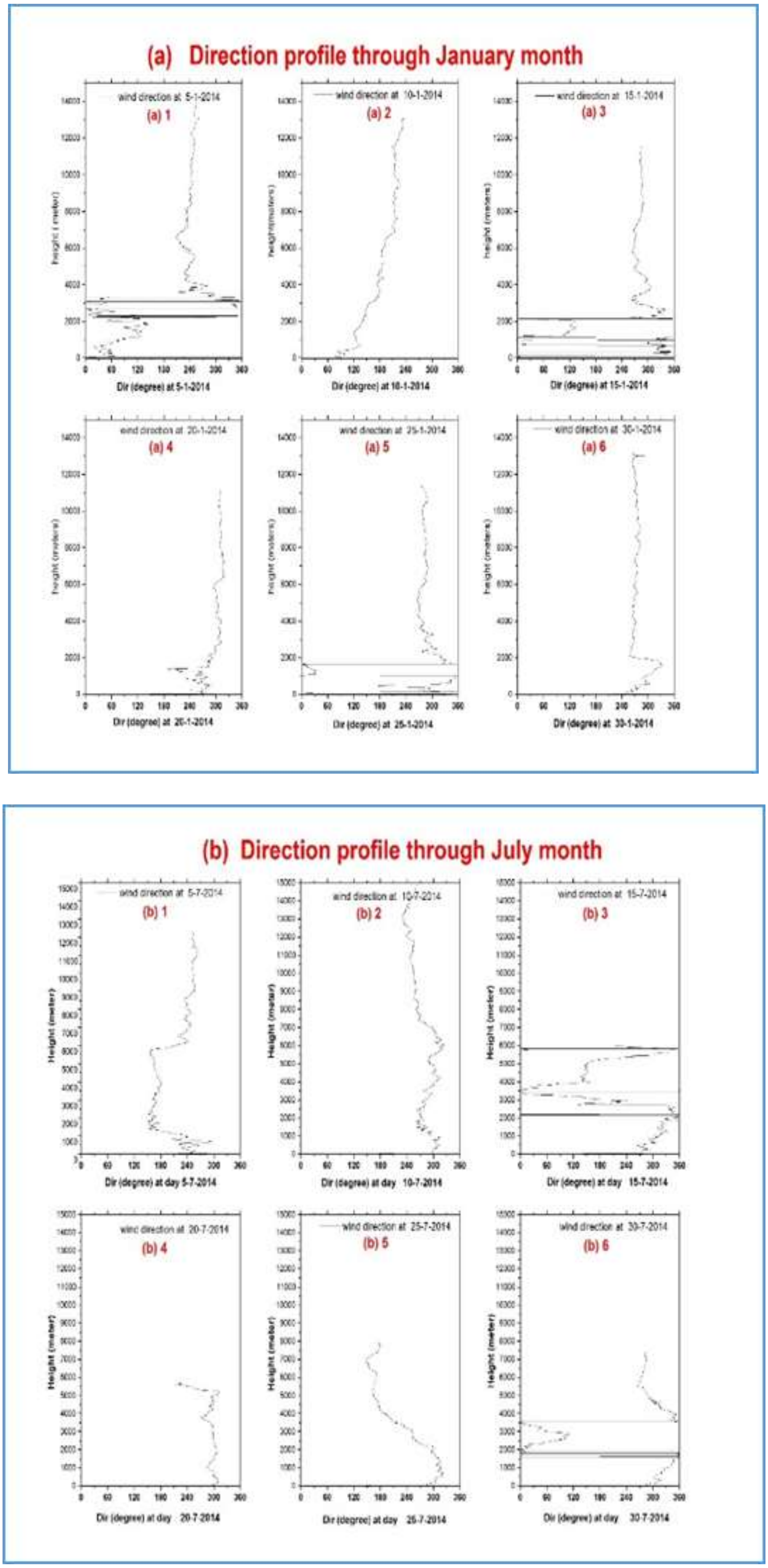
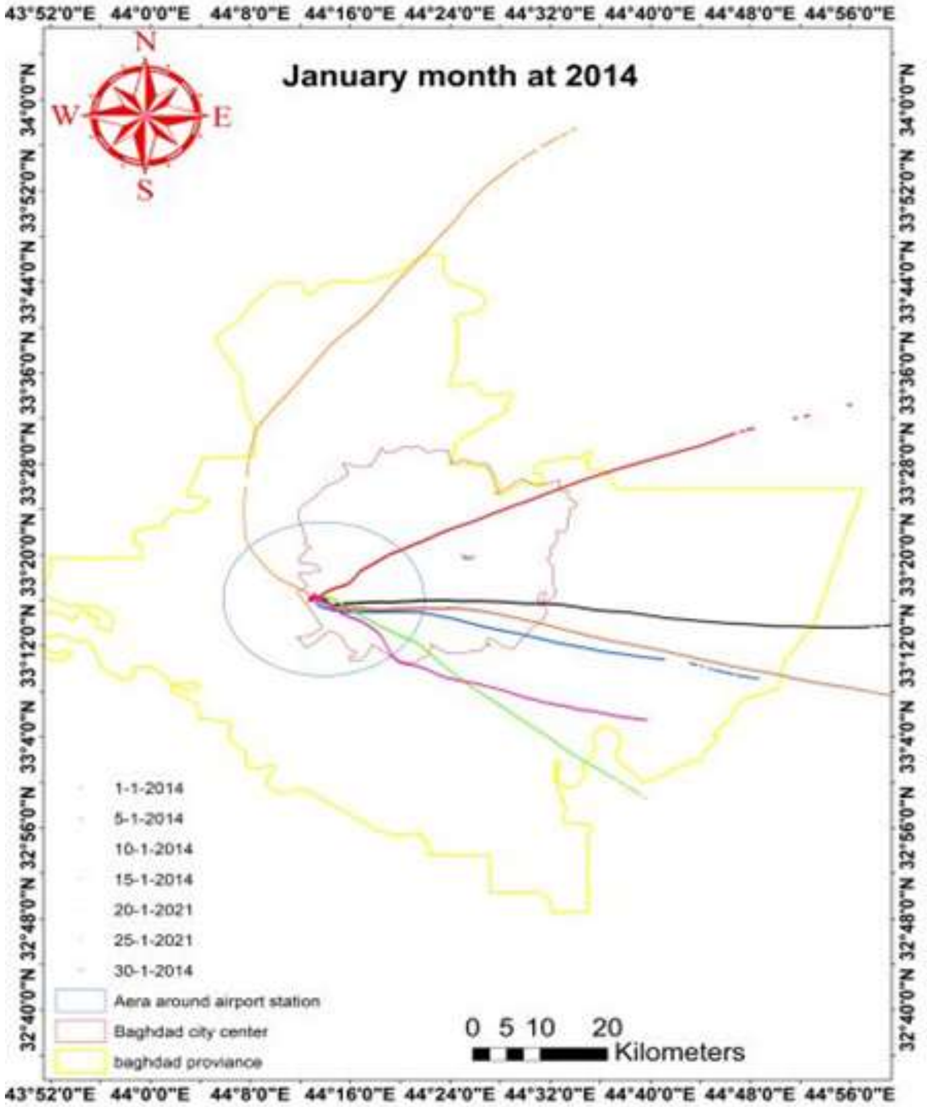


Figure 9. behavior of wind direction profile at upper layers at days 5, 10, 15, 20, 25, 30 from months (a) Jan (b) July

As for checking state in July only, the path of the balloon was mostly towards the east, see (Figure 10b). The reason for the absence of horizontal movement for large distances from the airport station in the summer, explained by the large air mixture, in the one hand and on the other hand vertical movement of convective wind speed, which makes horizontal movement over large distances unavailable, as is the case in January observations, where there is movement horizontal allows movement to great distances before the balloon bursts and falls, in addition to the presence of atmospheric depressions during the winter months in which the movement is counterclockwise and there is a large synoptic process of ascent and heights in the existing limiting layer, on the other hand the absence of vertical convective movement makes horizontal movement resulting from the different pressure systems in a fully active mode.



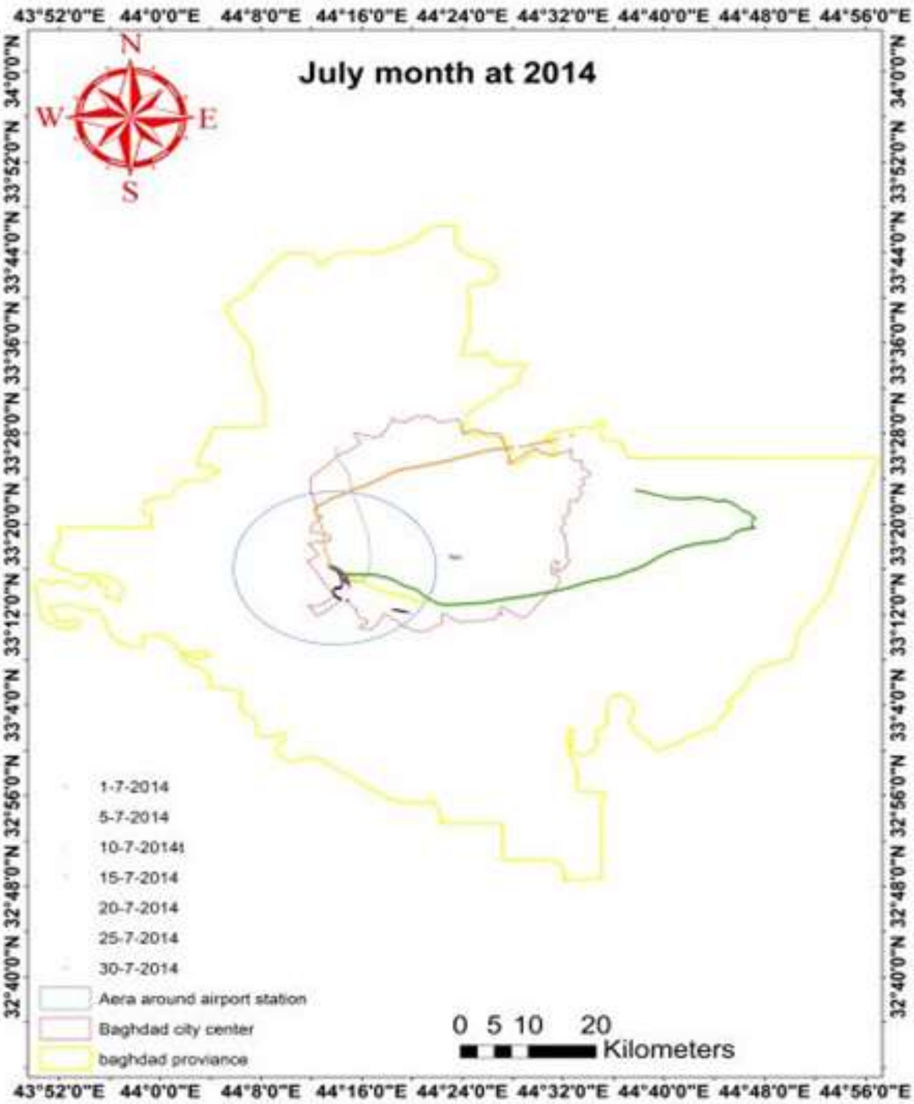


Figure 10. Trends radiosonde lunched from Baghdad airport station at days 5, 10, 15, 20, 25, 30 from months (a) Jan (b) July through 2014

Conclusions

Convection defined as masses of relatively warm air moving from the hot surface to the top. Sometimes these masses appear within convective clouds when there is a change in the water phase, such as, condensation of water vapor. The energy in the air in the form of an overflow has a great importance in the movement of any object located in the upper atmosphere (airplanes, balloons ... drones and in air navigation in general). Understanding the behavior of these hot air masses and their impact on air stability is one of the important things. In determining the path of movement of an object moving in the air. The current study is an attempt to determine the effect of convective conditions on the behavior of different weather factors within the atmosphere. Dependent on Win9000 program, which is an integrated system for storing, analyzing and displaying observations and data of the upper layers of the atmosphere. Through the comparison of cases studied, it was concluded that there is a strong influence of convective masses on the behavior of the main atmospheric parameters, and this case was clarified by the radiosonde path during these conditions. In winter (January) and summer (July) low speed values can lead to a disturbance in the observed direction due to the absence of prevailing wind speeds. Wind speed increases with altitude in most of the cases observed during the month of January, while wind speed can decrease or remain close to its values during the month of July under convective conditions. The presence of intense atmospheric mixing and vertical movement due to buoyancy during the month of July leads in most of the observations to the presence of relatively few wind speeds even in the upper layers of the air within the jet stream, where the wind speed does not reach in the best cases to 30m/s during the month of July, while in January it reaches Values Wind speed of more than 65m/s at higher altitudes.

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