Table S1: Chemistry and Physics options used in WRF-chem

Physics options		
Microphysics	Thompson	(Thompson et al., 2008)
Longwave/Shortwave radiation	RRTMG	(Iacono et al., 2008)
Land Surface Physics	NOAH	
Planetary Boundary layer	MYNN 2.5	(Nakanishi and Niino, 2006)
Cumulus parameterizations	GRELL 3D	(Grell, 2002)
Chemistry Options		
Gas-phase chemistry	MOZART	(Emmons et al., 2010)
Aerosols	MOSAIC	(Zaveri et al., 2008)
Anthropogenic Emissions	EDGAR-HTAP2	(Janssens-Maenhout et al., 2015)2
Biogenic Emissions	MEGAN	(Guenther et al., 2006)
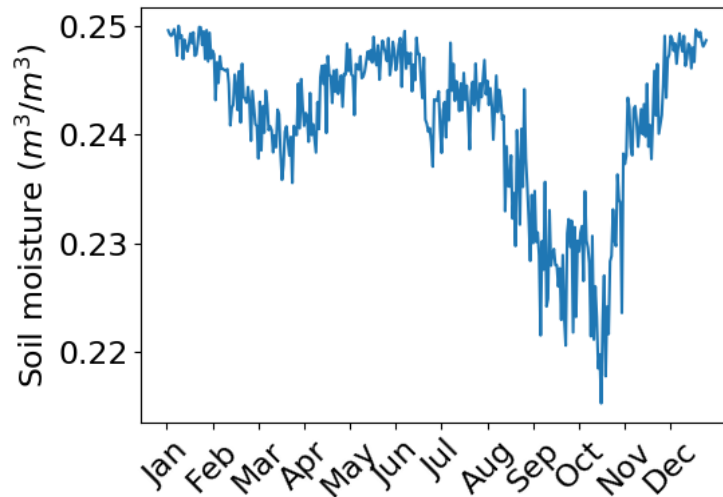
Figure S1: Daily average soil moisture for peat across the study area (95-120°E and 10°S-10°N) for 2015.
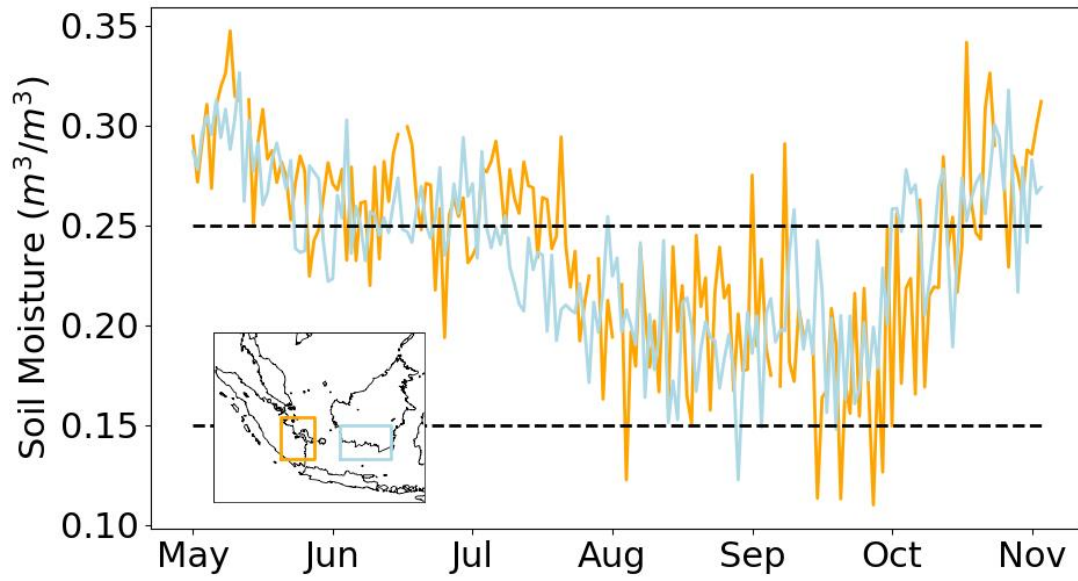
Figure S2: Soil moisture over high fire peatland regions (shown inset). The upper and lower soil moisture limits used to calculate depth are shown by the dotted lines.

Equation S1

Fractional bias, FB, is defined by

$$FB = \frac{1}{N} \sum \frac{(M_i - O_i)}{(M_i + O_i)/2}$$

Where N is the number of pairs of modelled (M) and observed (O) values.
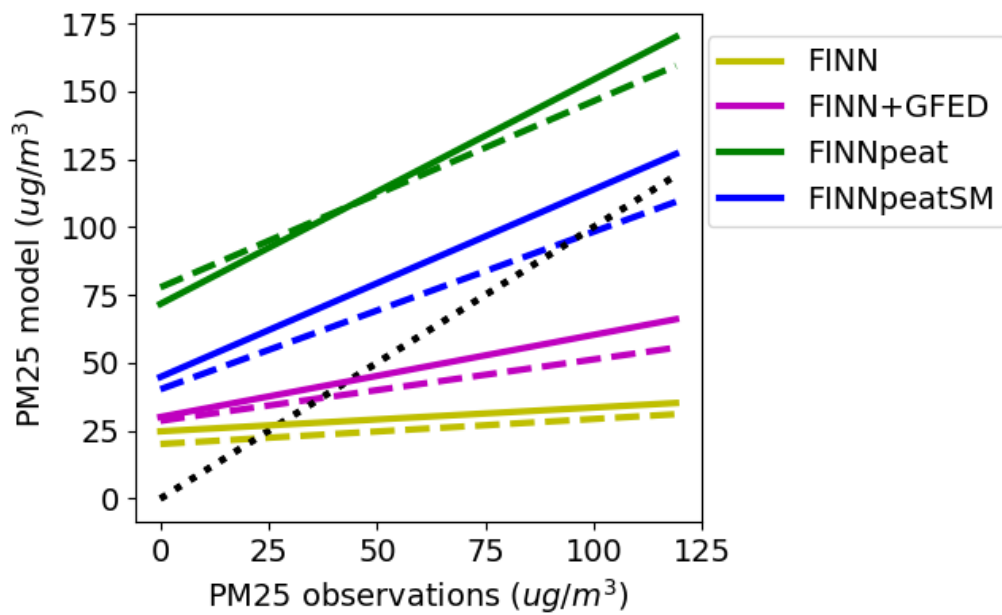
Figure S3: 24 hour mean PM$_{2.5}$ from observations and model simulations with different fire emissions datasets and injection options. Solid lines are simulations with surface injections, dashed lines and simulations with boundary layer injection. 1:1 relationship shown by black dotted line.
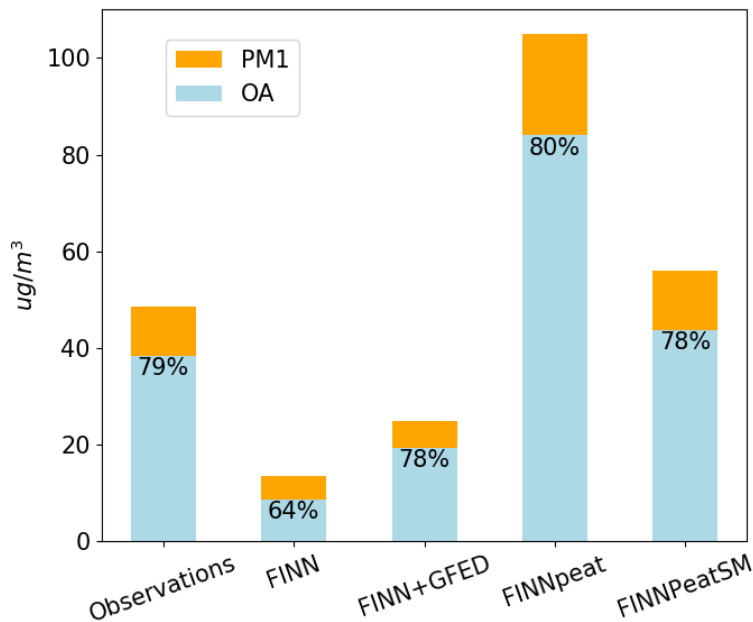
Figure S4: Average PM$_1$ and OA in Singapore for October 10th-31st, for observations and WRF-chem runs with the boundary layer injection option and different fire emissions datasets. The percentage contribution of OA to PM$_1$ is shown on each bar. PM$_1$ observations are a sum of Cl, NH4, NO3, SO4 and OA. PM$_1$ from the model is NH4, NO3, SO and OA.
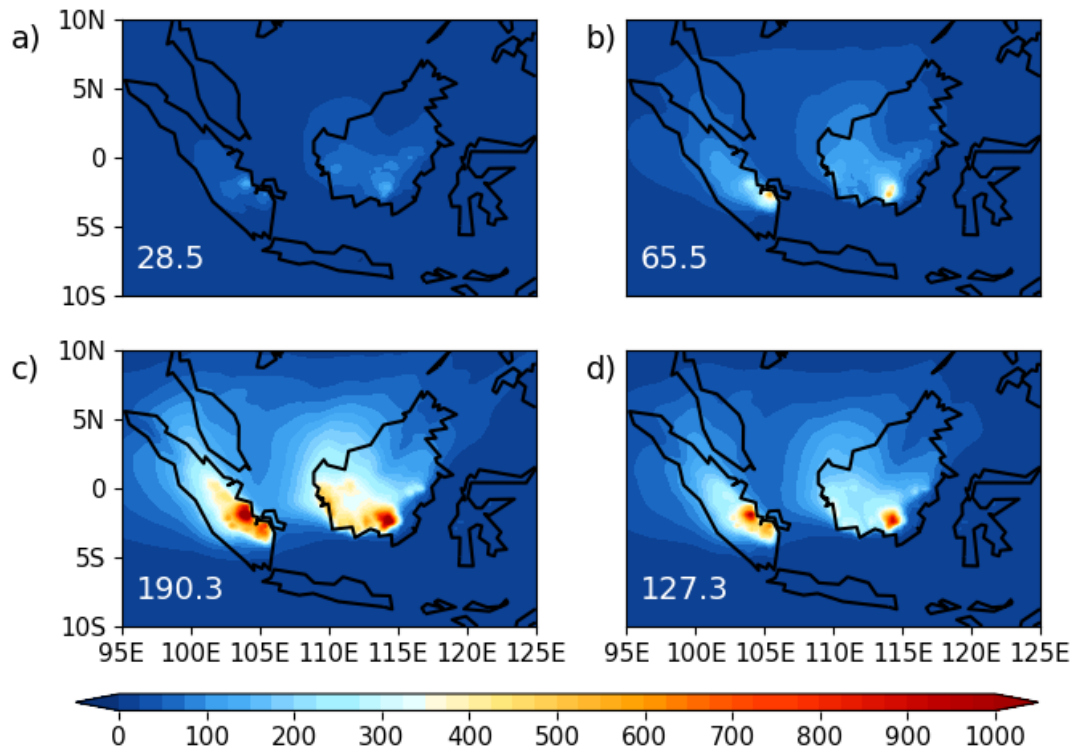
Figure S5: Mean model surface PM$_{2.5}$ concentration (μg m^{-3}) from fires for Sep-Oct 2015 with the boundary layer injection and (a) FINN emissions, (b) FINN+GFEDpeat, (c) FINNpeat and (d) FINNpeatSM. On each plot is the surface PM$_{2.5}$ from fires averaged over Sumatra and Borneo for September and October
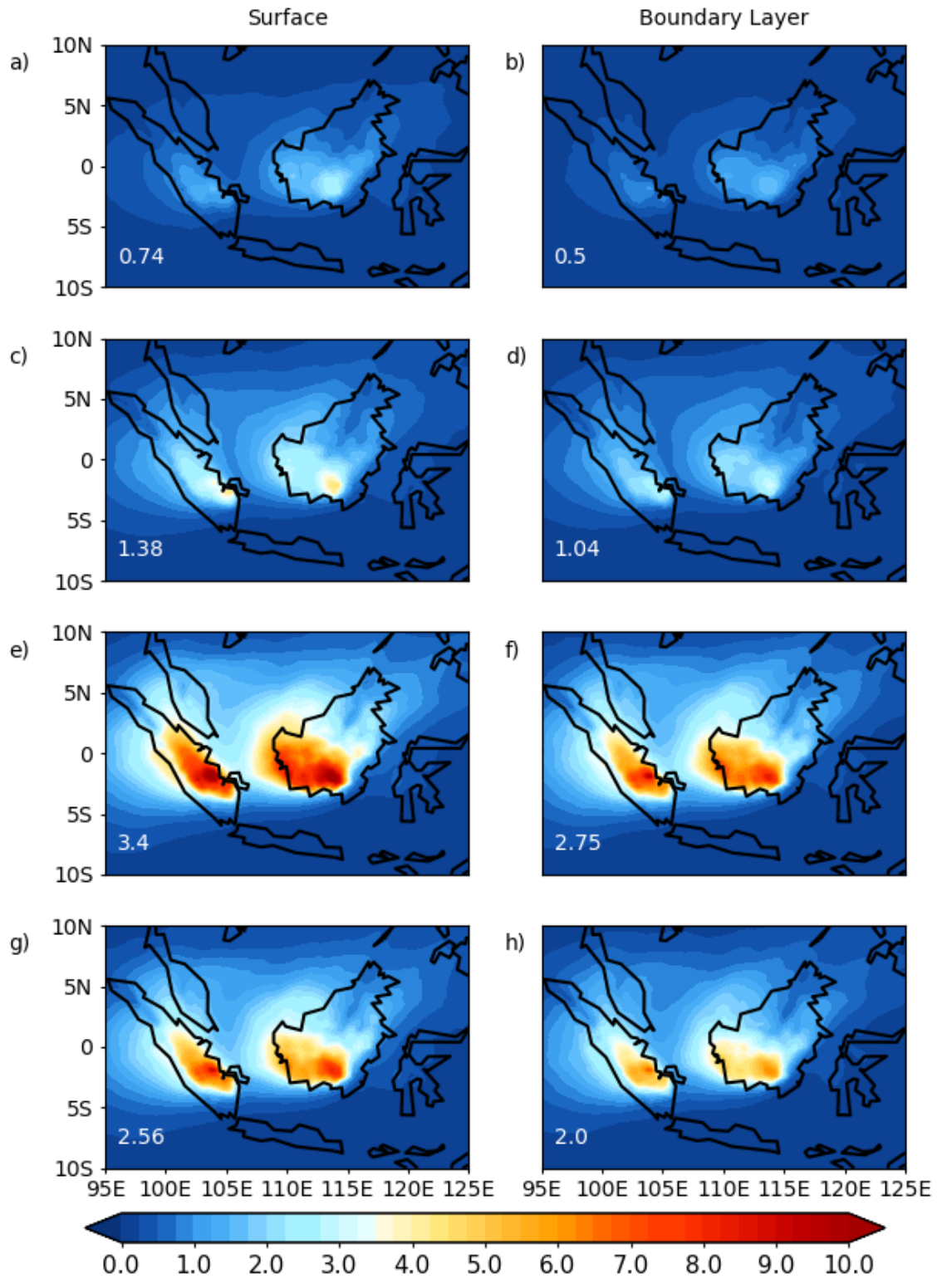
Figure S6: Mean AOD from fires for Sep-Oct 2015 with the surface (a,c,e,g) and boundary layer injection (b,d,f,h) and FINN emissions (a-b), FINN+GFEDpeat (c-d), FINNpeat (e-f) and FINNpeatSM (g-h). On each plot is the average AOD from fires for September and October.