On the Concentrations of Matter Emitted from a Source in the Atmosphere when a 'Flux-Zero' Level Exists above the Source—II (Point source)

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Introduction

We have reported on the concentrations of matter emitted from a source in the atmosphere when a 'flux-zero' level exists above the source.[1] In that paper, in order to elucidate the effects of the 'flux-zero' level on the vertical concentration profiles, consequently on the ground level concentrations, we treated quantitatively only two dimensional cases, namely the phenomena in x (leeward) and z (vertical) plane. However, three dimensional phenomena are more important practically, so we investigated numerically the problems for a point source.

Formulae

We assume that a point source is at $(0, 0, h)$, and x, y and z are coordinates leeward, cross wind and vertically upward respectively. The concentration is given by the eq. 7-31) in the former paper:

$$C=\frac{q}{H}\frac{1}{\pi}\frac{2x}{Au}\,e^{\frac{2x^2}{A}}\sum_{\nu=0}^{\infty}K_0\left(\frac{2x}{A}\sqrt{\left(1+\frac{ABj_\nu^2}{4Hx^2}\right)(x^2+y^2)}\right)\times\frac{J_0\left(j_\nu\sqrt{\frac{z}{H}}\right)J_0\left(j_\nu\sqrt{\frac{h}{H}}\right)}{[J_0(j_\nu)]^2} \qquad 1),$$

$$\left.\begin{aligned}A&=q_A(\varphi_A x+e^{-\varphi_A x}-1)\\B&=q_B(\varphi_B x+e^{-\varphi_B x}-1)\end{aligned}\right\} \qquad 2),$$

where q is source intensity (unit/s), u is wind velocity on the level of the source (m/s), H is the height of the 'flux-zero' level, K_0 is the 1st kind modified Bessel function of the order zero and J_0 is the 1st kind Bessel function of the order zero. j's are the zero points of J_1 which is the 1st kind Bessel function of the order 1. q_A, q_B, φ_A and φ_B are the diffusion parameters[2] and they are shown in Table 1.*

* In this paper, numerals 4.78 (−2), for example, means 4.78×10^{-2}.

Table 1. φ_A, $\sqrt{q_A}$, φ_B and q_B. h is the source height

ζ	h	φ_A	$\sqrt{q_A}$	φ_B	q_B
0.4	0.5	4.78(-2)	4.26(1)	4.20(-2)	3.50(-1)
	10	4.78(-2)	4.26(1)	4.60(-2)	2.93(-1)
	20	4.78(-2)	4.26(1)	4.71(-2)	2.86(-1)
	30	4.78(-2)	4.26(1)	4.77(-2)	2.83(-1)
	50	4.78(-2)	4.26(1)	4.80(-2)	2.78(-1)
	70	4.78(-2)	4.26(1)	4.81(-2)	2.75(-1)
	100	4.78(-2)	4.26(1)	4.82(-2)	2.70(-1)
	150	4.78(-2)	4.26(1)	4.83(-2)	2.69(-1)
	200	4.78(-2)	4.26(1)	4.84(-2)	2.67(-1)
	300	4.78(-2)	4.26(1)	4.84(-2)	2.64(-1)
0	0.5	1.48(-2)	1.56(1)	1.10(-2)	5.30
	10	1.09(-2)	2.18(1)	2.46(-2)	1.02
	20	1.01(-2)	2.37(1)	3.00(-2)	7.00(-1)
	30	9.7 (-3)	2.48(1)	3.29(-2)	5.65(-1)
	50	9.2 (-3)	2.62(1)	3.79(-2)	4.41(-1)
	70	8.9 (-3)	2.71(1)	4.02(-2)	3.80(-1)
	100	8.6 (-3)	2.84(1)	4.27(-2)	3.39(-1)
	150	8.3 (-3)	2.94(1)	4.40(-2)	3.08(-1)
	200	8.0 (-3)	3.04(1)	4.63(-2)	2.93(-1)
	300	7.7 (-3)	3.23(1)	4.75(-2)	2.78(-1)
-0.1	0.5	4.50(-3)	7.59(1)	4.25(-3)	3.48(1)
	10	2.12(-3)	1.59(2)	1.48(-2)	2.87
	20	1.80(-3)	1.88(2)	1.98(-2)	1.61
	30	1.61(-3)	2.09(2)	2.34(-2)	1.14
	50	1.40(-3)	2.38(2)	2.87(-2)	7.55(-1)
	70	1.29(-3)	2.57(2)	3.30(-2)	5.78(-1)
	100	1.17(-3)	2.85(2)	3.70(-2)	4.59(-1)
	150	1.06(-3)	3.07(2)	4.20(-2)	3.57(-1)
	200	9.8 (-4)	3.40(2)	4.44(-2)	3.18(-1)
	300	8.8 (-4)	3.66(2)	4.78(-2)	2.79(-1)
-0.2	0.5	1.12(-3)	2.77(2)	1.30(-3)	3.73(2)
	10	2.52(-4)	1.24(3)	7.20(-3)	1.18(1)
	20	1.78(-4)	1.73(3)	1.10(-2)	5.19
	30	1.44(-4)	2.14(3)	1.40(-2)	3.21
	50	1.11(-4)	2.77(3)	1.93(-2)	1.69
	70	9.50(-5)	3.30(3)	2.38(-2)	1.11
	100	7.90(-5)	3.93(3)	2.95(-2)	7.22(-1)
	150	6.50(-5)	4.88(3)	3.74(-2)	4.50(-1)
	200	5.60(-5)	5.54(3)	4.28(-2)	3.41(-1)
	300	4.54(-5)	6.83(3)	4.78(-2)	2.94(-1)

The ground level concentration on the x axis are given by

$$C_0=\frac{q}{H}\frac{1}{\pi}\frac{2x}{Au}e^{\frac{2x^2}{A}}\sum_{\nu=0}^{\infty}K_0\Big(\frac{2x^2}{A}\sqrt{1+\frac{ABj_\nu^2}{4Hx^2}}\Big)\frac{J_0\Big(j_\nu\sqrt{\frac{h}{H}}\Big)}{J_0(j_\nu)^2} \qquad 3).$$

Numerical calculatiom

We calculated the ground level concentraions in the cases: stability parameter ζ is 0.4 (stable), 0 (neutral), -0.2 (unstable), $q/u=1$, $h=50$, 100, 150, 200 m, $H=50$, 100, 150, 200, 300, 400 and 500 m ($h\leqq H$).

The shapes of the vertical concentration profiles at every leeward distances are similar to those reported in the former paper, though the absolute values are different because the sources are line in the former paper, but they are point in this paper.

As one example, the profiles in the case $h=50\,m$ and $\zeta=0$ are shown in Fig. 1.

If we put for ground level concentraions when the height of the 'flux-zero' level is H as C_{Ho}, and when the level does not exist as C_∞, we get the relations between C_{Ho}, C_∞ and x and they are given in Table 2, which are shown graphically in Fig. 2-1-a~2-3-c. In these figures, 1, 2, 3 denote $h=50$, 100, 150 m and a, b, c denote $\zeta=0.4$, 0, -0.2. Furthermore, the relations between C_{Ho}/C_∞ and x are given in Table 3.

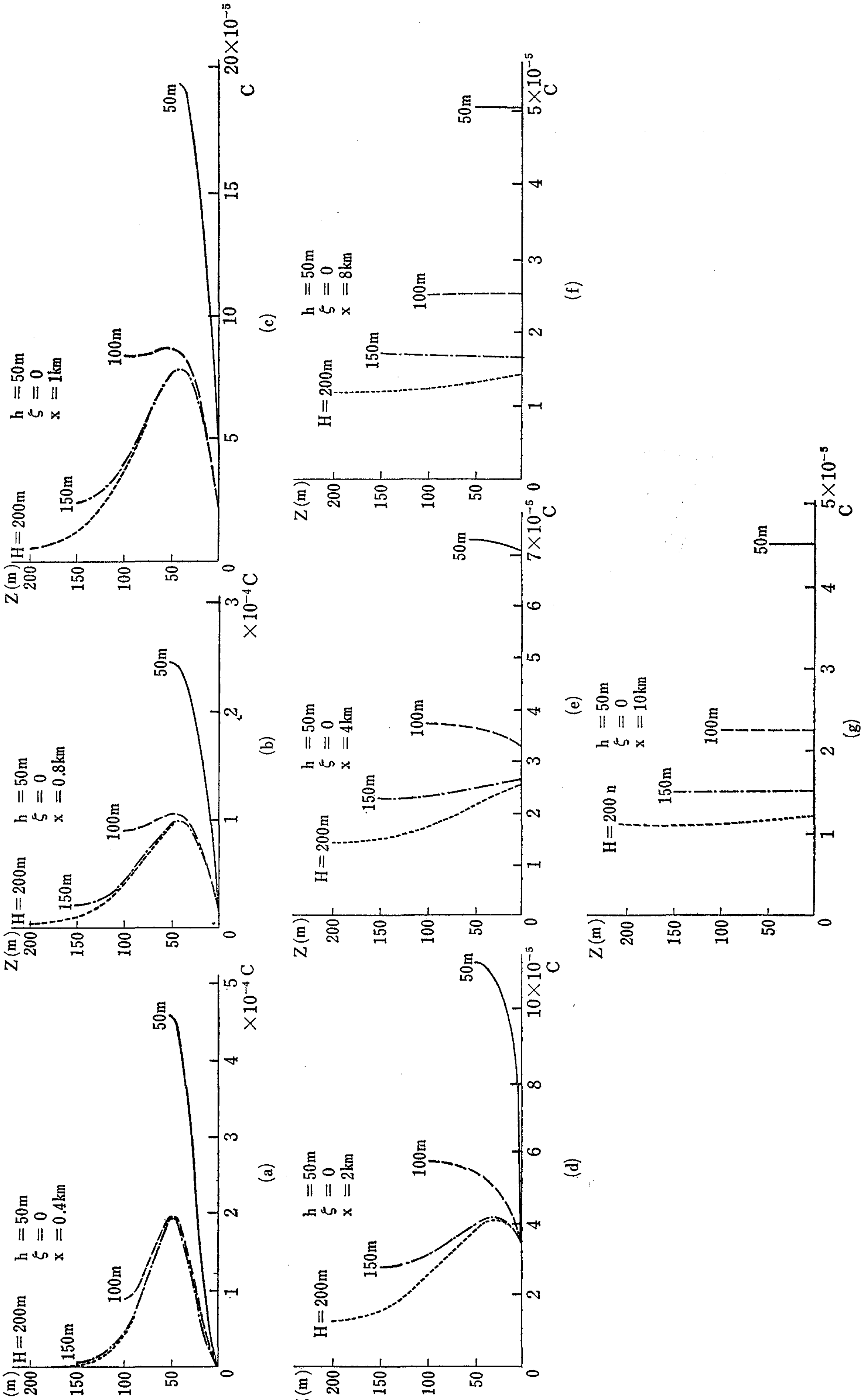


Fig. 1. Concentration profiles for the case of h=50 m, ζ=0.

Table 2. Relations between C_{Ho}, C_∞, H, ζ and x.

		C_{Ho} (h = 50 m)							C_∞
ζ	H (H/h) / x	50 (1)	100 (2)	150 (3)	200 (4)	300 (6)	400 (8)	500 (10)	∞ (0)
0.4	200	3.748(-10)	1.874(-10)	1.870(-10)	1.862(-10)	1.854(-10)	1.878(-10)	2.451(-10)	1.567(-10)
	400	8.690(-7)	4.230(-7)	4.230(-7)	4.230(-7)	4.230(-7)	4.230(-7)	4.230(-7)	3.143(-7)
	800	3.669(-5)	1.742(-5)	1.742(-5)	1.742(-5)	1.742(-5)	1.742(-5)	1.742(-5)	1.703(-5)
	1000	6.942(-5)	3.254(-5)	3.254(-5)	3.254(-5)	3.254(-5)	3.254(-5)	3.254(-5)	3.229(-5)
	2000	1.763(-4)	7.899(-5)	7.769(-5)	7.769(-5)	7.769(-5)	7.769(-5)	7.769(-5)	7.769(-5)
	4000	1.824(-4)	8.339(-5)	7.160(-5)	7.160(-5)	7.160(-5)	7.160(-5)	7.160(-5)	7.058(-5)
	8000	1.356(-4)	6.663(-5)	4.733(-5)	4.181(-5)	3.997(-5)	3.984(-5)	3.984(-5)	3.981(-5)
	10000	1.213(-4)	6.027(-5)	4.145(-5)	3.472(-5)	3.166(-5)	3.133(-5)	3.130(-5)	3.130(-5)
	20000	8.574(-5)	4.318(-5)	2.862(-5)	2.170(-5)	1.590(-5)	1.410(-5)	1.356(-5)	1.333(-5)
	40000	6.063(-5)	3.030(-5	2.021(-5)	1.515(-5)	1.015(-5)	7.794(-6)	5.312(-6)	5.174(-6)
0	200	4.481(-8)	2.180(-8)	2.180(-8)	2.180(-8)	2.180(-8)	2.178(-8)	2.200(-8)	2.440(-10)
	400	3.166(-6)	1.519(-6)	1.519(-6)	1.519(-6)	1.519(-6)	1.519(-6)	1.519(-6)	6.975(-7)
	800	3.133(-5)	1.462(-5)	1.461(-5)	1.461(-5)	1.461(-5)	1.461(-5)	1.461(-5)	1.380(-5)
	1000	4.703(-5)	2.166(-5)	2.161(-5)	2.161(-5)	2.161(-5)	2.161(-5)	2.161(-5)	2.137(-5)
	2000	7.984(-5)	3.560(-5)	3.432(-5)	3.432(-5)	3.432(-5)	3.432(-5)	3.432(-5)	3.432(-5)
	4000	7.036(-5)	3.312(-5)	2.656(-5)	2.563(-5)	2.550(-5)	2.549(-5)	2.549(-5)	2.549(-5)
	8000	5.045(-5)	2.505(-5)	1.723(-5)	1.444(-5)	1.316(-5)	1.302(-5)	1.301(-5)	1.301(-5)
	10000	4.506(-5)	2.249(-5)	1.519(-5)	1.215(-5)	1.037(-5)	1.007(-5)	1.003(-5)	1.002(-5)
	20000	3.178(-5)	1.589(-5)	1.060(-5)	7.975(-6)	5.560(-6)	4.654(-6)	4.312(-6)	4.099(-6)
	40000	2.245(-5)	1.122(-5)	7.481(-6)	5.612(-6)	3.745(-6)	2.829(-6)	2.313(-6)	1.559(-6)
-0.2	200	3.436(-6)	1.630(-6)	1.629(-6)	1.629(-6)	1.629(-6)	1.629(-6)	1.629(-6)	8.701(-9)
	400	2.273(-5)	1.047(-5)	1.040(-5)	1.040(-5)	1.040(-5)	1.040(-5)	1.040(-5)	6.900(-6)
	800	4.018(-5)	1.816(-5)	1.723(-5)	1.727(-5)	1.727(-5)	1.727(-5)	1.727(-5)	1.727(-5)
	1000	4.058(-5)	1.836(-5)	1.704(-5)	1.692(-5)	1.690(-5)	1.690(-5)	1.690(-5)	1.690(-5)
	2000	2.710(-5)	1.272(-5)	1.029(-5)	9.799(-6)	9.656(-6)	9.643(-6)	9.643(-6)	9.643(-6)
	4000	1.357(-5)	6.876(-6)	4.856(-6)	4.147(-6)	3.766(-6)	3.693(-6)	3.678(-6)	3.678(-6)
	8000	7.441(-6)	3.645(-6)	2.444(-6)	1.886(-6)	1.434(-6)	1.287(-6)	1.234(-6)	1.189(-6)
	10000	6.030(-6)	3.014(-6)	2.013(-6)	1.530(-6)	1.105(-6)	9.466(-6)	8.817(-7)	8.145(-7)
	20000	3.475(-6)	1.741(-6)	1.161(-6)	8.626(-6)	5.839(-7)	4.472(-7)	3.727(-7)	2.525(-7)
	40000	2.171(-6)	1.085(-6)	7.231(-7)	5.427(-7)	3.618(-7)	2.715(-7)	2.175(-7)	8.131(-8)

a h=50 m

		C_{Ho} (h = 100 m)						C_∞
ζ	H (H/h) / x	100 (1)	150 (1.5)	200 (2)	300 (3)	400 (4)	500 (5)	∞ (0)
0.4	200							4.693(-21)
	400							1.001(-11)
	800	2.687(-7)	1.309(-7)	1.309(-7)	1.309(-7)	1.309(-7)	1.309(-7)	1.117(-7)
	1000	1.321(-6)	6.396(-7)	6.396(-7)	6.396(-7)	6.396(-7)	6.396(-7)	5.943(-7)
	2000	2.323(-5)	1.115(-5)	1.094(-5)	1.094(-5)	1.094(-5)	1.094(-5)	1.090(-5)
	4000	6.096(-5)	3.131(-5)	2.733(-5)	2.689(-5)	2.689(-5)	2.690(-5)	2.690(-5)
	8000	6.411(-5)	3.863(-5)	2.947(-5)	2.528(-5)	2.496(-5)	2.494(-5)	2.495(-5)
	10000	5.939(-5)	3.733(-5)	2.779(-5)	2.243(-5)	2.172(-5)	2.164(-5)	2.163(-5)
	20000	4.287(-5)	2.850(-5)	2.128(-6)	1.467(-5)	1.236(-5)	1.159(-5)	1.123(-5)
	40000	3.030(-5)	2.021(-5)	1.516(-5)	1.027(-5)	7.687(-6)	6.384(-6)	4.808(-6)
0	200							
	400	3.463(-9)	1.692(-9)	1.692(-9)	1.692(-9)	1.692(-9)	1.692(-9)	2.502(-11)
	800	4.172(-7)	2.017(-7)	2.015(-7)	2.015(-7)	2.015(-7)	2.015(-7)	9.987(-8)
	1000	1.275(-6)	6.133(-7)	6.121(-7)	6.121(-7)	6.121(-7)	6.121(-7)	4.319(-7)
	2000	1.149(-5)	5.523(-6)	5.344(-6)	5.388(-6)	5.388(-6)	5.388(-6)	5.238(-6)
	4000	2.421(-5)	1.275(-5)	1.081(-5)	1.052(-5)	1.052(-5)	1.052(-5)	1.052(-5)
	8000	2.324(-5)	1.430(-5)	1.073(-5)	8.978(-6)	8.793(-6)	8.794(-6)	8.794(-6)
	10000	2.128(-5)	1.358(-5)	1.003(-5)	7.881(-6)	7.520(-6)	7.469(-6)	7.470(-6)
	20000	1.520(-5)	1.011(-5)	7.563(-6)	5.160(-6)	4.248(-6)	3.909(-6)	3.720(-6)
	40000	1.073(-5)	7.154(-6)	5.366(-6)	3.578(-6)	2.705(-6)	2.221(-6)	1.560(-6)
-0.2	200	5.990(-9)	2.905(-9)	2.903(-9)	2.918(-9)	2.677(-9)	1.551(-9)	1.961(-15)
	400	3.300(-7)	1.587(-7)	1.574(-7)	1.574(-7)	1.574(-7)	1.574(-7)	2.233(-9)
	800	2.503(-6)	1.213(-6)	1.167(-6)	1.164(-6)	1.164(-6)	1.164(-6)	4.340(-7)
	1000	3.636(-6)	1.781(-6)	1.681(-6)	1.673(-6)	1.673(-6)	1.673(-6)	9.816(-7)
	2000	6.623(-6)	3.465(-6)	2.997(-6)	2.898(-6)	2.893(-6)	2.893(-6)	2.893(-6)
	4000	5.770(-6)	3.366(-6)	2.637(-6)	2.502(-6)	2.459(-6)	2.453(-6)	2.452(-6)
	8000	3.471(-6)	2.225(-6)	1.664(-6)	1.297(-6)	1.191(-6)	1.161(-6)	1.161(-6)
	10000	2.827(-6)	1.866(-6)	1.393(-6)	1.011(-6)	8.945(-7)	8.556(-7)	8.556(-7)
	20000	1.594(-6)	1.061(-6)	7.951(-7)	5.360(-7)	4.212(-7)	3.651(-7)	3.012(-7)
	40000	9.567(-7)	6.378(-7)	4.784(-7)	3.191(-7)	2.400(-7)	1.939(-7)	1.011(-7)

b h=100 m

Table 2. Continued.

ζ	H (h/h) x	C_{Ho} (h = 150 m) 150 (1)	200 (1.33)	300 (2)	400 (2.7)	500 (3.33)	C_∞ ∞ (0)
0.4	200						
	400						
	800	2.392(-9)	1.175(-9)	1.175(-9)	1.175(-9)	1.175(-9)	7.898(-10)
	1000	2.868(-8)	1.403(-8)	1.403(-9)	1.403(-9)	1.403(-9)	1.155(-8)
	2000	3.294(-6)	1.610(-6)	1.579(-6)	1.579(-6)	1.579(-6)	1.552(-6)
	4000	2.222(-5)	1.187(-5)	1.023(-5)	1.022(-5)	1.022(-5)	1.021(-5)
	8000	3.636(-5)	2.317(-5)	1.620(-5)	1.546(-5)	1.540(-5)	1.540(-5)
	10000	3.624(-5)	2.432(-5)	1.627(-5)	1.492(-5)	1.474(-5)	1.472(-5)
	20000	2.846(-5)	2.105(-5)	1.375(-5)	1.089(-5)	9.837(-6)	9.269(-6)
	40000	2.021(-5)	1.516(-5)	1.009(-5)	7.590(-6)	6.199(-6)	4.372(-6)
0	200						
	400						
	800	7.063(-9)	3.451(-9)	3.448(-9)	3.451(-9)	3.448(-9)	5.015(-10)
	1000	3.803(-8)	1.855(-8)	1.850(-8)	1.850(-8)	1.850(-8)	6.464(-9)
	2000	1.571(-6)	7.723(-7)	7.493(-7)	7.493(-7)	7.493(-7)	6.718(-7)
	4000	8.487(-6)	4.590(-6)	3.894(-6)	3.881(-6)	3.881(-6)	3.880(-6)
	8000	1.301(-5)	8.375(-6)	5.799(-6)	5.493(-6)	5.480(-6)	5.480(-6)
	10000	1.282(-5)	8.681(-6)	5.778(-6)	5.248(-6)	5.169(-6)	5.167(-6)
	20000	9.923(-6)	7.354(-6)	4.812(-6)	3.788(-6)	3.391(-6)	3.170(-6)
	40000	7.030(-6)	5.272(-6)	3.512(-6)	2.640(-6)	2.150(-6)	1,476(-6)
-0.2	200				1.826(-10)		
	400	7.369(-9)	3.600(-9)	3.560(-9)	5.984(-9)	3.554(-9)	
	800	1.843(-7)	9.175(-8)	8.760(-8)	8.760(-8)	8.760(-8)	2.402(-9)
	1000	3.675(-7)	1.853(-7)	1.732(-7)	1.734(-7)	1.734(-7)	1.635(-8)
	2000	1.420(-6)	7.684(-7)	6.548(-7)	6.505(7)	6.502(-7)	4.223(-7)
	4000	2.395(-6)	1.443(-6)	1.083(-6)	1.045(-6)	1.040(-6)	1.040(-6)
	8000	2.102(-6)	1.424(-6)	9.631(-7)	8.583(-7)	8.317(-7)	8.317(-7)
	10000	1.789(-6)	1.251(-6)	8.314(-7)	7.149(-7)	6.788(-7)	6.788(-7)
	20000	9.932(-7)	7.336(-7)	4.851(-7)	3.781(-7)	3.291(-7)	2.907(-7)
	40000	5.869(-7)	4.403(-7)	2.931(-7)	2.204(-7)	1.786(-7)	1.062(-7)

c h=150 m

ζ	H (H/h) x	C_{Ho} (h = 200 m) 200 (1)	300 (1.5)	400 (2)	500 (2.5)	C_∞ ∞ (0)
0.4	200					
	400					
	800					
	1000	6.187(-10)	3.042(-10)	3.045(-10)	3.048(-10)	2.097(-10)
	2000	4.590(-7)	2.221(-7)	2.223(-7)	2.223(-7)	2.141(-7)
	4000	8.160(-6)	3.900(-6)	3.883(-6)	3.830(-6)	3.823(-6)
	8000	2.143(-5)	1.101(-5)	9.608(-6)	9.469(-6)	9.461(-6)
	10000	2.330(-5)	1.257(-5)	1.038(-5)	1.003(-5)	9.978(-6)
	20000	2.097(-5)	1.317(-5)	9.805(-6)	8.445(-6)	7.655(-6)
	40000	1.515(-5)	1.007(-5)	7.517(-6)	6.054(-6)	3.984(-6)
0	200					
	400					
	800	2.648(-10)	1.298(-10)	1.299(-10)	1.300(-10)	
	1000	2.098(-9)	1.026(-9)	1.026(-9)	1.026(-9)	1.511(-10)
	2000	2.737(-7)	1.321(-7)	1.320(-7)	1.320(-7)	1.036(-7)
	4000	3.294(-6)	1.578(-6)	1.540(-6)	1.539(-6)	1.518(-6)
	8000	7.745(-6)	4.021(-6)	3.466(-6)	3.405(-6)	3.405(-6)
	10000	8.272(-6)	4.515(-6)	3.684(-6)	3.539(-6)	3.521(-6)
	20000	7.230(-6)	4.572(-6)	3.400(-6)	2.905(-6)	2.597(-6)
	40000	5.196(-6)	3.454(-6)	2.582(-6)	2.076(-6)	1.325(-6)
-0.2	200					
	400	1,978(-10)	9.641(-10)	9.593(-10)	1.010(-10)	
	800	1.674(-8)	7.633(-9)	3.982(-9)	7.608(-9)	
	1000	4.251(-8)	2.045(-8)	2.033(-8)	2.032(-8)	1.466(-10)
	2000	3.475(-7)	1.677(-7)	1.862(-7)	1.625(-7)	4.425(-8)
	4000	9.272(-7)	4.651(-7)	4.236(-7)	4.187(-7)	3.660(-7)
	8000	1.239(-6)	6.792(-7)	6.512(-7)	5.320(-7)	5.320(-7)
	10000	1.158(-6)	6.585(-7)	5.256(-7)	4.885(-7)	4.885(-7)
	20000	7.227(-7)	4.566(-7)	3.424(-7)	2.918(-7)	2.631(-7)
	40000	4.318(-7)	2.863(-7)	2.139(-7)	1.726(-7)	1.067(-7)

d h=200 m

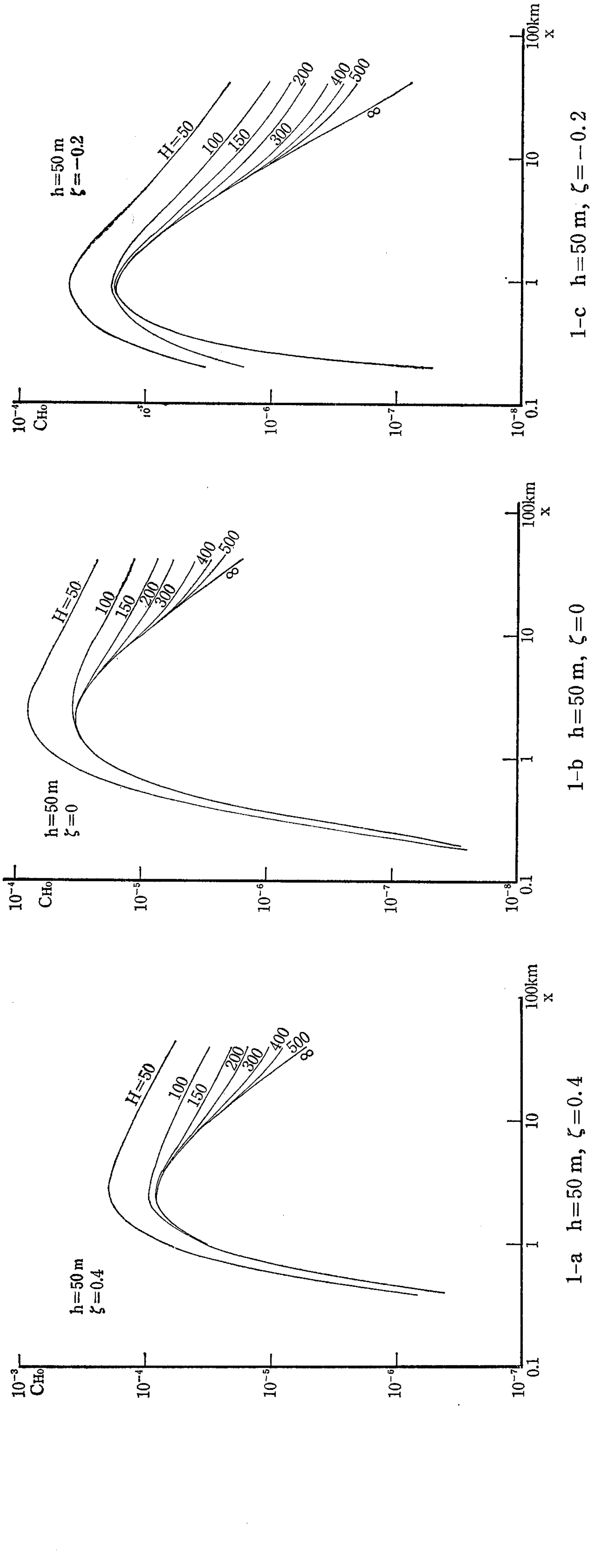
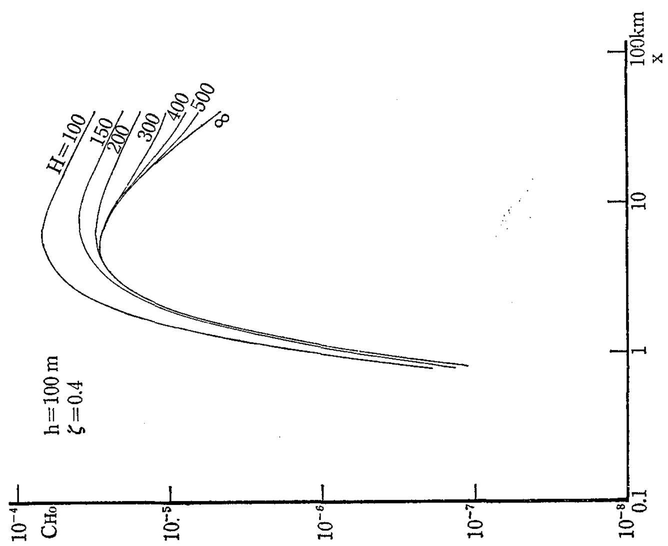
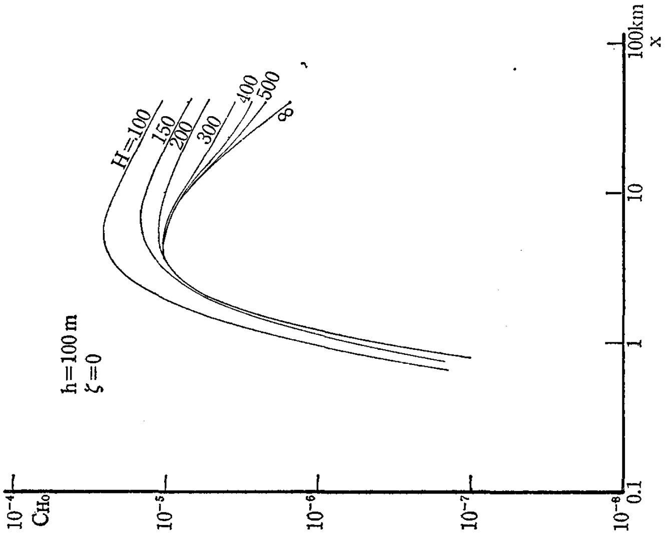


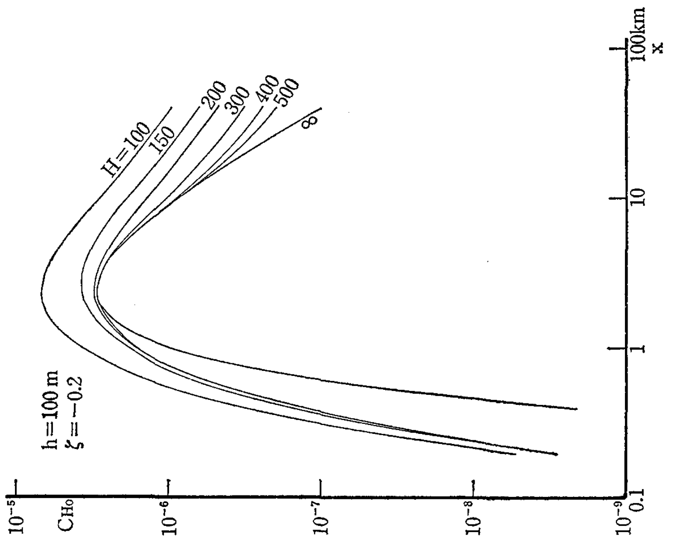
Fig. 2. Relations between C_{Ho}, H and x.



2-a h=100 m, $\zeta=0.4$

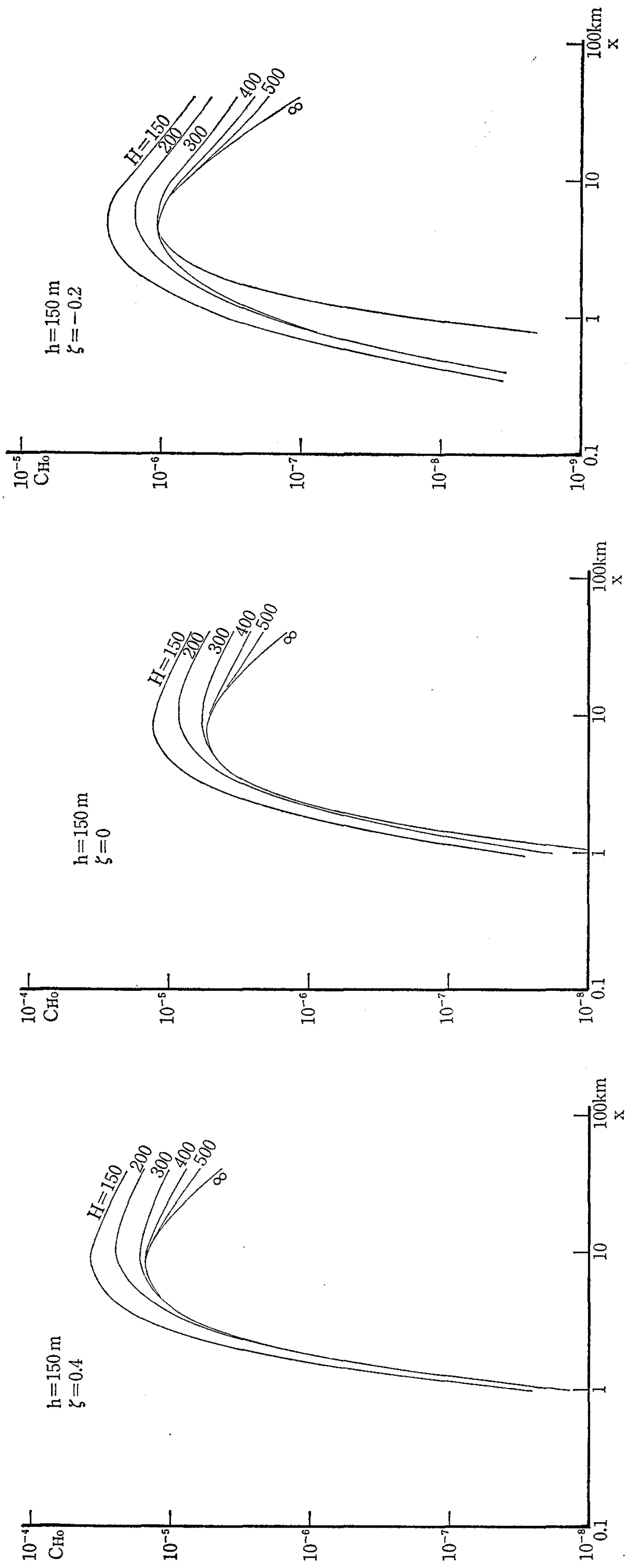


2-b h=100 m, $\zeta=0$



2-c h=100 m, $\zeta=-0.2$

Fig. 2. Continued.



3-a h=150 m, ζ=0.4

3-b h=150 m, ζ=0

3-c h=150 m, ζ=−0.2

Fig. 2. Coutinued.

Table 3. Relations between C_{Ho}/C_∞, H, ζ and x.

	h (m)	50							100					
ζ	H (H/h) x	50 (1)	100 (2)	150 (3)	200 (4)	300 (6)	400 (8)	500 (10)	100 (1)	150 (1.5)	200 (2)	300 (3)	400 (4)	500 (5)
0.4	200													
	400	2.77	1.36	1.36	1.36	1.36	1.36							
	800	2.15	1.02	1.02	1.02	1.02	1.02	1.02	2.41	1.17	1.17	1.17	1.17	1.17
	1000	2.15	1.01	1.01	1.01	1.01	1.01	1.00	2.23	1.08	1.08	1.08	1.08	1.08
	2000	2.27	1.02	1.00	1.00	1.00	1.00	1.00	2.14	1.02	1.00	1.00	1.00	1.00
	4000	2.58	1.18	1.01	1.00	1.00	1.00	1.00	2.27	1.17	1.02	1.00	1.00	1.00
	8000	3.40	1.67	1.19	1.05	1.00	1.00	1.00	2.57	1.55	1.17	1.01	1.00	1.00
	10000	3.88	1.92	1.32	1.15	1.01	1.00	1.00	2.75	1.73	1.28	1.04	1.00	1.00
	20000	6.43	3.24	2.15	1.62	1.19	1.06	1.02	3.82	2.54	1.90	1.31	1.10	1.03
	40000	11.7	5.86	3.91	2.93	1.96	1.50	1.02	6.30	4.21	3.15	2.14	1.60	1.33
0	200													
	400	4.54	2.18	2.18	2.18	2.18	2.18	2.18						
	800	2.27	1.05	1.06	1.06	1.06	1.06	1.06	4.18	2.02	2.02	2.02	2.02	2.02
	1000	2.20	1.01	1.01	1.01	1.01	1.01	1.01	2.95	1.42	2.42	1.42	1.42	1.42
	2000	2.33	1.04	1.00	1.00	1.00	1.00	1.00	2.15	1.04	1.00	1.00	1.00	1.00
	4000	2.76	1.29	1.04	1.00	1.00	1.00	1.00	2.29	1.21	1.02	1.00	1.00	1.00
	8000	3.88	1.93	1.32	1.11	1.01	1.00	1.00	2.64	1.63	1.22	1.02	1.00	1.00
	10000	4.50	2.24	1.52	1.21	1.03	1.00	1.00	2.85	1.82	1.34	1.06	1.01	1.00
	20000		3.88	2.58	1.95	1.36	1.13	1.05	4.09	2.72	2.03	1.39	1.14	1.05
	40000			4.80	3.60	2.40	1.81	1.48	6.88	4.59	3.44	2.29	1.73	1.42
-0.2	200													
	400													
	800	2.33	1.05	1.00	1.00	1.00	1.00	1.00	5.77	2.80	2.69	2.68	2.68	2.68
	1000	2.40	1.09	1.01	1.00	1.00	1.00	1.00	3.70	1.81	1.71	1.70	1.70	1.70
	2000	2.81	1.32	1.07	1.02	1.00	1.00	1.00	2.29	1.20	1.04	1.00	1.00	1.00
	4000	3.69	1.81	1.28	1.09	1.00	1.00	1.00	2.35	1.37	1.08	1.02	1.00	1.00
	8000	6.14	3.07	2.06	1.59	1.21	1.08	1.04	2.99	1.92	1.43	1.03	1.03	1.00
	10000	7.40	3.70	2.47	1.88	1.36	1.16	1.08	3.30	2.18	1.63	1.18	1.05	1.00
	20000		6.90	4.60	3.42	2.31	1.77	1.48	5.29	3.52	2.64	1.78	1.40	1.21
	40000			8.90	6.67	4.45	3.34	2.67		6.31	4.73	3.16	2.37	1.92

a h=50 and 100 m

	h (m)	150					200			
ζ	H (H/h) x	150 (1)	200 (1.3)	300 (2)	400 (2.7)	500 (3.3)	200. (1)	300 (1.5)	400 (2)	500 (2.5)
0.4	200									
	400									
	800	3.05	1.50	1.50	1.50	1.50				
	1000	2.49	1.22	1.22	1.22	1.22	2.95	1.45	1.45	1.45
	2000	2.12	1.04	1.02	1.02	1.02	2.14	1.04	1.04	1.04
	4000	2.18	1.16	1.00	1.00	1.00	2.13	1.02	1.00	1.00
	8000	2.36	1.50	1.05	1.00	1.00	2.27	1.16	1.02	1.00
	10000	2.46	1.65	1.11	1.01	1.00	2.33	1.26	1.04	1.01
	20000	3.07	2.27	1.48	1.18	1.06	2.74	1.72	1.28	1.10
	40000	4.63	3.47	2.31	1.74	1.42	3.80	2.52	1.89	1.52
0	200									
	400									
	800									
	1000	5.88	2.87	2.86	2.86	2.86	2.94	1.45	1.45	1.45
	2000	2.34	1.15	1.12	1.12	1.12	2.14	1.04	1.04	1.04
	4000	2.19	1.18	1.00	1.00	1.00	2.14	1.02	1.00	1.00
	8000	2.37	1.53	1.06	1.00	1.00	2.26	1.16	1.02	1.00
	10000	2.48	1.68	1.12	1.02	1.00	2.34	1.26	1.04	1.01
	20000	3.13	2.32	1.52	1.20	1.07	2.78	1.39	1.36	1.12
	40000	4.76	3.57	2.38	1.79	1.46	3.92	2.61	1.95	1.57
-0.2	200									
	400									
	800									
	1000	2.25	1.13	1.06	1.06	1.06				
	2000	3.36	1.82	1.55	1.54	1.54	7.85	3.79	4.21	3.67
	4000	2.30	1.39	1.04	1.00	1.00	2.53	1.27	1.16	1.14
	8000	2.53	1.71	1.16	1.03	1.00	2.33	1.28	1.22	1.00
	10000	2.64	1.84	1.23	1.05	1.00	2.37	1.35	1.08	1.00
	20000	3.42	2.52	1.67	1.30	1.13	2.75	1.74	1.30	1.11
	40000	5.53	4.15	2.76	2.08	1.68	4.05	2.68	2.01	1.62

b h=150 and 200 m

Considerations

The values of C_{Ho}/C_∞ are large when x is small, and they tend to 1 as x becomes larger, and then they become larger again when x becomes much larger. These retios are larger in unstable conditions than those in stable conditions. The large ratios near the source are not essential, because the values of C_{Ho} are originally small.

On the other hand, when H/h is 1, the values of C_{Ho} is large, but when H/h is more than 2, the valucs are nearly 1, and it shows that the existence of the 'flux-zero' level does not considerably affect the ground level concentration. Furthermore, as it has been remarked in the former paper, the vertical temperature gradient which occurs ordinarily, can not be regarded to be such 'flux-zero' level. We are now carrying out the investigations about the diffusion phenomena in such temperature profiles in the wind tunnel with thermally stratified layers.

Literature

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