Supplemental Information

Direct calibration using atmospheric particles and performance evaluation of PSM 2.0 for sub-10 nm particle measurements

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The size resolution of PSM ($Res(d_p^*)$) can be derived as follows:

$$Res(d_p^*) = {d_p^*}/{\Delta d_p}$$

$$= \frac{f[S^*]}{f\left[S^* - \frac{\Delta S}{2}\right] - f\left[S^* + \frac{\Delta S}{2}\right]}$$

$$= \frac{f[S^*]}{\left\{f[S^*] - f'[S^*]\frac{\Delta S}{2} + \frac{1}{2}f'[S^*]\left(\frac{\Delta S}{2}\right)^2\right\} - \left\{f[S^*] + f'[S^*]\frac{\Delta S}{2} + \frac{1}{2}f'[S^*]\left(\frac{\Delta S}{2}\right)^2\right\}}$$

$$= -\frac{f[S^*]}{f'[S^*]\Delta S}$$

$$= -\frac{S^*}{\Delta S}\frac{d_p^*}{f'[S^*]S^*}$$

$$= Res(S^*)\frac{d_p^*}{S^*}\frac{1}{-f'[S^*]}$$

where d_p is the particle size measured by the PSM. S^* is the saturator flow rate corresponding to the peak point of the Kernel function, and ΔS is the full width at half maximum of the Kernel function peak. $f[S^*]$ is the fitted function displaying the cut-off size at the saturator flow rate of S^*. $f'[S^*]$ suggests the derivation of the fitted function at the DEG saturator flow rate of S^*.

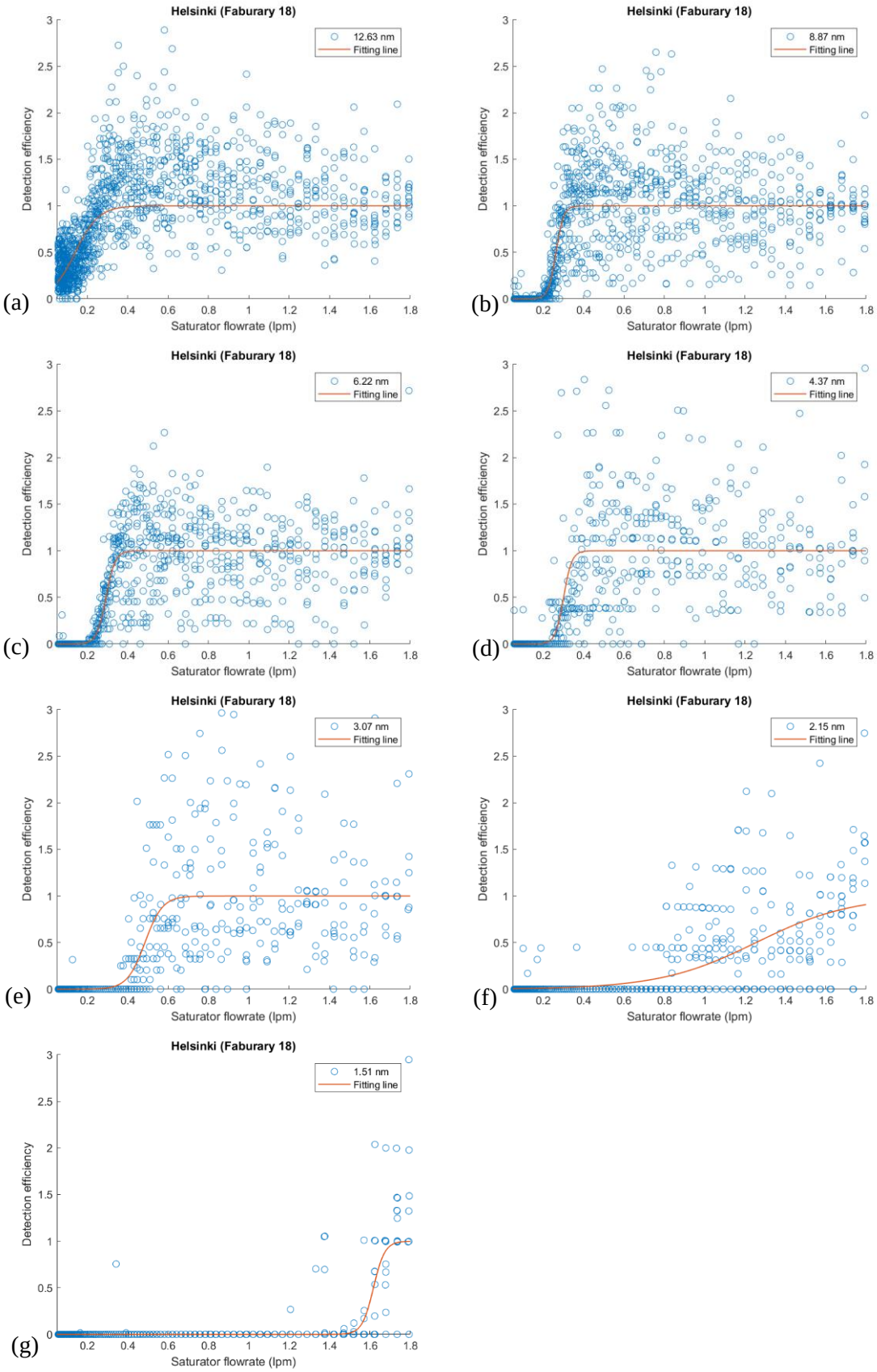


Figure S1. Detection efficiency curve for particles of different sizes collected during NPF events in Helsinki. The fitting line is derived from all measurement points.

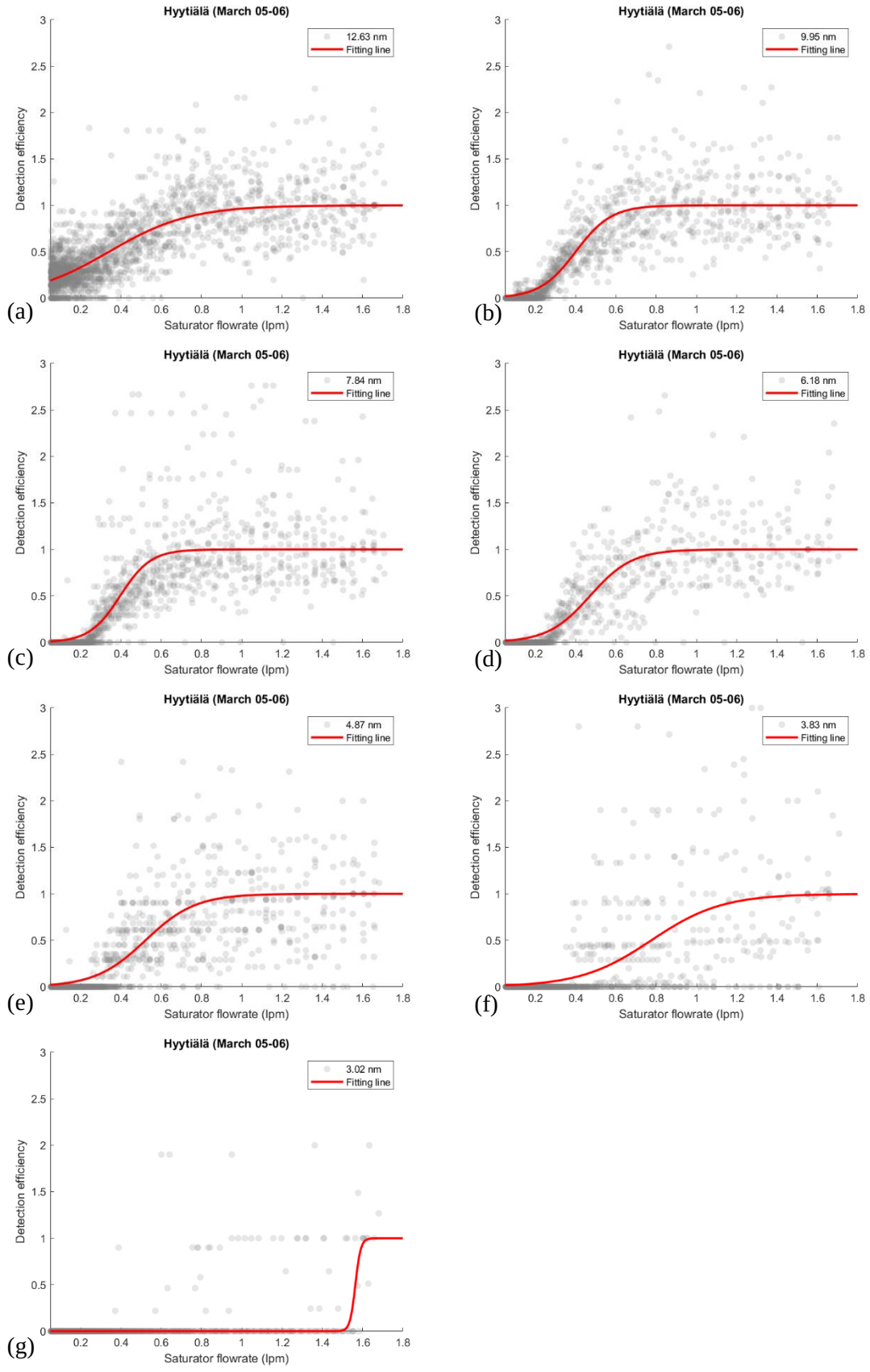
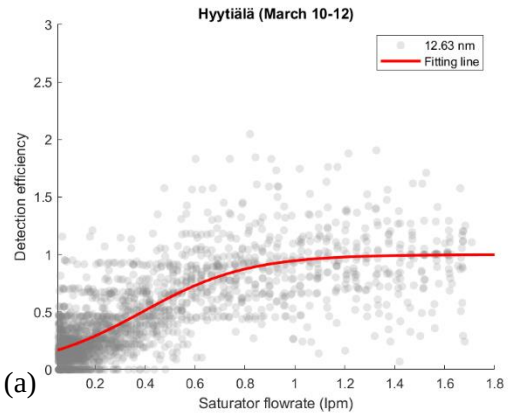
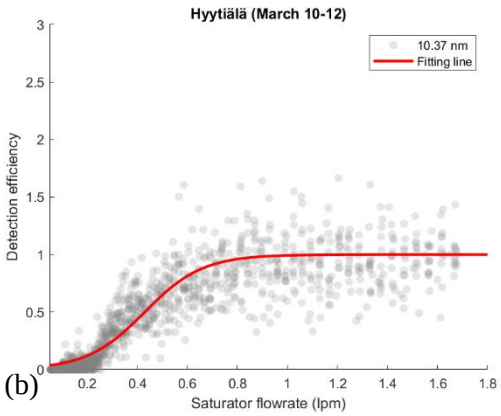


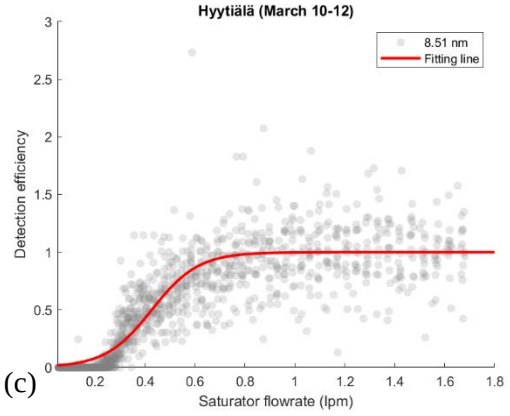
Figure S2. Detection efficiency curve for particles of different sizes collected during NPF events in Helsinki on 5 to 6 March. The fitting line is derived from all measurement points.


Hyytiälä (March 10-12)
12.63 nm
Fitting line
Detection efficiency
Saturator flowrate (lpm)

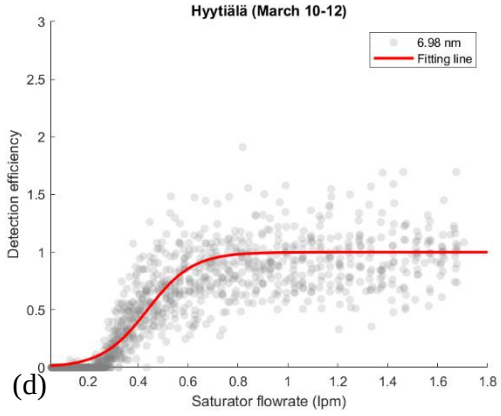
(a)


Hyytiälä (March 10-12)
10.37 nm
Fitting line
Detection efficiency
Saturator flowrate (lpm)

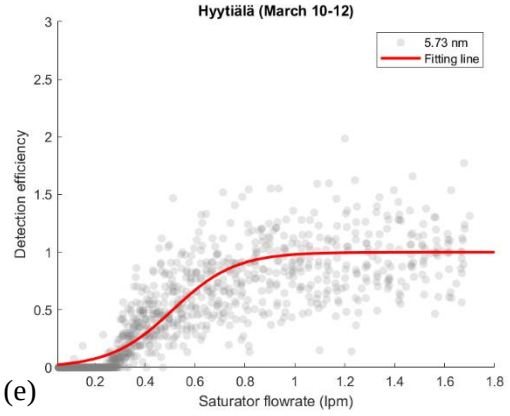
(b)


Hyytiälä (March 10-12)
8.51 nm
Fitting line
Detection efficiency
Saturator flowrate (lpm)

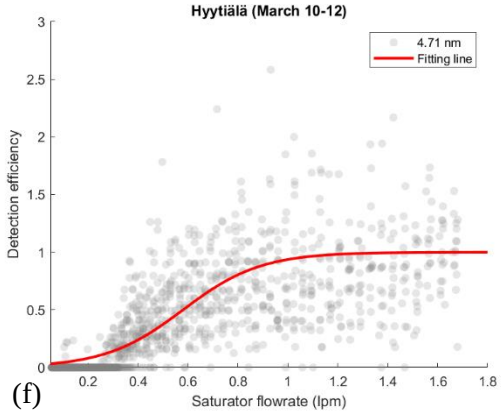
(c)


Hyytiälä (March 10-12)
6.98 nm
Fitting line
Detection efficiency
Saturator flowrate (lpm)

(d)


Hyytiälä (March 10-12)
5.73 nm
Fitting line
Detection efficiency
Saturator flowrate (lpm)

(e)


Hyytiälä (March 10-12)
4.71 nm
Fitting line
Detection efficiency
Saturator flowrate (lpm)

(f)

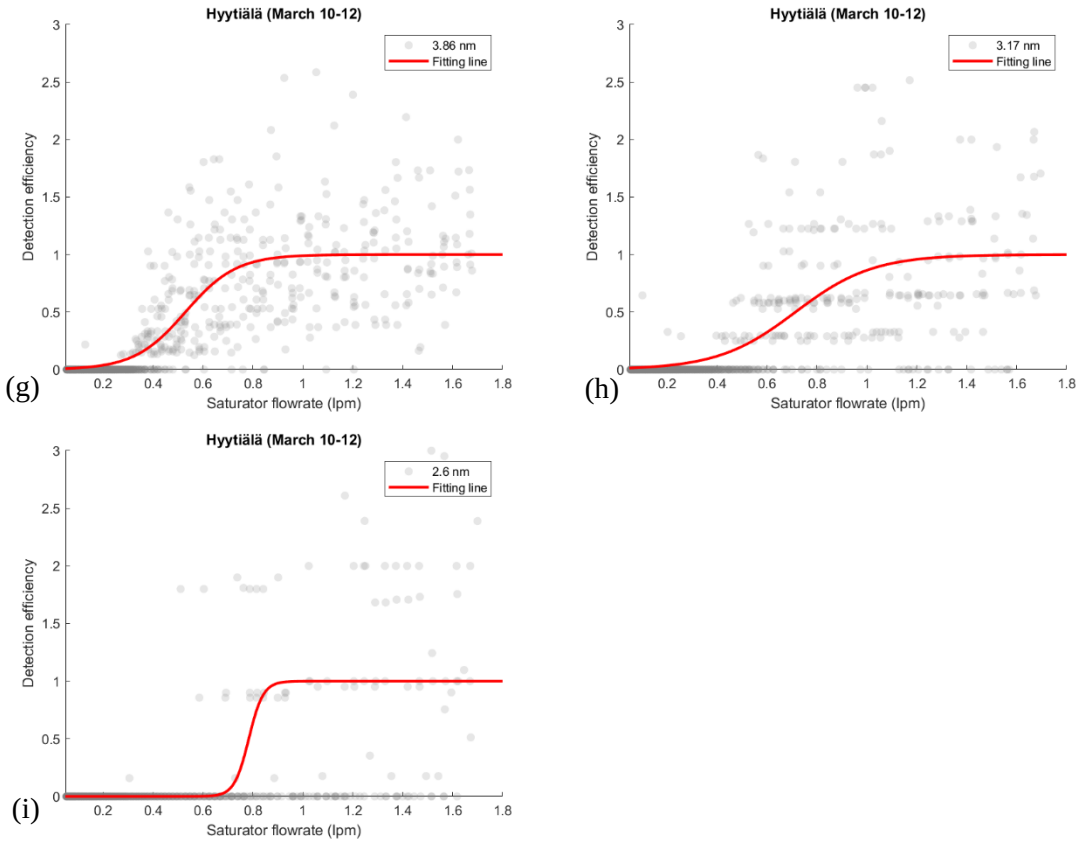


Figure S3. Detection efficiency curve for particles of different sizes collected during NPF events in Helsinki on 10 to 12 March. The fitting line is derived from all measurement points.