We thank referee for their helpful comments, and address specific issues that they raised below.

(1) In RANS modeling, the turbulent Schmidt number (Sc) is specified. However, the values of Sc used in urban flow and pollutant dispersion modeling are widely distributed (Tominaga and Stathopoulos 2007, AE). The magnitude of calculated turbulent aerosol flux directly depends on the value of Sc. Hence, the relative importance of mean and turbulent aerosol fluxes at the street canyon top height can be changed for a chosen value of Sc in the cases that the magnitude of turbulent aerosol flux is not much different from that of mean aerosol flux. What is the value of Sc used in this study? Please discuss this issue.

A wide range of turbulent Schmidt numbers (Sc) has been proposed (0.2 to 1.3) for different flow conditions, depending on the skill of the RANS model in predicting the turbulent eddy viscosity (Tominaga and Stathopoulos, 2007). The turbulent Schmidt Number was assumed to be 1.0 in all cases, ignoring potential variations to the Schmidt number due to varying extents of forced convection and stability. The choice of 1.0 implies that the turbulent eddy viscosity _$_{t}$ is the same as the eddy mass diffusivity D_t Although this value is slightly higher that what is current used in commercial CFD modelling, (0.7 or 0.9) (Spalding, 1971 and Launder, 1978), it is consistent with Kumar (2009) who considered dispersion of nanoparticles in urban street canyons and is within the range of previously measured values of 0.18 to 1.34 (Flesch, 2002) based on field observations under different atmospheric stability and wind conditions.

A lower turbulent Schmidt number would enhance the turbulent aerosol flux and vice versa. As the value of Schmidt number chosen is within the upper end of the range suggested by previous studies, we would expect that the qualitative observations of the relative extents of both turbulent and advective fluxes to be the unchanged.

(2) Aerosol dynamical processes are not included in the CFD model. Why do authors consider two aerosol size modes (Aitken mode and accumulation mode)?

Although aerosols are treated as inert scalar in this study, a bimodal size distribution was incorporated to describe the dispersion patterns expected of typical urban aerosol size distributions. Due to the low volumetric loading and stokes number of aerosols within both modes, this assumption is a plausible one. This initialisation would set the stage for further discussion and evaluation of this assumption to be further discussed in a subsequent paper.

(3) This manuscript nicely demonstrates that the calculated aerosol flux is very sensitive to the windward wall heating. A literature review indicates that simulated mean flow patterns in a street canyon can differ even with the same (or very similar) aspect ratio and heating intensity when the windward wall is heated, depending on CFD models. This potentially implies large uncertainties in calculated mean and turbulent aerosol fluxes. Please discuss this issue with relevant studies being cited.

Thank you for your compliments.

Considering windward wall heating, it was found that the transition from single vortex to a dual- vortex regime (as effects of buoyancy increases) has implications for the relative extents of turbulent and advective aerosol fluxes. The observed change in regime is in qualitative agreement with previous numerical studies, although there is quantitative discrepancy in evaluation of the transitional Richardson Number in results obtained by various groups for a given (or similar) canyon aspect ratio. Pankus (2002) found that the transitional threshold to be of the order of 1. This is an order of magnitude higher than most studies. For example, Sini (1996) estimated the threshold to be ~ 0.15, which is lower than the range of values obtained by Mestayer (1995) (~ 0.16 to ~ 0.5) and Panao (2008) (~ 0.25 to ~ 0.33). We found that the transitional Richardson Number to be in the range of ~ 0.22to ~ 0.54, which is within the range of most studies.

The discrepancy does indicate that results of the simulated flow patterns for windward heated walls differ, depending on the CFD model. It also suggests sensitivity of the results to mesh configuration and boundary conditions, implying that there is huge uncertainty in the numerically quantified fluxes. Further work is needed to investigate reasons for such variability to better ascertain the transitional Richardson Number for purposes of eventual parameterization of canyon fluxes into regional scale models.

(4) Please explain reasons for the pattern of the heat flux vs. net aerosol flux for U = 2.5 m/sec in terms of mean flows in the street canyon.

We discuss reasons for the pattern of the heat flux vs. net aerosol flux referring to Figure 16. For 10 m/s and 5 m/s, we observe a gentle negative relation between the net aerosol flux and heat flux. A single vortex flow regime was observed for both wind speeds and with increasing heat flux at the windward side of the canyon. The turbulent aerosol flux decreases slightly due to reduction is concentration shear along the horizontal axis at the roof level.

At 2.5 m/s however, we observe a change regime from a single anticlockwise vortex to a dual vortex (*as R_i (Richardson Number) increases from 0.21 to 0.54*), with the lower anti-clockwise vortex circulating a region of high concentration and an upper clockwise vortex. The result of this is a decrease of turbulent flux by an order of magnitude and a slight decrease in amount of aerosols retrained into the canyon. A further increase of R_i from 0.54 to 0.81 (with increasing heat intensity at the windward wall) leads to a decrease in aerosol and heat flux out of the canyon due to the weakening of the upper clockwise vortex and corresponding enhancement of the lower vortex.

(5) Linking aerosol fluxes in two different spatial scales is an important problem. The manuscript title reflects this problem. However, this important problem is not so nicely dealt with in this manuscript. The term "city-scale" appears to be inappropriate considering the measuring height and the heterogeneity nearby the measurement tower. More proper to use the term "neighborhood-scale"? To what extent is each of the four

simplifications valid? We know aerosol dynamical processes are not negligible in street canyons (e.g., coagulation). Comparing the diurnally averaged aerosol fluxes (observation) with simulation data is problematic.

We note and accept the redefinition from "city-scale" to "neighbourhood scale".

The crux of our simplification and the underlying assumption of linking particle number flux from canyon to tower measurements is that transport timescales of aerosols from urban canyons into the "above canyon" canopy on the neighbourhood scale are shorter than that of aerosol processes which modify particle number (e.g. coagulation and nucleation). Ignoring potential external sources of semi-volatile (condensable) vapour, it is unlikely that condensable vapour would accumulate to a high enough level super-saturation for nucleation to take place during transport from canyon to neighbourhood scales. To facilitate our analysis, we compare the expected timescales of transport from the street canyon to the tower (approximately 80m high) with coagulation timescales.

We may evaluate the vertical transport component by evaluating the exchange velocity at the canyon/ canopy interface. Nonetheless, this timescale evaluation of the transport would be an over-estimate and thus a stringent evaluation of the importance of aerosol processes. It was suggested the exchange velocity (U_E) of the canyon is 1% of the horizontal velocity component (Hamlyn & Britter, 2005). U_E is evaluated at the interface of the canyon and the canopy and is likely to be a factor lower than the vertical velocity expected within neighbourhood scales as it does not consider augmentation of vertical velocity by other factors (such as instability or turbulence) in larger scales. We thus expect the magnitude of dilution timescales to be in the order of 1 or 2. Considering typical background concentrations of fine/ ultrafine particles (Table 1), which we would expect within the urban canopy, we find that the timescales of coagulation to be in the order of 5 (~$4x10^5 s$). This value is 3 to 4 orders of magnitude larger than that of the transport timescales and does *suggest* that the impact of coagulation on number concentration is unimportant as the aerosols transport from the urban canyon into the "above-canyon" canopy.

Although the above analysis shows that particulate number may not be influenced by aerosol processes, we do not rule out the possibility of chemical transformation due to disequilibrium of ammonium nitrate compounds and partitioning which may influence particulate mass. More work is thus needed to link particulate mass emission at both scales.

Table 1: Typical PM background Values (Uhrner, 2007)

	Aitken Mode	*Accumulation Mode*
Number Concentration (particles/ m^3)	$1x10^{10}$	$2.5x10^9$
Geometric Mean Diameter (nm)	50	120
Standard Deviation	1.8	1.9

The comparison of diurnal average and the parameterization obtained from CFD results is a first step to link both scales with the plausible assumption that flux at the tower height is a summation of fluxes from a network of street canyons in the vicinity. Nonetheless, the parameterization is based on a constant emission and the less than optimal performance of the parameterization suggests that variability in traffic sources has to be incorporated into the parameterization to improve the comparison.

Finally, we thank the Reviewer for the compliments and detailed feedback. This is very much appreciated.

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