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Front cover: From the First international conference (EURASAP Workshop) on harbours and air quality (H&AQ)

EDITORIAL

Dear EURASAP members,

Rossen Nenov, a bachelor at BTU Cottbus, Faculty of Environmental Science and Process Engineering, has carried out at NIMH a student's practice in March 2006. In addition to the study related activities he wished to do some "useful" work. I asked him to prepare for print the EURASAP Newsletters 59 and 60. And he did so.

The EURASAP Newsletter Editor

Scientists' Contributions

DRAFT ON THE EFFECT OF VENTING CORRIDORS ON THE URBAN CANOPY

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ABSTRACT

Many architects, city planners and members of the public who live in coastal cities with a hot summer climate assume that wide streets perpendicular to a coastline would act as "Venting Corridors" through which the sea breeze would penetrate deep into the city, naturally ventilate the urban canopy and improve the local environment. Wind tunnel experiments show, however, that this assumption is fallacious, as local removal of heat and pollution from urban canopy is primarily controlled by the intensity of the turbulence near the surface layer of city and not by the ground level wind speeds. For this reason, streets that are not parallel to the prevailing wind direction will produce considerable turbulence and better ventilate the urban canopy. Similarly, the assumption that high rise buildings would prevent natural ventilation of the urban environment is not correct, as such buildings generate large scale eddies that enhance the replacement of polluted air from the urban canopy by fresher air from elevated layers.

INTRODUCTION

Air pollution and elevated summer temperature significantly deteriorate the quality of the outdoor environment in many coastal cities. The seashore in such places will many times provide refuge from the unbearable climate within the city, particularly when a light, cool and clean breeze blows there. It is not surprising, therefore, that the public as well as many professional city planners would like this breeze to penetrate far into the city in order to improve the climate within the urban canopy. Urban Ventilating Corridors, they assume, could achieve this goal. In other words, wide streets oriented normal to the coastline, which will enable fresh and cool air to flow into the inner city. Similarly, they highly object construction of high- rise buildings at or near the coastline, assuming that they would block the flow of fresh air from the sea. A typical example appears in a paper presented at the IBPSA01 conference in Brazil, where Shaviv et al. (2000 and 2001) demonstrated the use of design tools for planning a new commercial district in Tel Aviv. This district is adjacent to one of the busiest South-North oriented highways in Israel, approximately 2 km east of the parallel seashore. Using numerical simulations with commercial Computational Fluid Dynamics (CFD) software (Fluent), they have shown that relatively wide West-East streets in this district will increase the ground level wind speeds in these streets during westerly winds. Assuming that the frequency of the westerly winds in this region in the summer is high, they have concluded that such Venting Corridors would improve the local summer climate in that district as well as in a nearby residential district east of it. Accepting their conclusions, the City of Tel Aviv imposed building regulations for that district that will ensure the realization of such Venting Corridors. We'll show that the above conclusions are grossly incorrect. The myth of the Ventilating Corridors is based on an implicit assumption that an increase of the ground level wind speed within the urban canopy is associated with a reduction of both the air temperatures and pollution at the street level. This assumption ignores the dominant role of turbulence in the venting of the urban canopy. Without turbulence, and particularly without high vertical turbulent fluctuations, the fresh air entering the Venting Corridors at the seashore and flowing at the street level will be rapidly contaminated by local ground level sources of heat and pollutants, whereas the air flowing above the city at relatively higher speeds will remain as fresh as it was over the sea. This scenario roughly resembles what happens when the Atmospheric Surface Layer is *stably stratified*. The worst episodes of urban air pollution have been recorded in such cases due to the suppression of the vertical turbulent fluctuations. On the other hand, when the surface roughness of the urban canopy generates intense vertical turbulence, the exchange between the polluted air layer near the ground and the elevated unpolluted air layers increases, and fresh air descends to the street level from the upper layers, in spite of the fact that the mean horizontal wind speed near the ground is reduced. Of course, this exchange is beneficial only if the upper layer remains unpolluted. Thus, at large distances from the seashore, the desired effect of turbulence disappears, except perhaps in areas

downstream of significant ground level sources of pollutants, such as major transportation routes. The above descriptive explanation is obviously very rough, as turbulent flows and turbulent transport in urban configurations are extremely complicated phenomena. Theoretical studies of the turbulent flows in urban configurations are hardly possible. Therefore, field studies, numerical simulations and physical wind-tunnel simulations are usually employed in such studies. Field studies are, unfortunately, extremely difficult and expensive. The art of numerical simulations has considerably advanced during the last two decades; a new discipline, Computerized Fluid Dynamics (CFD), has been established and many powerful commercial CFD packages are available. However, the accuracy of such simulations depends not only on the resolution of the spatial and temporal discretization schemes used in such simulations, but also on the modeling of turbulence, which can never be accurately represented in numerical codes. Thus, great care has to be taken in the application of CFD and the interpretation of the results. Following these reservations, the use of CFD codes for urban design is hardly acceptable, unless some of the simulations have been validated by wind-tunnel simulation or field studies. In fact, many professional journals have issued special prerequisites for publishing such studies (See for example: ASME Editorial Board, 1994; Coleman and Stern, 1997; AIAA, 1998; and Oberkampf and Blottner, 1998). Wind-tunnel simulations have also their own limitations. It appears, however, that such physical simulations have been very successful in studies of urban flows and transport processes (Cermak and Takela; 1985). It was therefore decided to study the effect of street orientation, relative to the wind direction, on the dispersion of pollutants from a ground level source in a wind tunnel model. Some of the results of this study have already been published (Poreh, 1994). Thus, only the parts that are relevant to urban venting will be presented herein.

THE WIND TUNNEL SIMULATION

The simulation was performed at the Environmental Wind-Tunnel of the Civil and Environmental Faculty at the Technion - Israel Institute of Technology. Vortex generators and surface roughness were placed in the upstream part of the 2 m wide, 1.8 m high and 15 m long test section of the tunnel. These have created a turbulent boundary layer that simulates a typical airflow above a suburban surface at the scale of the model. A 1.80 m wide and 3.00 m long model of an urban area was placed downwind section of the tunnel, as shown in Figure 1. The urban model was built of uniformly spaced and oriented rows of rectangular buildings (H =B=8 mm, L/H = 2.25). The relative distance between the short facades of the buildings was (DB)/H=0.75, whereas the relative distance between the long facades of the buildings was (DL)/H=2.0, assuming that these facades face the wide streets in the urban region. The large difference between DL and DL ensured that the model would demonstrate of the Venting Corridor Effect when the Wind Direction (WD) would be parallel to the direction of the wide streets (WD=0) and that at WD=90° the resistance to air flow at ground level would be maximum.

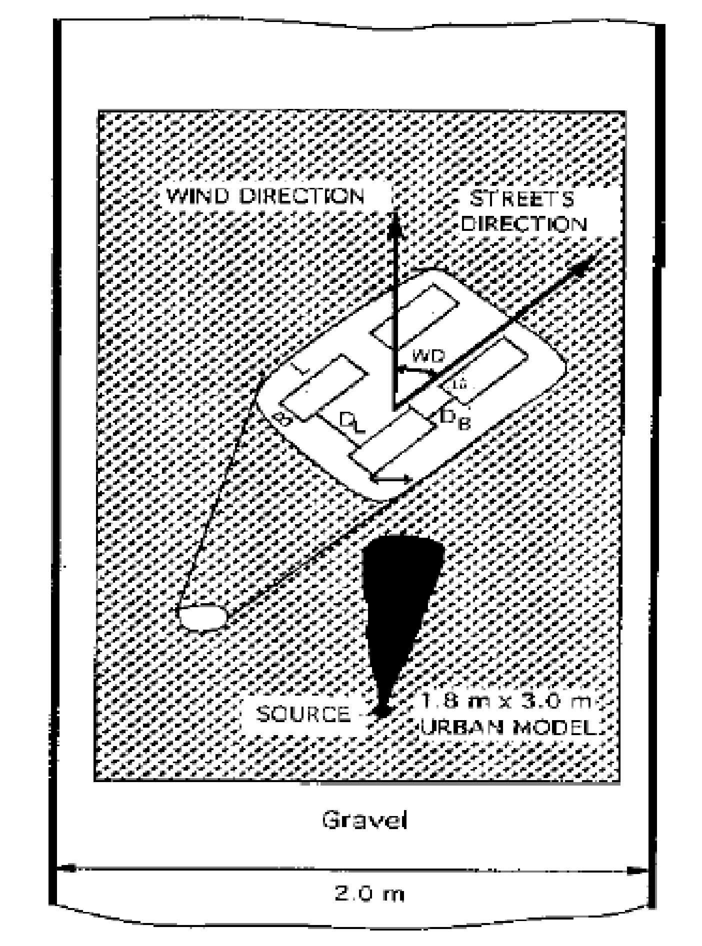

Fig. 1. Schematic description of the urban model in the wind tunnel

The sections of the 3.00 m x 1.80 m model could be assembled so that the angle between the wind direction and the direction of the streets would be set at different values; WD = 0°, 23°, 45°, 67° or 90°, without changing the boundaries of the entire model. Thus, the windward edge of the model was always perpendicular to the wind direction to avoid secondary motion in the wind tunnel. A controlled flux Q of propane from a neutrally buoyant mixture of propane and helium was emitted at a relatively low exit velocity at the upstream part of the model (see figure 1). The mean concentration of thepropane, C, at different points downwind the sources was determined using 5 minute samples by a calibrated gas chromatograph with a Flame Ionization Detector. Using the values of C, the dimensionless concentrations, $C^*=C\delta^2U/Q$, based on the thickness of the boundary layer δ and the velocity U at z=δ, were calculated. It should be noted that the use of the dimensionless concentration makes it possible to calculate the concentrations in the prototype (full scale area) for different boundary conditions (different values of U, δ, and Q) and to exhibit the effect of the geometrical configuration of the city on the dispersion and the concentration of pollution.

PRESENTATION AND ANALYSIS OF THE RESULTS

Mean velocity measurements just above the urban canopy indicated that the wind speed there was only 15% higher for WD=0° than for WD=90°. However, as expected, the mean wind speeds within the urban canopy in the wide streets (Venting corridors) for WD=0° were many fold higher than those in the small gap DB between the buildings for WD=90°.

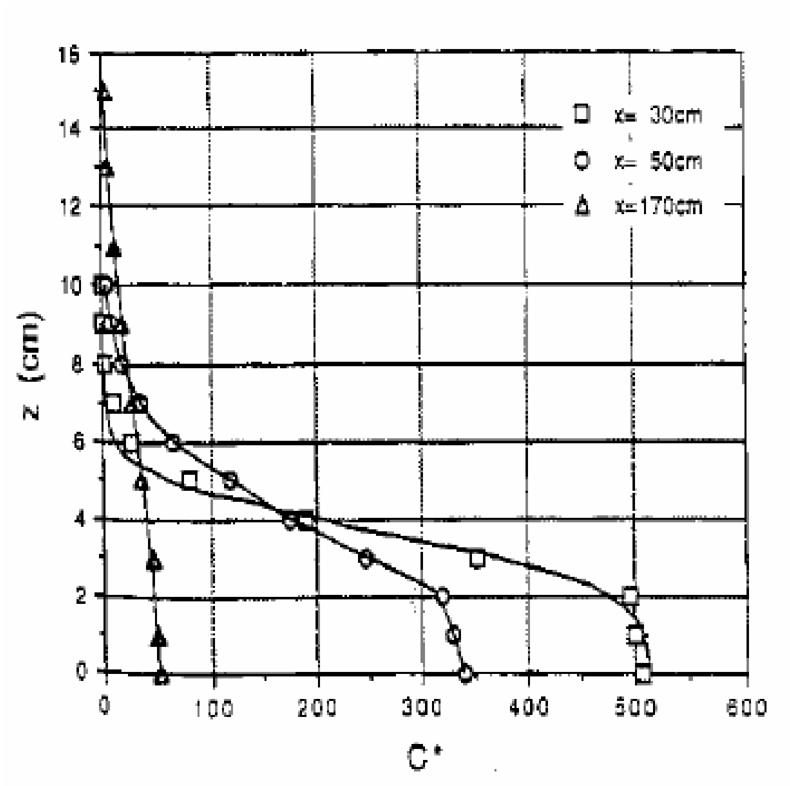

Fig. 2. Typical dimensionless vertical concentration profiles at different distances from the source

Figure 2 shows typical measured vertical dimensionless concentration profiles at the centerline of the diffusing plume for different distances from the source for WD=45o. The figure clearly shows that the maximum concentration from the ground level source is always at the ground of the urban canopy. It also depicts the rapid vertical dispersion the emitted tracer and the decay of the maximum dimensionless concentration with the distance from the source.

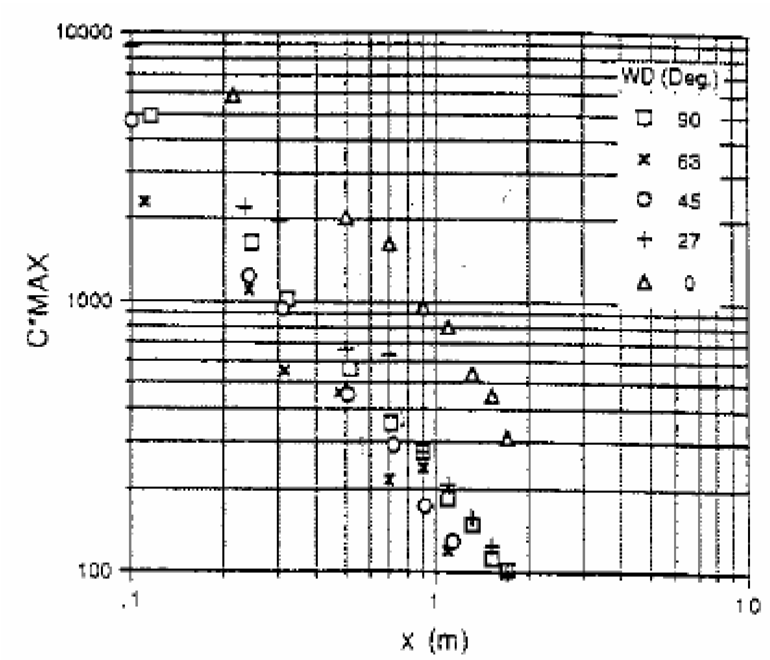

Fig. 3. The change of the ground level dimensionless concentration with the distance from the source for different wind directions

Figure 3 presents the measured variation with the distance from the source of the maximum ground level dimensionless concentrations for different wind directions. One sees from the measurements that on the average there is very little difference (±20%) between the concentrations measured at the same distance for all wind directions, except for WD=0. At WD=0, however, for which the ambient wind flows is parallel to the "Ventilating Corridors", the mean dimensionless concentrations are higher by about a factor of four (4) from the corresponding value in the other wind directions.

DISCUSSION

These wind tunnel experiments confirm the expectation that the bulk properties of the mean dispersing plume can be largely affected by the urban configuration and the relative wind direction. Of particular importance is the observation that when the wind direction far above the ground flows is parallel to the main and wide streets, the ground level concentrations can be an order of magnitude larger than for cases in which the ambient wind speed is not parallel to the streets. As explained earlier, this finding is not surprising, although it does contradict the intuitive concept of the Venting Corridors if one takes into consideration that the turbulence generated by the urban canopy configuration is the primary factor that determines the rate of dispersion of heat and pollutants from ground level sources. It is natural to ask, however, if the results obtained in this model apply to other type of pollutant sources and to other urban configurations. The decrease with distance from the source of the ground level concentrations in the present model is caused by both lateral and vertical dispersion of the pollutants. Clearly, in case of a line source, like main transportation route normal to the wide streets, the large difference between WD=0 and the other wind directions would be much smaller, roughly by factor of 2 and not 4.

How would a change from the uniform urban canopy in the present model to the more realistic case of buildings with different heights affect the magnitude of the ground level concentration? In general, any configuration that increases the turbulence within and above the urban canopy would enhance the local dispersion and reduce ground level concentrations. Thus, the negative effect of venting corridors in the direction of the prevailing wind will be mitigated, but no positive effect of such corridors is expected. On the other hand, a uniform increase of the heights of all the buildings in any region, will create a street canyon effect; namely reduced mixing in that region and increased concentrations at all wind directions and particularly at WD=0.

Now, in some cases, the positive effect of an increased air speed within the venting corridor on the thermal comfort of the people might be important. Undoubtedly, it is a welcome effect during the summer days and in some cases it might be significant one. However, in most cases it is temporal one, as people don't spend too much time in the streets in hot days. On the other hand, the effect of air pollution on the health of people does not disappear. Moreover, increased outdoor concentrations increase the indoor air quality. In addition, increased wind speeds during the summer might be associated be a similar, but unwelcome, increase of wind speeds during storms and winter.

A final note on the positive effect of high-rise buildings mentioned earlier is appropriate. Such an effect is limited to the neighborhood of such buildings, as the turbulence they generate eventually decays. One should also realize that if a cluster of close high-rise buildings is built, the negative street canyon effect appears. One should also remember that the positive effect of intensive turbulence mixing is inherently local; since the pollutants removed from the urban canopy eventually contaminate the air layers above the urban canopy.

CONCLUSIONS

The intuitive expectation that Venting Corridors oriented in the direction of prevailing summer winds will improve the quality of the outdoor environment in the urban canopy is usually incorrect. On the contrary, it might increase concentration of pollutants from transportation and worsen comfort during winter.

ACKNOWLEDGEMENT

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VALIDATION OF THE AEROPOL MODEL AGAINST THE KINCAID DATA SET

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INTRODUCTION

This validation study is the next step in validation of the AEROPOL model against the Model Validation Kit established at the Mol workshop, 1994 (Olesen, 1994). Earlier the AEROPOL model was validated against two minor data sets from the Kit: the Lillestrøm (Kaasik, 2000) and the Copenhagen (Kaasik and Kimmel, 2004) data set, both with relative success compared to the five models validated earlier (Olesen, 1995). In this paper the validation against the arc-wise maximal concentrations of "Quality 3" (most unambiguous) subset of Kincaid data is presented and discussed.

The AEROPOL model is a Gaussian plume model developed at Tartu Observatory, Estonia (Kaasik and Kimmel, 2004), which includes the reflection and partial adsorption of the pollutant at the underlying surface, wet deposition, and the initial rise of buoyant plumes. AEROPOL model has been initially developed for power plants, which have stack parameters in the same range with Kincaid one and applied in several case studies and environmental impact assessments targeted at such sources (e.g. Sofiev et al., 2003). There was found reasonable agreement with deposition measurements, but no direct validation against dispersion of a highly buoyant plume still occurred. Thus, it is justified to ask, what is the probable accuracy of these applications and under which conditions that model may go wrong.

BASIC CONCEPTS

Model

The AEROPOL model is a local dispersion model based on the stationary Gaussian plume with reflections from the underlying surface and capping inversion. Details are described by Kaasik and Kimmel (2004).

The initial plume rise is calculated relying on the basic concepts of Briggs' empirical approach (Stern et al., 1984). The basic quantity to estimate the rise is the buoyancy flux F, which is calculated as

$$F = \frac{g w_s D^2 (T_s - T)}{4 T_s} \qquad (1)$$

where D, ws and Ts are respectively the stack diameter, gas velocity and temperature. T is the ambient air temperature. The plume is rising gradually with distance x (km) from the source by the "two-third law":

$$H(x) = H_0 + \frac{160 F^{1/3} x^{2/3}}{u} \qquad (2)$$

where H0 is the stack height (meters) and u is the wind velocity (m/s). The final plume rise ΔH=H-H0 (limit for Eq. (2), meters) was initially given by Briggs as

$$\Delta H = \frac{21.425 F^{3/4}}{u} \qquad \text{for } F<55\ m^4/s^3 \qquad (3)$$

$$\Delta H = \frac{38.71 F^{3/5}}{u} \qquad \text{for } F>55\ m^4/s^3 \qquad (4)$$

Eq. (3) and (4) have been empirically derived from field data with buoyancy fluxes not exceeding 1000 m4/s3 (Pasquill & Smith, 1983). On the basis of field studies carried out near Narva power Plants, Estionia, it was suspected that Eq. (3), (4) result in too high plume rises for larger buoyancy fluxes. Thus, in the AEROPOL model those were replaced with a formula, matching both Eq. (3), (4) with 10% precision within their scope and giving remarkably lower values for F>1000 m^4/s^3 (Kaasik, 2000):

$$\Delta H = \frac{40[\ln(1+F)]^2}{(1+160/F)^{1/2} u} \qquad (5)$$

The contemporary version of AEROPOL has options to determine the plume dispersion parameters either from routine meteorological observations (wind, solar elevation, cloud amount) or applying the sensible heat flux data and two-level wind speed. By both ways the Pasquill stability classes are applied for that (Pasquill & Smith 1983, Table 6.V). As the sensible heat flux was measured in the Kincaid experiment, the later option (expected more accurate) is applied. The stability classes are derived from

their relation with 10 m wind speed and the surface heat flux (Pasquill & Smith 1983, Fig. 6.1).
AEROPOL uses different dispersion parameters depending on source height and landscape. For small and low releases the Briggs rural or urban parameters (Pasquill and Smith, 1983, Table 6.VI C) are applied, for high stacks (50 m and more, i.e. incl. Kincaid) – the Brookhaven parameters by Smith (1968). These parameters have form:

$$\sigma_y = ax^p, \quad \sigma_z = bx^q,$$

where a, b, p and q are determined as given in Table 1.

Table 1 Brookhaven stability parameters for high stacks.

Coefficients	Pasquill stability classes			
	A, B, C	D	E	F
a	0.36	0.32	0.31	0.31
p	0.86	0.78	0.74	0.71
b	0.33	0.22	0.16	0.06
q	0.86	0.78	0.74	0.71

Data set

The Kincaid data set, including 1284 arc-hours is much more extensive than the Lillestrøm (22 arc-hours) and Copenhagen (23 arc-hours) ones. Even the "Quality 3" subset (only arc-hours with a single, clear and continuous maximum) includes 338 arc-hours that are about 15 times more than Lillestrøm or Copenhagen ones. 315 arc-hours of them were applied for AEROPOL runs, as the rest 13 have gaps in initial meteorological data set that cannot be

processed by AEROPOL without ambiguous extrapolation. Nevertheless, the results are compared below with validation results of five models reported by Olesen (1995) claimed to be based on the full "Quality 3" data set, as about 4% missing data cannot be fatal to the results.
Despite the large number of arc-hours the applied data set did not cover the full range of dispersion conditions, but only neutral-to-unstable part with a slight shift towards unstable stratification: 107 arc-hours belong to the Turner class 4 (nearly-neutral), 128 to class 3 (slightly unstable), 68 to class 2 (moderately unstable) and 12 to class 1 (strongly unstable). Class 1 hardly occurs and class 2 is seldom at high latitudes, where AEROPOL model was used for practical purposes. Stable classes 5 and 6 do not occur in the subset, but they were rather frequent in past applications of AEROPOL. Thus, that validation does not result in a comprehensive valuation for model's applicability. The compendium of validation exercises against the Kincaid, the Copenhagen (neutral) and the Lillestrøm (stable) data sets looks more like that, although there are no buoyant plumes in later two of them.

RESULTS

Standard validation

There were established some standard validation procedures and quantities for validation against the Model Validation Kit (Hanna et al., 1991). The results of validation in comparison with five models validated earlier (Olesen, 1995) are presented in Table 2.
In the comparison of all statistics, the AEROPOL model performs fairly at level. Despite rather poor correlation (but not the worst; all models except HPDM had severe problems with that) the mean

Table 2. Statistics for maximum arc-wise concentrations (normalised with emission, unit 10^{-9} s/m^3). Sigma – standard error, NMSE – normalised mean square error, COR – linear (Pearson) correlation coefficient, FA2 – fraction in factor 2, FB – fractional bias, FS – fractional standard deviation.

Model (country of origin, year of comparison)	Mean	Sigma	Bias	NMSE	COR	FA2	FB	FS
Observations (315 arc-hours) [1]	53.69	40.78	0.0	0.00	1.000	1.000	0.000	0.000
AEROPOL (Estonia, 2005)	42.05	31.90	11.64	1.09	0.126	0.572	0243	0.244
Observations (338 arc-hours) [2]	54.34	40.25	0.0	0.00	1.000	1.000	0.000	0.000
HPDM (USA, 1994)	44.84	38.55	9.5	0.75	0.441	0.565	0.192	0.043
IFDM (Belgium, 1994)	29.42	26.03	24.92	2.00	-0.132	0.423	0.595	0.429
INPUFF (Romania, 1994)	34.61	26.76	19.72	1.29	0.140	0.497	0.443	0.403
OML (Denmark, 1994)	47.45	45.48	6.89	1.24	0.146	0.547	0.135	-0.122
UK-ADMS (UK, 1994)	86.32	103.78	-31.99	2.45	0.228	0.518	-0.455	-0.882

[1] FOR AEROPOL ONLY
[2] FOR OTHER MODELS

value is only slightly biased, fraction in factor 2 is the best and normalised mean square error is the second best (after HPDM).
The scatter plot of normalised concentration does not differ substantially from those models listed by Olesen (1995). The quantile-quantile plot indicates that model tends to “nullify” some concentrations (these are near the stack) and does not produce as high concentrations as measured, disagreement appears at concentrations more than 100·10-9 s/m^3 (Figure 1).

Performance relevant to dispersion conditions
The “Quality 3” data set of arc-hours was divided into sub-samples representing maximums at each downwind distance separately. Thus, each sub-sample includes 20 – 51 arc-hours except for 1 km distance, which consist only of 7 arc-hours. 40 km sub-sample consisting of only one arc-hour was neglected. Dimensionless statistics NMSE, COR, FA2 and FB (see Table 2) for these sub-samples are presented in Figure 2. Fractional bias is high and normalised mean square error exceptionally high at low distances, indicating that in model calculation the plume usually did not reach the ground at distances less than 3 km. Both of these statistics and also fraction in factor 2 suggest best fit at 2 – 20 km from the source. At 30 – 50 km the overestimation appears, possibly due to too slow modelled dispersion. Rather small sub-samples and narrow range of concentrations in each of them may play a certain role in the complicated behaviour of correlation coefficients.

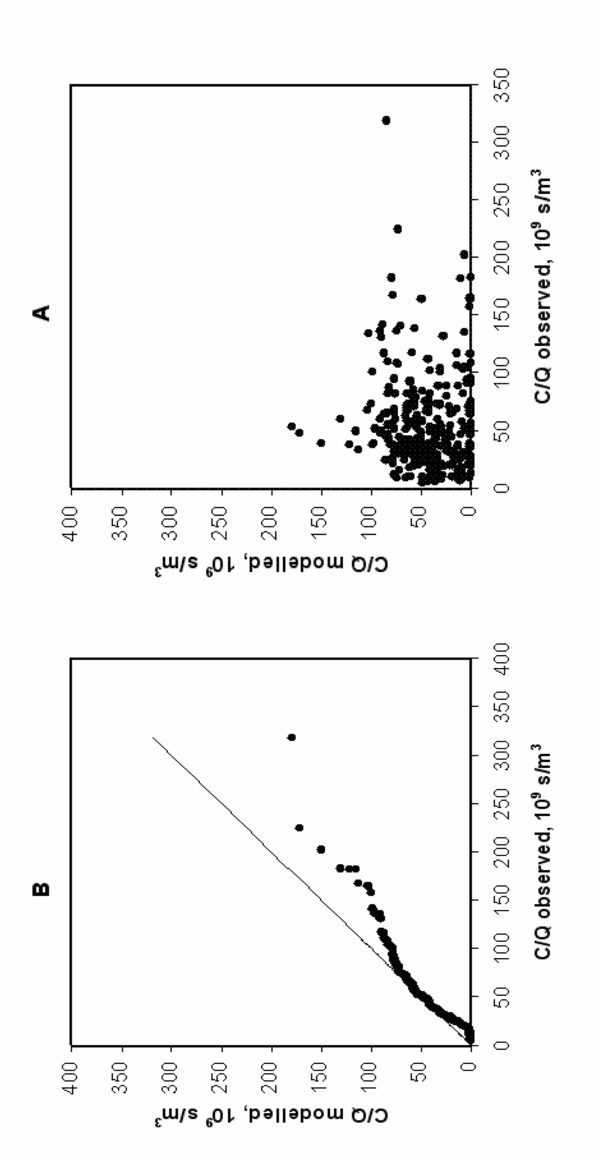

Fig. 1. Comparison of observed and modelled (AEROPOL) arc-wise maximum concentrations normalised with emissions, Kincaid "Quality 3" data set: A – scatter plot; B – quantile-quantile plot (solid line marks the one-to-one ratio).

To clarify the reasons of plume-height-dependent disagreement, the final plume rise by Briggs (Eq. (3), (4)) and Briggs & Kaasik (Eq. (5)) were examined (Figure 3). It appears that plume rise is highly variable, in the range of 100 – 2000 m in Briggs' original and 100 – 1200 m in updated formulation. It is known from Briggs' formulation that plume rise depends highly on thermal stability. Classifying these plume rises by Turner classes 1, 2, 3 and 4 (respectively 3, 25, 61 and 61 hours of experimental run), we see that average plume rise varies greatly: 635, 732, 415 and 235 m respectively.

To understand, how much the initial plume rise affects the accuracy of model results, the "Quality 3" data set was divided first into two nearly equal parts, with $\Delta H<300$ m (average $\Delta H=198$ m) and $\Delta H<300$ m (average $\Delta H=643$ m), and then into sub-sets by downwind distance. Results are presented in Figure 4. It appears that at "low plumes" the concentrations are moderately overestimated everywhere except very close to the source. Thus, we got an impression that modelled dispersion (at least vertical) is slightly too poor in nearly neutral conditions. The strongly negative correlation at mid-distances is a feature to be clarified further. It may be due to systematic wrong position of modelled down-wind maximum in respect to the measured one. The "high plume" graph repeats all main features of full data set (Figure 2), but coincidence is better at distances 10 – 20 km.

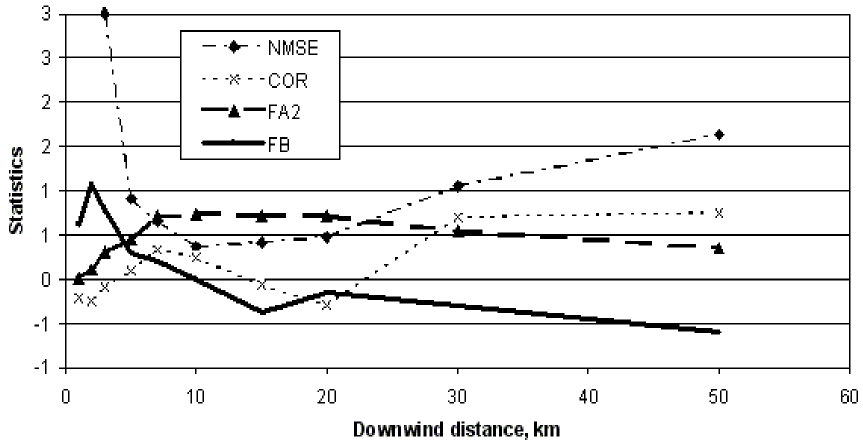

Fig. 2. Dimensionless statistics depending on downwind distance, "Quality 3" data set.

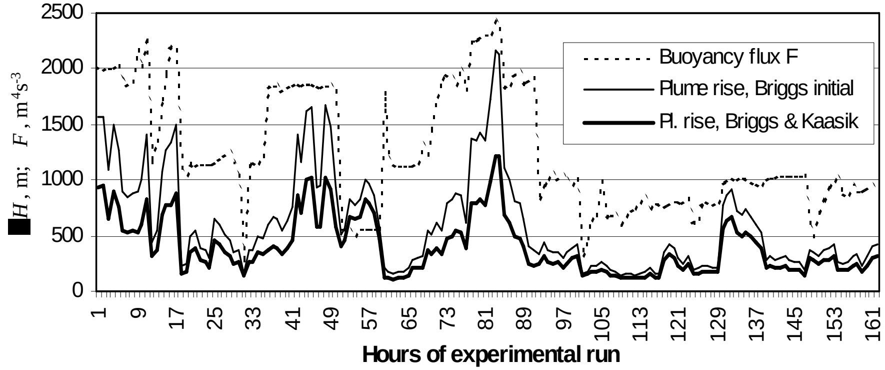

Fig. 3. Buoyancy flux and plume rise by Briggs initial formulae (3), (4) and Briggs and Kaasik (5) during the Kincaid experiment in time sequence, "Quality 3" runs only.

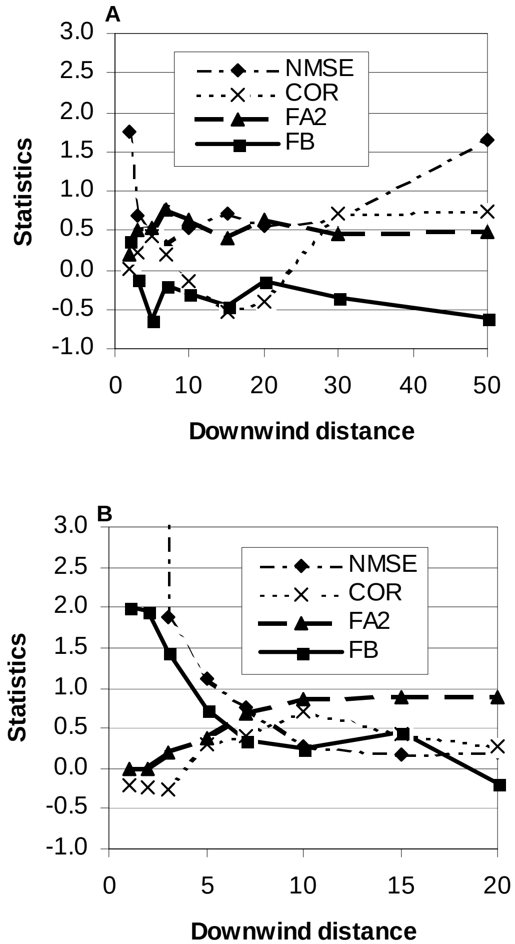

Fig. 4. Dimensionless statistics depending on downwind distance, "Quality 3" data set: A –cases with ΔH<300 m only (153 arc-hours); B –cases with ΔH>300 m only (161 arc-hours).

Let us examine the downwind plots of arc-wise maximal concentrations (Figure 5). Despite the large variability within each class (error bars indicate the standard deviation) it is evident that in moderately unstable conditions (class 2) the model fails completely at distances 1 – 3 km, suggesting that plume does not reach the ground before 5 km from the source. Performance is quite fine from 10 km further. Performance near the source is better for slightly unstable (class 3) and almost correct for nearly neutral (class 4) conditions, but in the later case the modelled arc-wise maximums are overestimated systematically (although not severely) starting from 5 km.
In order to introduce more variability in the plume height, there was made an AEROPOL run with zero plume rise, but this exercise resulted in severe overestimation of surface concentrations: in factor of 5 – 20 close to the sources and about twice at 10 km and further (Figure 6), indicating that true plume rises probably lie closer to those determined by Eq. (5) than to the zero-line. All statistics are remarkably similar to those based on model runs with plume rise at large distances (from 15 – 20 ahead), suggesting that plume is well mixed in vertical and thus, the lateral dispersion plays the key role. NMSE is somewhat higher than in the case with included plume rise.

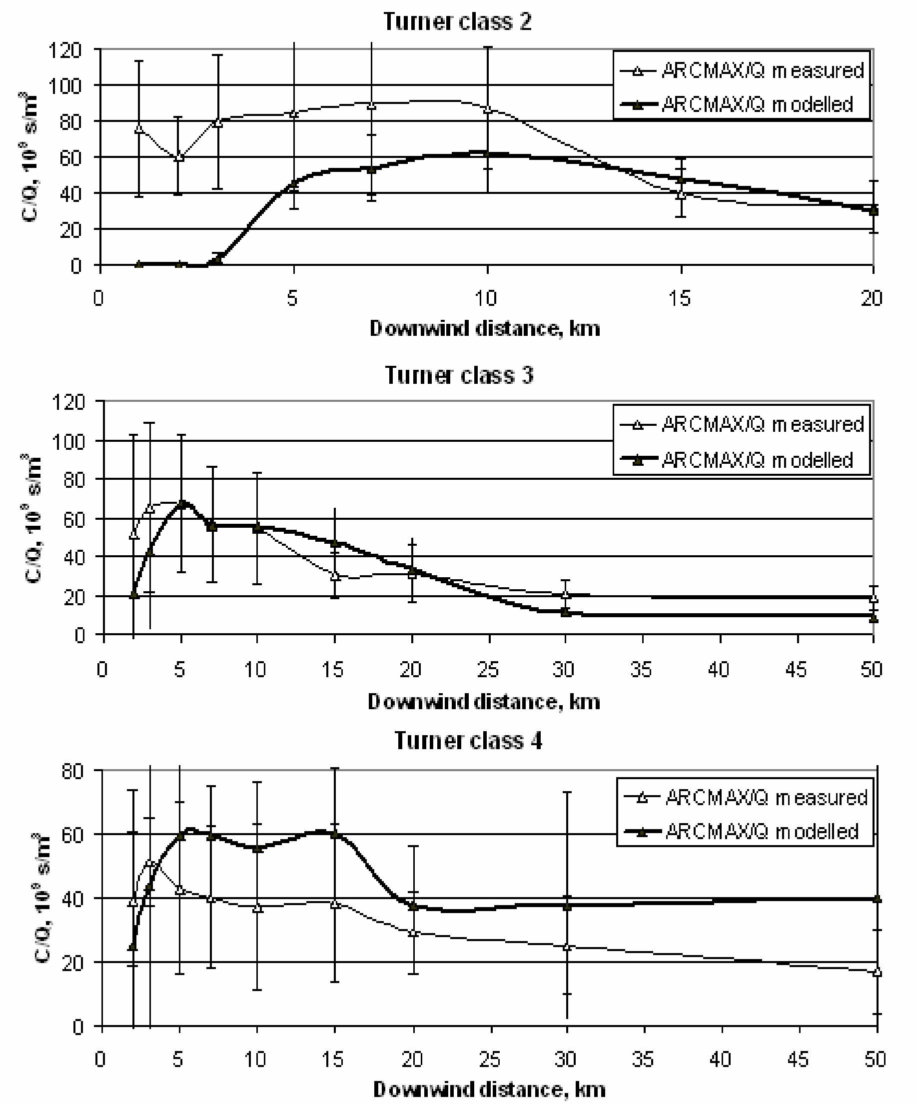

Fig. 5. Arc-wise maximal normalised concentrations depending on downwind distance, averaged for Turner stability classes 2 – 4 (see next page).

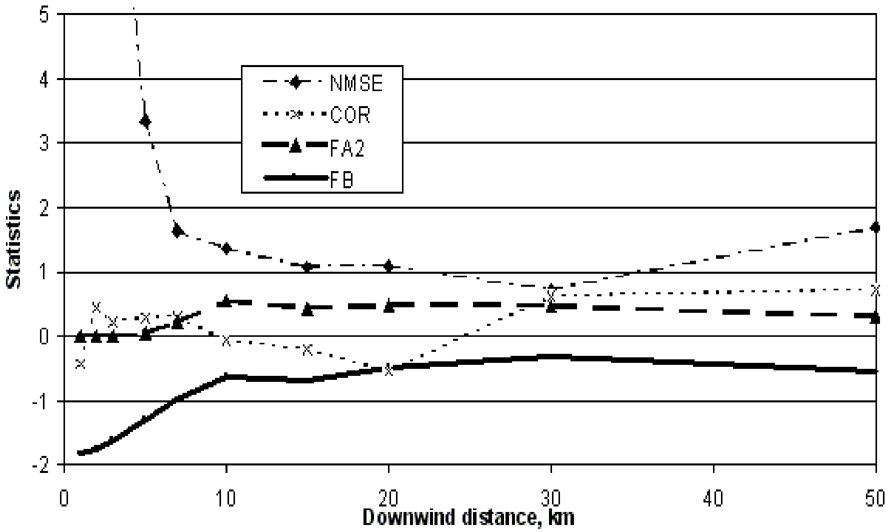

Fig. 6. Dimensionless statistics depending on downwind distance, "Quality 3" data set, no initial plume rise taken into account.

DISCUSSION AND CONCLUSIONS

The Briggs formulae overestimate severely the initial rise of a highly buoyant plume in the convective boundary layer. This conclusion concerns even the formulation with reduced dependence on the buoyancy flux, Eq. (5).

Regarding the Gaussian plume formula, it was not a surprise that hardly avoidable uncertainties in calculated plume rise may destroy the model accuracy despite of other well-tuned parameters, when plume rise is in the same order with stack height or larger. Nevertheless, this assumption is proven with a common plume rise

formulation and an extensive high-quality data set now.

As the former applications of AEROPOL concern mainly stable and nearly neutral stratification, the results above are not a reason for alarm. Nevertheless, these results must be considered in further development and applications of that model.

The results are encouraging for further investigation: varying the computing schemes for vertical and lateral dispersion parameters and plume rise in order to find the best Gaussian fit for Kincaid data set. Obviously the same dispersion parameters for entire unstable range of boundary layers (see Table 1) is too poor approximation even for highly elevated plumes.

The main ideas are: (1) to reduce the plume rise in unstably stratified boundary layer and (2) to vary the lateral and vertical dispersion parameters for Pasquill stability classes A – D.

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Past events

FIRST INTERNATIONAL CONFERENCE ON HARBOURS AND AIR QUALITY (H&AQ)

15-17 June 2005, Palazzo San Giorgio, Genova (Italy)

The First International Conference on Harbours and Air Quality (H&AQ) took place in Genoa, Italy, 15-17 June 2005. It has been supported by EURASAP and organized by the Department of Physics of the University of Genoa and the Port Authority of Genoa, Italy. The conference was financially supported by Fondazione CaRiGe, by Provincia di Genova and by D'Appolonia S.p.A.. The conference took place in an historical building named Palazzo San Giorgio, which is in front of the Genoa Aquarium area and the Porto Antico Marina. The medieval structure, built as a city building in 1260, is the headquarters of the Port Authority since 1904.

Ships are among the world's highest polluting combustion sources per quantity of fuel consumed. In cities with harbours (often in combination with petrochemical and energy-extensive industries), ship emissions contribute significantly to urban air quality. Especially, for PM10/PM2.5 and NO2, harbour related emissions should be taken into account to develop a cost-effective abatement strategy to comply with the EU air quality standards. Unfortunately, there is no consistent and reliable information available on ship emissions and impact on urban air quality, though research indicates its significance and offers approaches to tackle the problems. Consequently, there is lack of attention in urban air pollution policies to include water-transport into abatement strategy of cities with large harbours.

The H&AQ participants were more than 80, coming from 18 countries. The conference has been a forum where different experts in air pollution, as well as port and city authority representatives, discussed actual problems related to the following topics:

- emissions (13);
- meteorological modelling (2);
- air quality observations (12);
- air quality modelling (15);
- air quality management systems (7).

where the number in parenthesis indicates the number of presentations, both oral and poster.

The conference was opened by a session of 6 presentations concerning on the one hand some general aspects, on the other hand some specific topics like the EU policy to reduce ship emissions, and the EU funded projects HADA, ECOPORTS,and "Motorways of the Sea".

A panel discussion ended the conference. In the discussion future developments of the conference were highlighted, among them the need to involve more countries, especially those with large ports and outside Europe, and the need of opinion from both maritime and port authorities.

The debate among numerous candidates is open in order to decide the date and location of the next Harbours and Air Quality conference!

All conference presentations are available on the conference web page: http://www.fisica.unige.it/atmosfera/HAQ.htm

In the framework of the Conference a harbour tour on boat was organised (the picture enclosed is taken on the tour. More pictures are available on the cited web page).

Local organizers:
Elisa Canepa (elisa.canepa@fisica.unige.it)
Emilia Georgieva (georgieva@fisica.unige.it)
Corrado Ratto (ratto@fisica.unige.it)

Calendar

28th NATO/CCMS International Technical Meeting on Air Pollution Modelling and its Application, 15-19 May 2006, Leipzig, Germany, http://www.dao.ua.pt/itm, e-mail: itm@ua.pt, itm2006@tropos.de; Extended abstracts by 1 February 2006.

6th International Conference on Urban Climate (ICUC6), Göteborg, Sweden, June 12 – 16, 2006, http://www.gvc.gu.se/icuc6/, Extended abstracts by 10 April 2006.

6th Annual Assembly of the European Meteorological Society, *Ljubljana, Slovenia, 3-7 September 2006, Abstract deadline: 28 April 2006,* INFO & Abstract submission: http://meetings.copernicus.org/ems2006/annotation.html

The Euroscience Open Forum 2006, July 15th-19th 2006, Munich, Germany. View the conference programme and register at www.esof2006.org

International Conference "Living with climate variability and change: Understanding the uncertainties and managing the risks", Espoo, Finland, 17-21 July 2006 – www.livingwithclimate.fi

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JANUARY 2006

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