The Influence of Greenhouse Effect on Earth's Atmosphere Based on Artificial Intelligence

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Abstract. Greenhouse gases absorb and release a large amount of ground thermal radiation, and modify part of the energy between the earth and the atmosphere, so that it has a greenhouse effect. It is the main cause of global warming and climate anomaly caused by modern human activities. In order to solve the shortcomings of the existing research on the impact of greenhouse effect on the Earth's atmosphere, this paper briefly introduces the numerical methods of radiation and heat conduction coupling, the components of the Earth's atmosphere, and the sources and sinks of greenhouse gases. The calculation and analysis of spectral absorption coefficient and the configuration of super parameters of depth learning model are discussed. A numerical simulation of carbon dioxide concentration based on depth learning is constructed and the C02 concentration profile is calculated using the C02 statistical inversion flow of principal component analysis. The calculated temperatures of the standard atmosphere and the standard atmosphere with the carbon dioxide concentration doubled were compared. The data showed that the temperature in the upper stratosphere rose to 58.

1. Introduction

At present, water and climate pollution have different impacts on a global scale. The most obvious and important impact is that greenhouse gases such as carbon dioxide, which generate human activities, have experienced serious global warming.

Nowadays, more and more scholars have done a lot of research on the impact of greenhouse effect on the earth's atmosphere through various technologies and system tools, and have also made certain research achievements through practical research. Urban A V uses the Stochastic Time Reversed Lagrangian Transfer (STILT) model to estimate the seasonal cumulative footprint climatology of greenhouse gas measurements obtained at the 301 meter high Zottino Tower observation facility from 2009 to 2015 (excluding 2011). The results show that the Russian soil cover map based on MODIS data in 2014 was used in the same period to measure the impact of ZOTTO environmental soil cover. The analysis of the contribution of individual heads shows that the ZOTTO greenhouse gas concentration initiative is most affected by the types of crops near the tower, namely, sludge, mixed forest, and light and dark forest [1]. Hoyos Santillan J, based on the different spectral absorption of greenhouse gases, the distribution characteristics of the Earth's infrared frequency range (IR) and spectral radiation density with temperature rise, analyzed that RIE always increases the greenhouse gas effect, while the United States may increase or decrease the greenhouse gas effect due to the spectral change of the Earth's radiation energy, which depends on the positive and negative integration of the EEA cross spectrum. The quantitative data of this work also explains why the greenhouse gas effect will affect some spectral characteristics in extremely cold regions: when the surface temperature drops below 20 ° C, SAE CO2 will have a stronger impact, and both RIE and the United States will have a positive impact on the temperature rise in polar regions, because the global climate will double intensify [2]. Perry G thinks that the greenhouse effect is simulated in the laboratory setting, including a heated ground area and two chambers, one filled with air and the other filled with air or carbon dioxide. Due to the retroactive scattering of the previous ground area, higher infrared radiation was observed, and the infrared radiation was reduced. Increased infrared radiation due to backscattering from the anterior chamber. This should increase the air temperature in the rear chamber by 3.5 to 5 degrees, but no such increase was found [3]. Although the existing research on the impact of greenhouse effect on the earth's atmosphere is very rich, there are still many problems in its practical application.

This paper mainly generates the carbon dioxide concentration in China from January to December 2020 through simulation, and uses the obtained simulation data as training data to train the depth learning model Conv LSTM neural network, so that the final depth learning prediction model absorbs the internal model of atmospheric environment theory in the CMAQ number prediction model. The C02 concentration profile is calculated using the C02 statistical inversion flow of principal component analysis. Finally, the C02 concentration profile results calculated by numerical

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value and principal component analysis are obtained through neural network to calculate and solve the atmospheric radiation temperature field. Finally, the impact of different greenhouse gases on atmospheric temperature is comprehensively analyzed according to the results.

2. The Impact of Greenhouse Effect on the Earth's Atmosphere Based on a Artificial Intelligence

2.1 Earth Atmosphere

Atmospheric composition: The evolution process can be divided into three stages: original atmosphere, declining atmosphere and current oxidizing atmosphere. Due to the presence of light elements such as helium and carbon [4]. From drainage to water supply, drylands release water, carbon dioxide, carbon monoxide, methane, ammonium and sulfide, thus reducing the atmosphere. Today, the main components of N2 atmosphere (about 78% by volume), O2 (about 21%) and Ar (about 1%). In addition to the dramatic changes in the content of aquifers, other gases have also become trace gases. Although less than 1% of the total atmosphere [5].

2.2 Greenhouse Effect

The sources of atmospheric greenhouse gases can be divided into natural sources and anthropogenic sources. The increase of anthropogenic sources is the main factor for the increase of atmospheric greenhouse gas concentration.

(1) Carbon cycle. Carbon is generated between the global atmosphere, oceans, ocean boundaries, lithosphere, global biosphere and other carbon reserves, so carbon loss in the atmosphere is distributed in the carbon cycle of the atmosphere [6]. Carbon dioxide is absorbed through photosynthesis, thus allowing carbon to enter the atmosphere; Biological observation, decomposition and burning of organic matter, carbon returns to the atmosphere from the biosphere. A similar process occurs when exposed to light at sea level [7].

(2) Sources and sinks of methane. Methane has the strongest warming effect, because it receives organic substances in the atmosphere in the largest proportion, and can accept higher emissions than supercritical carbon dioxide without infrared. However, human behavior has the greatest impact on its relative concentration ratio in the environment, and a higher relative concentration ratio is required to estimate heat [8]. In addition, human activities have a significant impact on the human content in the atmosphere, and warming also requires the most relative change ratio. Figure 1 shows the percentage of all factors in the human source.

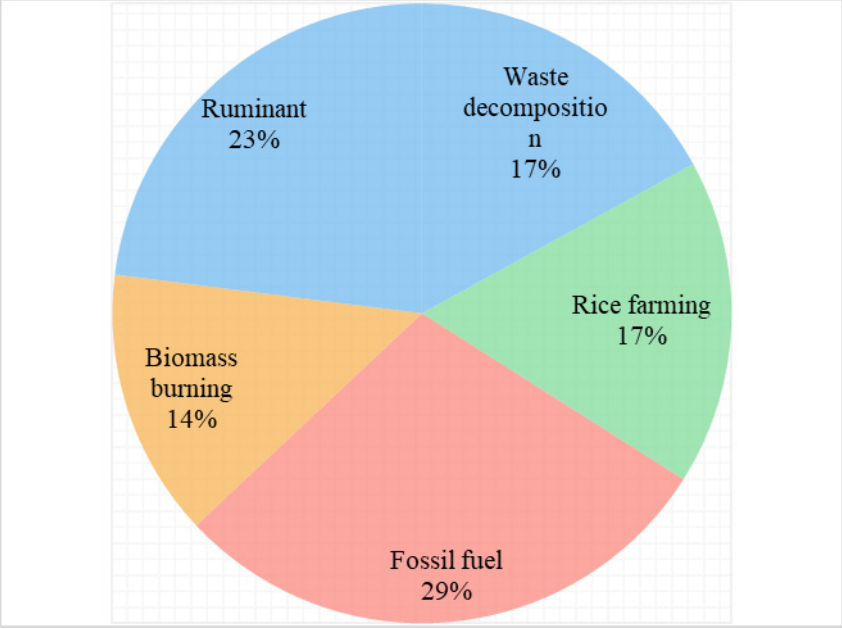

Figure 1. Schematic Diagram of the Proportion of Various Factors in Human Resources

2.3 Radiation and Heat Conduction Coupling

The following is the general form of the transient coupling heat transfer energy equation of radiation and heat conduction in radiation participating media, as shown in Formula 1.

$$rt\frac{\delta G}{\delta g}bvc(d_a gradF)-bvc\vec{p}+\varpi \qquad (1)$$

In the formula, r is the density, a is the specific heat capacity, d_a is the thermal conductivity of the

medium, ϖ is the heat source per unit volume, and $\vec{p}$ is the full spectrum radiant heat flow density vector. Since there are many expanded items in the formula, for the convenience of expression and differentiation, as shown in Formula 2.

$$\omega^{x}(G) = \int_{\Delta K} -bvc\vec{p}cW \tag{2}$$

It is called thermal radiation source term. With reference to the node division in the following section, Formula (1) can be discretized using the full implicit scheme.

$$rt\Delta x \frac{G_u^{n+1} - G_u^n}{\Delta g} = \frac{d_{a,ie}^{n+1}(G_{u+1}^{n+1} - G_u^{n+1}) + d_{a,ic}^{n+1}(G_{u-1}^{n+1} - G_u^{n+1})}{\Delta x} + \omega_x^{n+1} \tag{3}$$

Where, the time step is Δg, and the superscript m represents the time level of the non-stationary problem. $d_{a,ie}$. $d_{a,ic}$ is the thermal conductivity of the medium at the interface when harmonic averaging is adopted. Equation (3) is the basic discrete equation of the ray tracing node analysis method.

3. Research on the Influence of Greenhouse Effect on the Earth's Atmosphere Based on Artificial Intelligence

3.1 Calculation and Analysis of Spectral Absorption Coefficient

Since the HITRAN96 version is used for the calculation, and the wave number range of the database is 10~26354.15cm −, HITRAN is only used for the absorption coefficient of 1000~10000cm −, while MODTRAN is used for the absorption coefficient of 130000~60000 cm −. Eight gases are considered in the HITRAN spectral calculation: HO2, CO2, CH4, O3, NO2, CO, NH3, which are the components with large content in the atmosphere. In this paper, three working conditions are calculated, which are: the standard atmosphere for reducing water vapor concentration (hereinafter referred to as dry atmosphere); 2 times the CO2 concentration in the standard atmosphere; 2 times CO2 concentration in dry atmosphere [9]. In order to obtain correct information from the measured spectrum, a forward model is needed to correctly describe the physical process of the measurement process. The specific inversion process is shown in Figure 2.

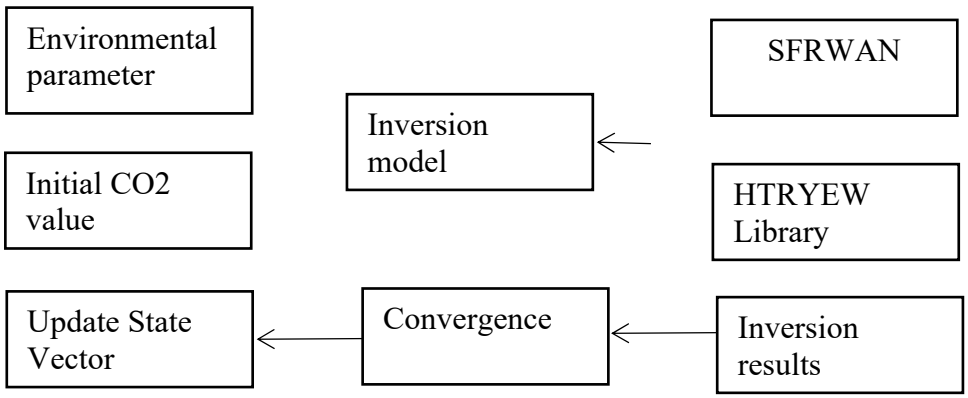

Figure 2. Schematic Diagram of Atmospheric C02 Profile Inversion

3.2 Hyper Parameter Configuration of Deep Learning Model

In the training process, the main super parameters of the deep learning model are configured as follows:

(1) Connection weight initialization: use the default standard normal distribution method in the pythoch framework to initialize all model parameters, and use the zero initialization method for the memory state of Conv LSTM to ensure that the original memory state is blank [10].

(2) Batch size: set the batch size to 13, divide the training set into about 352 batches, and complete the first round of training after batch training.

(3) Training rounds: the set model training rounds are 100. Stop training after 100 rounds of training.

(4) Optimizer: Adam optimizer suitable for MSE loss function is selected for optimization training [11].

(5) Learning rate: Select the learning rate of 0.001. During the training process, the learning rate will automatically decline and adjust according to the training progress.

4. Application Research on the Impact of Greenhouse Effect on the Earth's Atmosphere Based on Artificial Intelligence

4.1 Design of Artificial Intelligence Based Method for the Impact of Greenhouse Effect on the Earth's Atmosphere

(1) Numerical simulation of carbon dioxide concentration based on deep learning

The specific operation steps of the pollutant concentration numerical simulation model are as follows (as shown in Figure 3):

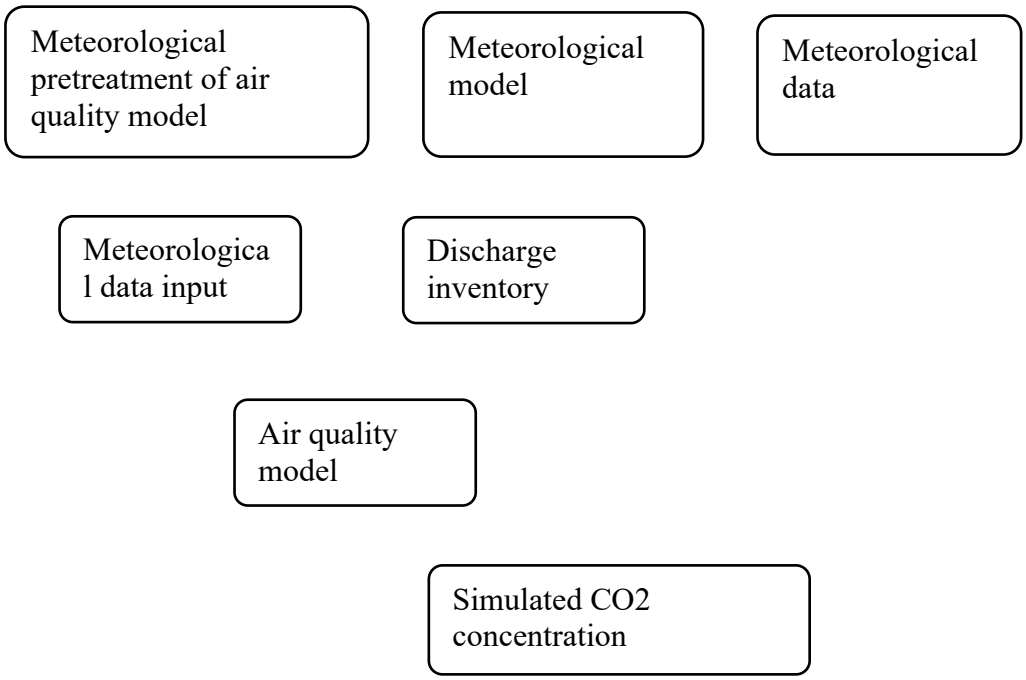

Figure 3. Route map of CO2 concentration numerical simulation

1) Data preprocessing: In this study, meteorological data and pollutant data read from pythonnetCDF4 interface are saved as standard shape 6874 × n × one hundred and sixty-five × 241. The simulated WRF meteorological data and CMAQ pollutant data can be conveniently and efficiently read and called by the deep learning prediction model written in python language.

2) Deep learning prediction model architecture: Conv LSTM model uses convolution operation to replace the matrix multiplication operation of the input gate in LSTM model. The 56 3's used in this experimental model architecture × 3. Convolution kernel, for example, handles 165 of 78 channels × 241 size grid data only requires 56 × three × three × 78 weight parameters. If full connected neural network is used, 78 × one hundred and sixty-five × 241 weighting parameters.

3) Model training results: 3000 groups of data from April to June 2020 were used to train and test the model, so as to quickly verify the effectiveness of the model on this data set. After training 100 epochs, MSE loss value converges to 36.29, and then use data to start training the model.

(2) Based on the C02 statistical inversion flow of principal component analysis, firstly, reduce the dimensions of the C02 profile training sample set and the radiance spectrum set respectively to obtain the main component data, and then build the statistical regression system set of C02 profile and radiance data through the principal component analysis method. Then, find the corresponding statistical standardized regression coefficient through the preloading environmental parameters, and finally collect the preloading spectrum, radiance spectrum set, and profile data, And find the statistical standardized regression coefficient obtained, and calculate the profile of C02.

4.2 Impact of Carbon Dioxide Concentration Change on Atmospheric Temperature

This paper collected some data on the structure and composition of the Earth's atmosphere, and the content, distribution and change trend of major greenhouse gases. On this basis, the atmosphere is stratified. The depth learning is used to conduct numerical simulation of carbon dioxide concentration, and then the data of numerical simulation is written into the parameter file of the trace node method program, and the complete parameter file setting is completed. Then start to calculate and solve the atmospheric radiation temperature field of C02 concentration profile calculated by principal component analysis. Finally, the calculation results are comprehensively analyzed, and the effects of different greenhouse gases on atmospheric temperature are investigated. As shown in Figure 4, a comparison of the calculated temperature is made between the standard atmosphere and the standard atmosphere when the carbon dioxide concentration in the standard atmosphere is doubled.

Table 1. Temperature data of standard atmosphere and its twice CO2

Temperature	Upper stratosphere	Near surface current layer	Lower stratosphere
200	36	39	59
220	39	41	56
240	42	46	51
260	47	50	45
280	58	57	36

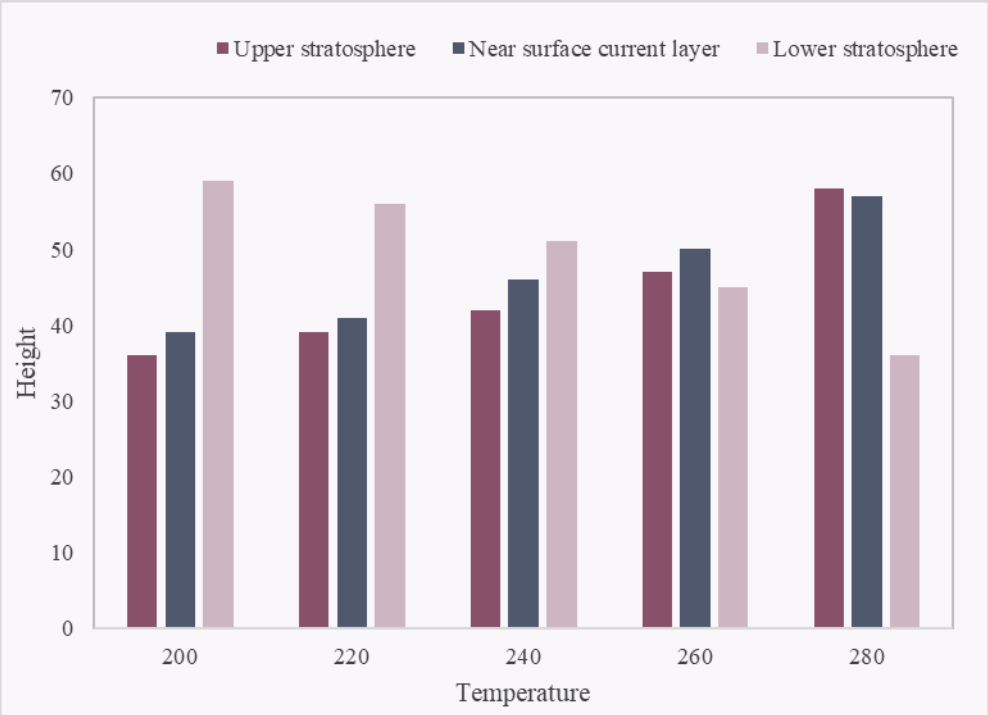

Figure 4. Temperature comparison of standard atmosphere and its twice CO2

It can be seen from Table 1 that there is a significant high temperature above the isotherm, and the high temperature in the troposphere near the ground increases while the high temperature in the stratosphere decreases. This paper points out that the increase of supercritical carbon dioxide content leads to the increase of the absorption coefficient of the atmosphere, so that the atmosphere above the stratosphere near the earth near the radioactive source rises due to receiving higher radiation energy. The lower part of the stratosphere decreases due to the decrease of the radiation energy received.

5. Conclusion

Because there is no comprehensive and clear quantitative analysis of the complex evolution process of greenhouse effect on the earth's atmosphere. Therefore, the following work has been done in this paper. The in-depth learning pollution prediction model is trained using the meteorological and emission data input by the 2020 annual CMAQ model and the CO2 concentration data output. According to the principal component analysis method, the statistical regression system set between C02 profile and radiance is established, and finally the C02 concentration profile is calculated. According to the results obtained by two artificial intelligence algorithms, the impact of atmospheric temperature caused by the change of carbon dioxide concentration is analyzed.

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