

Study the Relationship of Thermal Reflection Intensity with Its Height and Thickness

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Article Info

Received
02/10/2020

Accepted
15/12/2020

Published
13/5/2021

ABSTRACT

Surface heat inversion (SHI) is important in determining the spread of pollutants in the lower part of the troposphere. This paper presents the relationship between heat inversion intensity and its height and thickness using the daily radiosonde data (midnight) of the period from (2013-2014) obtained from the Iraq Meteorological Organization and Seismology (IMOS). The results of the study were that heat inversion intensity increases with the increase in height in winter, summer, and autumn, during the spring, so there is no relationship. The relationship of heat inversion thickness with intensity is linear in Spring, Summer, and Autumn, but inverse in Winter.

KEYWORDS: Inversion; height; intensity; thickness.

الخلاصة

يعد انعكاس حرارة السطح (SHI) مهماً في تحديد انتشار الملوثات في الجزء السفلي من طبقة التروبوسفير. يعرض هذا البحث العلاقة بين شدة الانعكاس الحراري وارتفاعها وسمكها باستخدام بيانات المسبار اللاسلكي اليومي (منتصف الليل) للفترة من (2013-2014) التي تم الحصول عليها من هيئة الأرصاد الجوية العراقية وعلم الزلازل (IMOS). وكانت نتائج الدراسة أن شدة الانعكاس الحراري تزداد مع زيادة الارتفاع في الشتاء والصيف والخريف خلال فصل الربيع فلا توجد علاقة. العلاقة بين سمك الانعكاس الحراري والشدة هي العلاقة بين الربيع والصيف والخريف، ولكنها معكوسة في الشتاء.

INTRODUCTION

Air temperature arise above the surface refers to stability of the boundary layer [1]. This phenomenon called "Surface temperature inversion" in this case the laps rate is against its normal state that means increasing of air temperature with height intend of decreasing air temperature with height [2]. Air temperature act as barrier prevents the exchanging between surface and atmosphere [3]. Intensity and thickness of the most important properties of surface heat inversion [4]. Inversion intensity is the energy of inversion and has essential importance, defined as the difference in air temperature between two heights at surface and apex of surface temperature inversion [5]. In terms of inversion intensity, it's always positive the reason behind that the difference between air temperature at lowest level [6]. Air temperature at highest level with increasing of difference positive temperature inversion becomes more intensity and more stability [7]. Intensity of inversion has ability to prevent vertical movement of pollutant

and has great effect of spreading contaminants [8]. Thickness of inversion defined as the difference between apex and surface of heat surface inversion [9]. Increasing of thickness inversion refer to the energy of inversion [10]. Many studies have emphasized on the surface heat inversion for example Z. S. Kasim on 1995 using daily (midnight and midday) upper-air meteorological data, found the relationship between the thickness and intensity of the heat inversion in summer and autumn is linear, while in winter and spring invers [11]. The main goal of this study is to conclude several empirical relationships among surface inversion parameters such as inversion layer height, its thickness and its intensity.

The body of the book is known as the front matter. When the book is divided into numbered chapters, by convention the introduction and any other front-matter sections are unnumbered.

Keeping the concept of the introduction the same, different documents have different styles to introduce the written text. For example, the introduction of a Functional Specification consists

of information that the whole document is yet to explain. If a User guide is written, the introduction is about the product. In a report, the introduction gives a summary about the report contents.

DATA AND METHODOLOGY

The purpose to execute this study, it obtained radiosonde data, included air temperature and elevation of the Baghdad station belonged to Iraqi Meteorological Organization and Seismology (IMOS) for a period of one year (2013-2014). The station is supposed to give the observations two times a day (00 and 12) GMT, but unfortunately it was available only one time, 00 GMT. Data have been provided 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. The data contains air temperature, pressure, dew temperature, humidity and wind speed with its direction at different heights, air temperature with height data were used for this study [7]. To calculate the Surface heat inversion characteristics, a general software package was built using MATLAB software. This software calculates each surface heat inversion characteristics according to their equation mentioned previously for Baghdad meteorological stations for the period (2013-2014). Calculated was the inversion height, the second height of the surface thermal inversion $H_{in}=Z_2$, As for the thickness, it was extracted with the difference between the two inversion altitude Z_2-Z_1 , and of inversion intensity by a difference of two temperatures at the beginning and end of inversion $T_2 - T_1$.

Relationship between of inversion intensity with height and thickness

In this section, have attempted to find out the relationships between heat inversion height with its intensity, and thickness with its, intensity. In this section as seen before there were scatter for the results of above variables, so the above replace idioms presented in semi-log lots.

Inversion intensity and height

The relationship between both the height and the intensity of the inversions is one of the most important characteristics of the inversion. Therefore, Figure (1) shows these relationships for each seasons of the year followed by the general mathematical formula:

$$H_{in} = \alpha + \beta * I_{in} \tag{1}$$

Where α and β empirical constants derived from the result height and intensity. The values of them are derived for each seasons and reporter in from Table 1. All relationships in this figure obeyed to Equation (1) have linear behavior with sharp increasing except for spring which is roughly constant. The results for all seasons show an increase in the intensity with the altitude, starting from the first inversion layer. The base of the inversion and up to the top of the inversion represents the second height, means that the relationship is positive as the altitude increases and the intensity increases and vice versa. As for the results of the behavior of this relationship was linear behavior in all seasons.

Table 1. The values for the constants of Equation (1).

season	α	β
winter	44.9	5.77
spring	40.5	1.35
summer	40.8	8.28
autumn	33.4	20.60

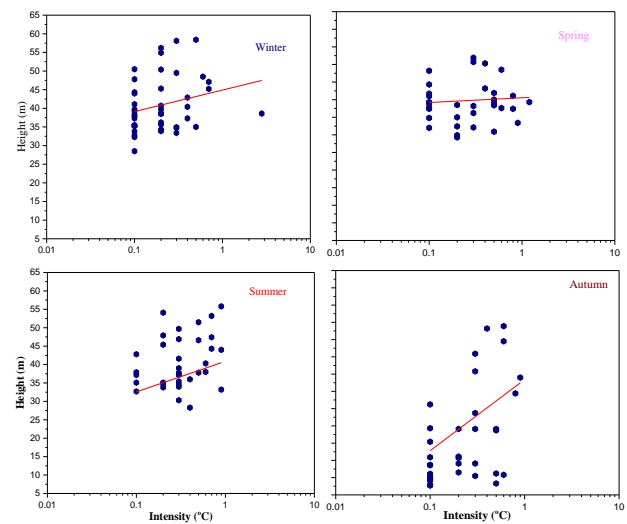


Figure 1. Relations for inversion intensity with their height during seasons.

Inversion intensity and thickness

After finding the relationship between the intensity of the inversion and altitude and discuss the results in item (A), Here, Figure (2) represents the relationship between the intensity and the thickness of the inversion in all seasons of the year followed by the general mathematical formula as follows:

$$Th_{in} = \zeta + \varkappa * I_{in} \tag{2}$$

where ζ and \varkappa empirical constants derived from the result thickness and intensity. The values of

them are derived for each seasons and reporter in from Table 2. The results of the relationship were direct in each of the spring, summer and autumn, any more the thickness of the inversion increases the intensity and behavior in these seasons is linear, while the behavior of the winter is reversed.

Table 2. The values for the constants of equation (2).

season	Σ	γ
winter	5.4	-19.0
spring	42.6	5.19
summer	18.8	7.27
autumn	10.3	6.16

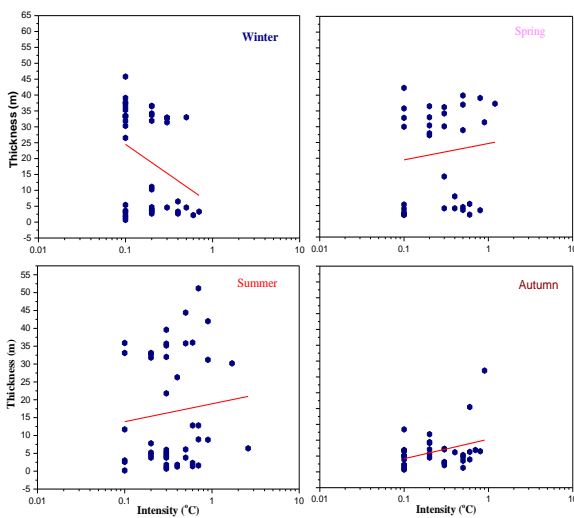


Figure 2. Relationship between intensity with thickness inversion during seasons.

CONCLUSION

Based on the observations of upper air layers measured by radiosonde for one year of 2013 at meteorological Baghdad station:

- 1- The relationship between both the height and the intensity of the inversions linear for seasons except for spring which is roughly constant.
- 2- Found an increase in the intensity with the altitude.
- 3- The relationship between the thickness and intensity of the heat inversion in each of the spring, summer and autumn is linear, but in winter invers.
- 4- Anymore the thickness of the inversion Particular faculties or courses may have their own guidelines for different aspects of presentation, so always check your own course

documentation or with course tutors. What follows is general advice on the presentation of courses assignments which is usually, but not always, appropriate.

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