 Distribution Numerical, Raising Smoke and Contamination Condense Distribution Stimulating in Chimney Exit

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ABSTRACT: Today distribution method and atmospheric contamination emission muddling is vulnerable in city region because industrial units grow in underdeveloped countries and contaminated produced by this units. Atmospheric contaminated distribution muddling is method for estimate concentration level and contaminated concentration in different interval relative to emission source. This practice is restricted to step after events occurring without proper administering these programs and we have more timely and monetary cost. In this paper investigate concentration distribution study from 2 dimensional and non-permanent states in land surface. If there is barrier in front of chimney, there is more contaminated gas distribution after chimney and maximum contaminated density is less in earth. When there are 3 chimney, there is no effect on contaminated density maximum distance. But in situation there is barrier in front of chimney, this distance is 1000 meter next to chimney. Earth atmosphere attack all kinds of contaminated due to industrial grow development and citizen grow. Modeling and investigating this contaminated distribution in environment surface uneven and kind of cover has basic role in contaminating distribution method because inhalator this contaminated in soil and ware have non-compensate damage to environment. One of the major concerns of industries is their effects on environment and sustainable development trend.

KEYWORDS: distribution method, Atmospheric contaminated, chimney, density, compensate-Non, Surface.

INTRODUCTION

Earth atmosphere attack all kinds of contaminated due to industrial grow development and citizen grow. Modeling and investigating this contaminated distribution in environment surface uneven and kind of cover has basic role in contaminating distribution method because inhalator this contaminated or their attract in soil and ware have non-compensate damage to environment. One of the major concerns of industries is their effects on environment and sustainable development trend. Air pollution by factories chimneys are of the major contaminated material. There are more study for measuring and investigating modeling aid to investigate different parameters change effect on contaminated produce and emission [1].

REVIEW

Cauchy et al pay attention to numerical modeling of exit steam in cooler- tower. They investigate steam column behavior. And also they study wind speed, Environment temperature and relative humidity effect on steam column distribution method. Result of numerical modeling has consistency to empirical results. Konink and Mokhtarzadeh investigate floating smoke column exit of multi-exit chimney. In atmospheric boundary layer, base of this study is momentum and energy

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equation solving. They use cfx-4 software for networking. The temperature of this column is $100^\circ C$ more than ambient.

Turbulence model is $k-\varepsilon$. Results of multi-exit chimney comparison with one exit chimney under identical exit situation for Debi, Momentum and temperature. There are clear differences in speed fields and temperature in first stage. But in this paper don’t investigate atmospheric temperature change with elevation. Brown and filcher investigate smoke of one refinery chimney. They use cfx-5 and cfx-4 software’s for solve slope networking. But don’t pay attention to floating effect. They use of grid adaption for area with high radian and use standard log profile for air speed enter. Turbulence model was $k-\varepsilon$. Burnett et al investigated experimentally exit smoke column distribution of chimney And use even temperature profile. They say temperature difference between smoke column and air is insignificant. And investigated elevation, chimney diameter and speed ratio of exit smoke to chimney effect. Brown and filcher investigate smoke of one refinery chimney. They use cfx-5 and cfx-4 software’s for solve slope networking. But don’t pay attention to floating effect. They use of grid adaption for area with high radian and use standard log profile for air speed enter. Turbulence model was $k-\varepsilon$.

Over camp study smoke column rising of one-point or multi-point source. He considered sustain atmosphere situation and floating effects. Enter air speed profile followed of power law. He obtains unethical relation for smoke column rising with relationship between floating flow changes with time and sustain parameter. Sampayo et al investigated pollution emission due to nuclear refinery. Bases of this investigation are solving momentum, energy and concentration equations. They investigate 3 different states. With no barrier or building near powerhouse and zero temperature difference between contamination and ambient temperature. 3-Bee barrier or building near powerhouse and non-zero temperature difference between contaminated and ambient temperature. In this project use fluent business software for study output warm smoke column emission of one chimney in 2 aspect state, for applying flouncy force to problem, gravitas acceleration in vertical is 9181. The geometries are: many chimneys next to each other, one chimney, and one barrier behind and in front of chimney present building in chimney proximity. Also 2 No, Co contaminated considered as exit gas of chimney. Temperature in earth surface is $25^\circ C$ and exit gas temperature is $125^\circ C$ and atmosphere situation is null. Null situation apply to solve enter as on temperature UDF. Enter air speed to solve slope apply to problem as experimental log.

**PROFILE**

**Turbulence distribution**

![Figure 1 state wind speed profile in proximity of land](image)

Speed change relative to elevation is function of earth surface. Speed change relative to elevation is function of daytime. Air flow is like one turbulence flow and its turbulence show with one irregular movement. This irregular movement is very big in atmosphere. In the day sun heat lead to thermal turbulence and so turbulence composition layer increased and as result wind profile is even relative to slope. Another kind is mechanical turbulence and generated from air movement in artificial or natural level. When there is intense wind, it’s expected atmosphere air mixed by mechanical turbulence. We could see earth effect on wind speed profile lead to air flow homogeneity while level in even and speed profile has sharp slope in earth surface. There is more mechanical turbulence in uneven surfaces. And wind speed cross-section has fewer slopes and
progressed to atmosphere with more deep. Air un leveled movement effect is very important for pollution diluted. If mass of air transferred of one level to other level, this mass contains momentum and thermal energy and also batters everything of pollution sources. So smoke distributed in vertical and horizontal trend by turbulence. The effect of air un regularly movement shows on smoke column. Very large un regularly movement accompany by thermal turbulence and appearance in sunny evening. And lead to smoke column big motion with less distribution. Small un regularly motion increase gradually smoke column un regularly motions. Irregular motion with their values are equal smoke column have the most effects on smoke column distribution. Fortunately atmosphere has irregular motion with different sizes and smoke columns distributed like one complex way in wind trend. Earlier discussion about turbulence in planet boundary layer z=0 to z=z state by slide. We described wind speed profile by powers rule. One of these profiles is as below [5,6,7,8].

\[
\frac{u}{u_0} = \left( \frac{z}{z_0} \right)^n
\]  

(1)

In 1-2 relation, n value change %12 to %15 base on atmospheric situation. One flat plate match by \( \frac{3}{7} \) power and \( n=\frac{14}{7} \). For one even level estimated \( \frac{4}{7} \) value by decrease atmosphere temperature. In 2figures and (a) smoke column distributed in one small irregular movement field. One smoke column moved in one relatively straight trend in one assumed field with small turbulence movement. And its cross-section increase gradually. If this movement are very big in comparison very big smoke column aspects and smoke column size grow very little but will have wide complicated trend. In figure 3 and in (c) smoke column distributed in irregular movement field, day common air with irregular movement is very different. Also smoke column grow as progressed in wind motion trend and become complicated [39,38,40,41,42,43].

![Figure 2 Effect of surface roughness on the velocity](image1)

Figure 2 shows the variation of velocity with respect to the height of the day or night.

![Figure 3 shows the variation of velocity with respect to the height of the day or night.](image2)
Separated flows

One of artificial effect is mechanical turbulence and generated under city building effect with different elevation. Separated flow near building lead to condense pollution in downstream. Figure 4 shows sample of one separated trend around one cylinder [1].

Flow lines moved very simple about frame if there is no viscosity and flow symmetry in both side of object. But we know movement is not symmetry about cylinder and flow separated. But the speed of flow is low in back of cylinder. And large irregular movement separated of cylinder well. And a circular flow of Carmon with remolded number is 60 to 500. Also separating flow in back of cylinder or chimney lead to enclosed material flax in separated region. So its possible smoke column do\’t exceed chimney tip or it turn to down and behind of chimney while output material speed is equal or less than ambient air speed [19,20,30,40,46].

Figure 5 show flow situation.

There are similar flow average flows on top of building. Below figure show this case [3,4,5].

Figure 6 Flow average about building
Separated flow create big hole in back of building. In hole flow is inverse, so pollutions emission big downturn sources will carry to up-turn wind flow if emission in flow separated space. Pollution reaches to whole maintain for time, because composition between major flow and present flow is very slow. Also flow separated can be behind one hill or in valley.

Figure 7 Separated flow cases

Figure 7 Shows what occur if separated hole and trial in back of building block smoke column emission of up-trod source. In (a) smoke column don’t enter to hole but enter to trial. Also dispersion to down increase due to composition in trial, Turbulence In (b) smoke column enter to front and as result.

Make more condense polluted material in trial and back of building. Factory designers engineers should be certain they don’t reach smoke column to building stern state chimney situation on building or near building according to experimental rule should be such chimney height are more than 2/5 times of building height [19,29,38,39].

(2-2) \[ H_2 \geq 2.5H_3 \]

Halitski discussed gas pollution dispersion near building and present information about flow pattern about building.

Figure 8 separation effects in smoke column dispersion

TEMPERATURE IN THE ATMOSPHERE

Change temperature with height has significant effect on pollution movement for example thermal inverse situation lead to pollution composition bound in vertical trend. Turbulence value is function of temperature decrease with elevation. From static force balance on one Elman of air in dz height and da cross-section level:

(3-2) \[ \sum_{\text{z}} F = 0 \]

\[ \frac{\partial p}{\partial z} - \frac{p \partial dA}{\partial z} \]

Because always p is positive, Positive dz lead to negative dp. We should know about how \( \rho \) change with p or z, because we obtained integral of this relation. We know \( P = \rho RT \) is voluble equation for air situation [2,3,4,5].

(4-2) \[ \int_{P_1}^{P_2} \frac{dp}{\rho} = -f_{z_1}^{z_2} dZ \]

We should determine how temperature changed with height. In earlier estimation we assumed atmosphere didn’t changes by elevation and are isothermal so we have.

(5-2) \[ \ln \frac{P_2}{P_1} = \frac{z_1 - z_2}{RT} \]

If earth level is assumed \( Z_1 = 0 \):

(6-2) \[ P_2 = P_1 e^{-\frac{z_2}{RT}} \]

Because T is constant, this model leads to relationship which pressure decrease as function of elevation as log. Also in this model required to infinite elevation for reach to zero pressure. And also we know this thing is not really. We can use better model by assuming air create of layers that temperature different but temperature is homogenous in every day.
Also there is one isothermal atmosphere for \( n = 1 \) and one isentropic atmosphere for \( n = 14 \). It means a trophy is function of constant height. If \( PV^n \) is constant and air has properties of complete gas, we should found relationship between \( P \) and \( T \).

\[
\begin{align*}
8-2 & : P_1^{n_1} V_1^{\frac{1}{n_1}} = P_2^{n_2} V_2^{\frac{1}{n_2}} \\
9-2 & : \frac{P_1 R T_1}{P_1} = \frac{P_2 R T_2}{P_2} = T_1 \left( \frac{P_1}{P_2} \right)^{\frac{n-1}{n}}
\end{align*}
\]

By inverse equality right side and generality \( T_2 \) to \( T \) and \( P_2 \) to \( P \)

\[
10-2 : T = T_1 \left( \frac{P_1}{P_2} \right)^{\frac{1}{n}}
\]

With substitute 10-2 in 2-4

\[
11-2 : \int \left( \frac{P_1}{P_2} \right)^{\frac{n-1}{n}} \frac{1}{g} dp = Z_2 - Z_1
\]

After integrating, we obtain 12-2 relation

\[
12-2 : Z_2 - Z_1 = \frac{n}{n-1} g R T_1 \frac{1}{g} \left[ 1 - \left( \frac{P_1}{P_2} \right)^{\frac{n-1}{n}} \right]
\]

So temperature lineal decreased relative to elevation or slope \( -\frac{dT}{dz} = \) decrease temperature with elevation called lapse rate. Temperature decrease speed is \(-3.5^\circ F \) in every 1000 foot or \( \%65^\circ C \) in every 100 meter in normal or standard atmosphere of USA. We have below relation for match this value of decrease temperature.

\[
13-2 : \frac{-3.5}{1000} = -\left( \frac{n-1}{n} \right) \frac{g R}{n}
\]

\[
\text{for Air } R = 53.34 \text{ ft-lb} / \text{lbm} - zg \left( \text{or } R = 1.986 / \text{Mg} = 0.0866 \text{cal/g-k} \right)
\]

\[
n = 0.186 \rightarrow n = 1.23
\]

Now we want know polytrophic atmosphere reach to want elevation by \( n = 1, 2, 3 \)? We see of 8-2 equation if \( P_2 = 0 \), \( Z_2 = \frac{n R T_1}{(n-1) g} \), or it will be \( Z_2 = 50 \) km. Atmosphere beneath layer boundary is 12 km height in average geographical width. Also this elevation is more in equator and less in pole. In troposphere \( n = 1/2 \) is good estimation stratosphere is above troposphere and troposphere and in this region temperature is relatively constant and \( n = 1 \).

Adiabatic state is indeed atmosphere but commonly called it adiabatic and is very important and \( n = 1/4 \).

\[
14-2 : \frac{dT}{dz} = -\frac{\delta g}{c_p} = \left( \frac{9.8 m}{\text{sec}^2} \right) \left( 20.97 \frac{R}{g - \text{mol}} \right) \left( 4.186 \frac{\text{cal}}{\text{kg} \cdot \text{C}} \right) \times \frac{1}{1000 \frac{2}{\text{kg}}} = -0.0098 \frac{\text{C}}{\text{m}} \approx -0.01 \frac{\text{C}}{\text{m}}
\]

**Figure 9:** Kind of ambient temperature decrease value
Meteorologist use potential temperature and is temperature on dry air mass reach to its earlier temperature to standard pressure. Considered one case of temperature with adiabatic temperature decrease value, so temperature decrease value is static potential temperature in adiabatic state

**Inversion**

We know every air mass that temperature decrease level to elevation \( \frac{dT}{dz} \) is great then \( \frac{dT}{dz} \) and adiabatic is stable. Inversion situation lead to on stable atmosphere. Consequently make on radiation inversion in right and remove in morning. We see this phenomenon in goy of morning in dessert area like southwest of America. Radiation inversion removed by cloud because earth radiate to warm cloud. Also intense wind decrees this kind of inversion, because turbulent make with wind remove thermal guardians [21,22,23,24,25,26].

![Figure 10: Thermal inversion during day](image1)

Inversions are in median elevation due to air mass leakage and unfortunately stay for several days. Air leakage with 1000 meter speed, when air goes to low level and more pressure become warmer and pressed, Air near to earth less leakage and less affected. It’s possible this process considered as one adiabatic series with \( n=1/4 \). And temperature increased to above local temperature curve level before leakage [17,18].

![Figure 11: Air Subside inversion lead to warming above earth](image2)

Because sky with no cloud feature with high pressure regions, its possible one radiation inversion create in earth surface

![Figure 12: Composition inversion](image3)

There are other kinds of inversion. Sea breeze makes cool air earth level and warmer air in above. Passing one cool or war air lead to inversion

![Figure 13: The temperature inversion at the confluence of warm and cold air masses](image4)
Curve 1: Profile of enter air speed to solve slope

Curve 2: Decrease temperature with elevation

Figure 14: CO$_2$ flow line in 3 chimneys

Figure 15: No Concentration contour in 3 chimneys
Figure 16: Now flows line in 3 chimneys

Figure 17: Curves: Contamination concentration NO on earth level

Curve 3: Contamination concentration CO on earth level

Curve 4: Contamination concentration CO on earth level
CONCLUSION

Pollution air dispersion is more in space after chimney and maximum value of pollution concentration is less on earth level while there is barrier in front of chimney. 3 chimneys beside each other have not effect on distance but this distance is 1000 meter next to chimney when there is barrier in front of chimney. In high elevated building is collocate after chimney, contaminated level in building left side is more than right side wall. But in 3 chimneys beside each other and barrier after chimney, Pollution kind has effect on pollution condensation maximum distance. When output pollution of chimney these barrier leads to pollution concentration value don’t depend on pollution kind. And concentration graphs of No & Co are reductively identical. But pollution concentration value is more in earth level in 3 chimney and barrier [47,48,49,50].

SUGGESTIONS

Below suggestions are useful in completing this project. [1].

1. Investigating inversion phenomenon in atmosphere.
2. Apply pressure change with elevation.
3. Use of other turbulence models like LES & RSM.
4. Investigate dilution effect on smoke column emission and rising.
5. Investigating effect of multi-exit chimney on smoke column raise and emission.
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