



*Supplement of*

## **Direct calibration using atmospheric particles and performance evaluation of Particle Size Magnifier (PSM) 2.0 for sub-10 nm particle measurements**

**Yiliang Liu et al.**

*Correspondence to:* Yang Chen ([chenyang@cigit.ac.cn](mailto:chenyang@cigit.ac.cn)) and Juha Kangasluoma ([juha.kangasluoma@helsinki.fi](mailto:juha.kangasluoma@helsinki.fi))

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1. Derivation of size resolution.
2. Figure S1-S3.

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

$$\begin{aligned} Res(d_p^*) &= d_p^* / \Delta d_p \\ &= \frac{f[S^*]}{f\left[S^* - \frac{\Delta S}{2}\right] - f\left[S^* + \frac{\Delta S}{2}\right]} \\ &= \frac{f[S^*]}{\left\{f[S^*] - f'[S^*]\frac{\Delta S}{2} + \frac{1}{2}f'[S^*]\left(\frac{\Delta S}{2}\right)^2\right\} - \left\{f[S^*] + f'[S^*]\frac{\Delta S}{2} + \frac{1}{2}f'[S^*]\left(\frac{\Delta S}{2}\right)^2\right\}} \\ &= -\frac{f[S^*]}{f'[S^*]\Delta S} \\ &= -\frac{S^*}{\Delta S} \frac{d_p^*}{f'[S^*]S^*} \\ &= Res(S^*) \frac{d_p^*}{S^*} \frac{1}{-f'[S^*]} \end{aligned}$$

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  $\Delta S$  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  $S^*$ .

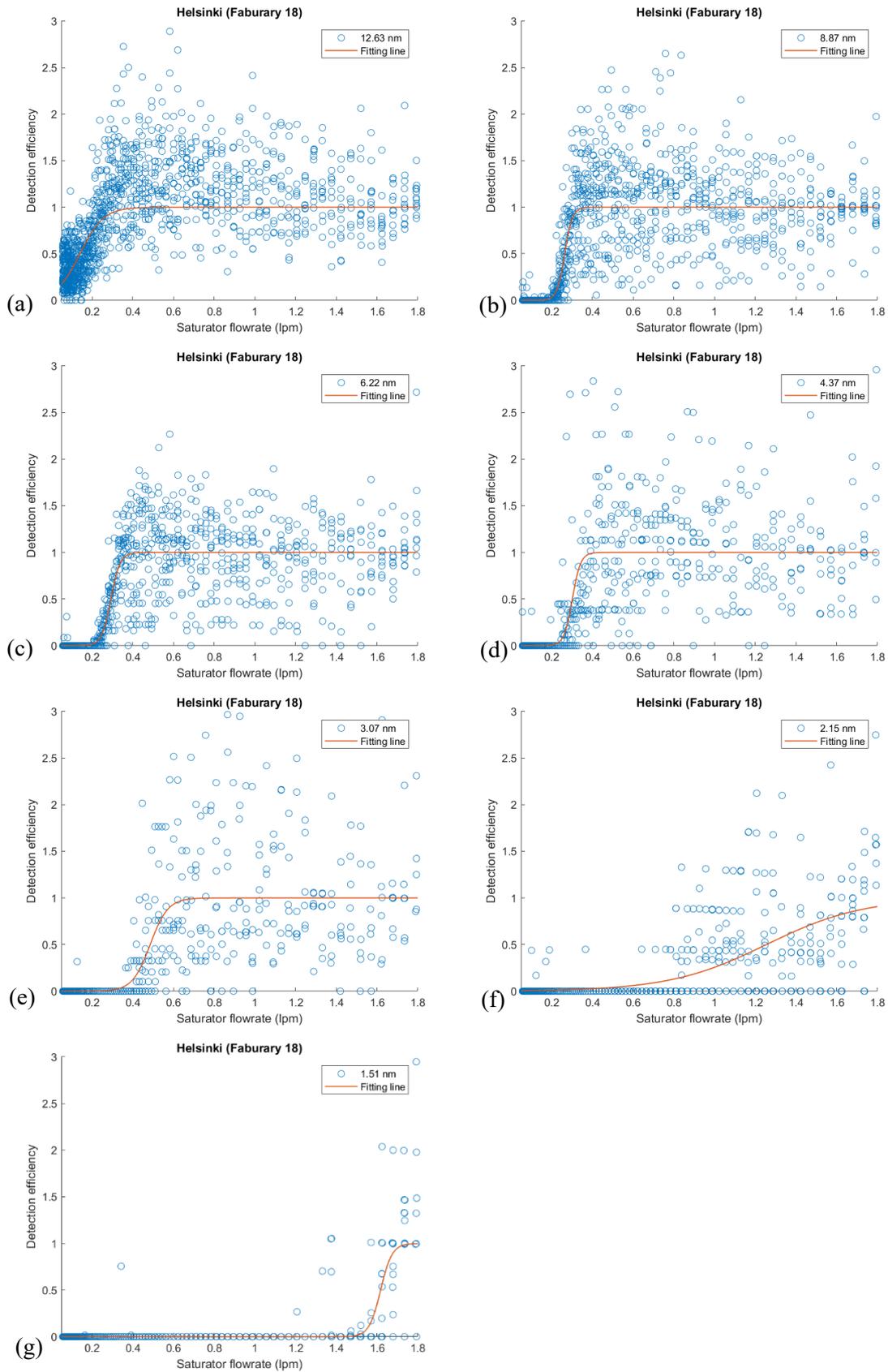


Figure S1. Detection efficiency curve for particles of different sizes collected during NPF events in Helsinki. The fitting line is derived from all measurement points.

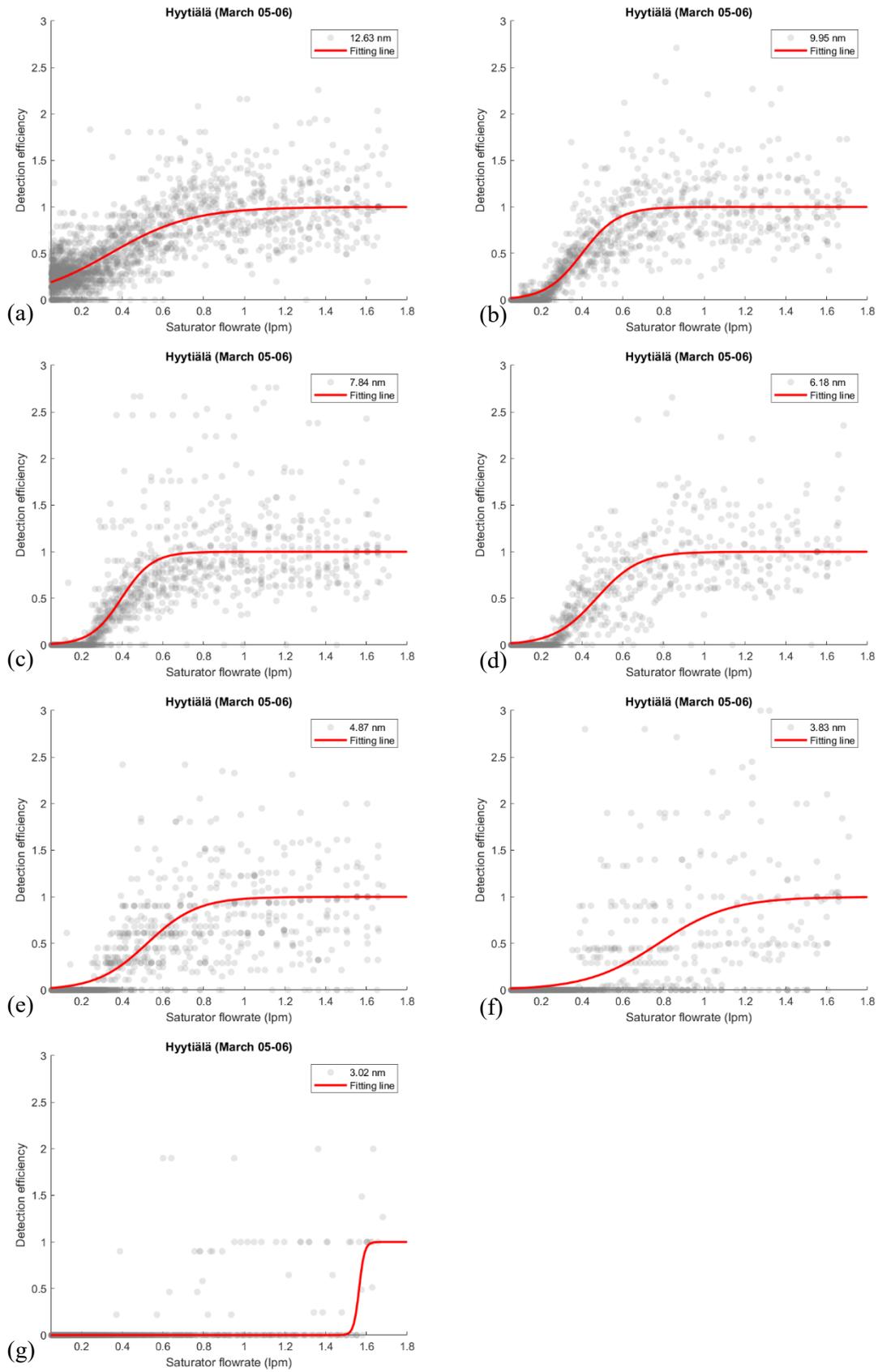
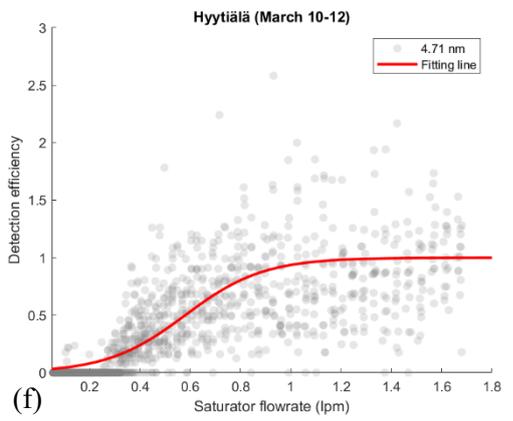
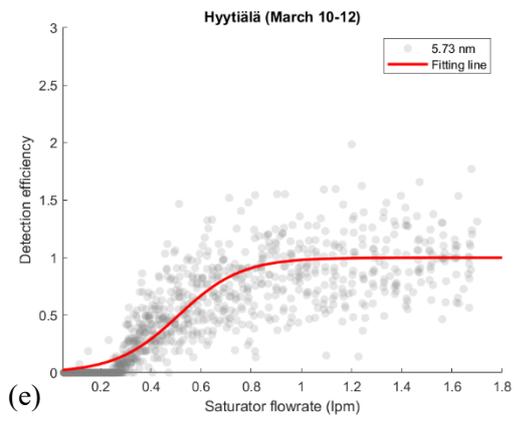
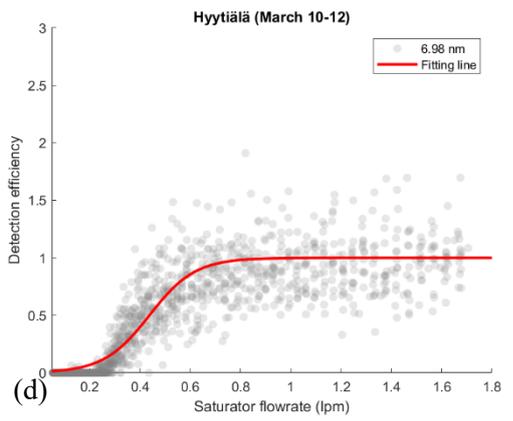
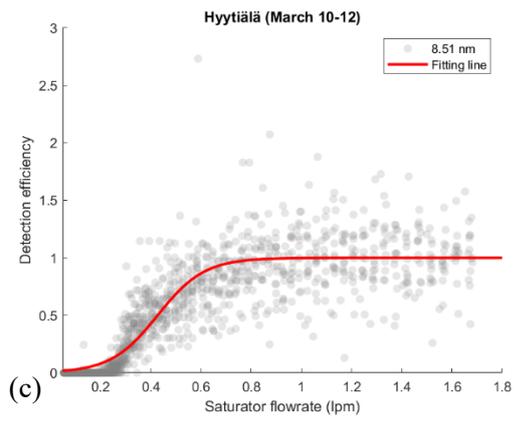
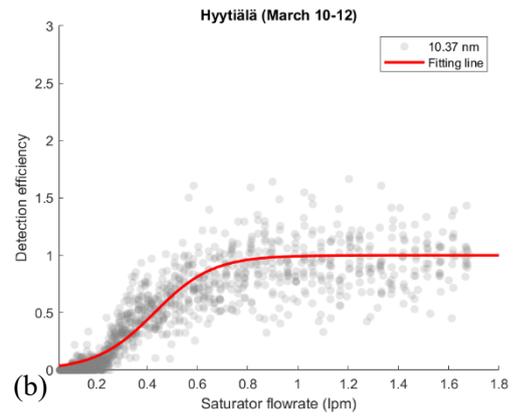
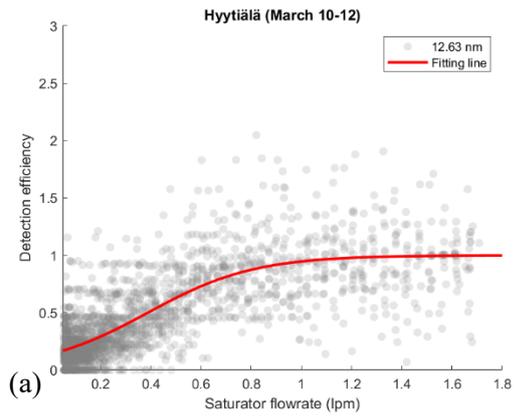


Figure S2. Detection efficiency curve for particles of different sizes collected during NPF events in Hyytiälä on 5 to 6 March. The fitting line is derived from all measurement points.



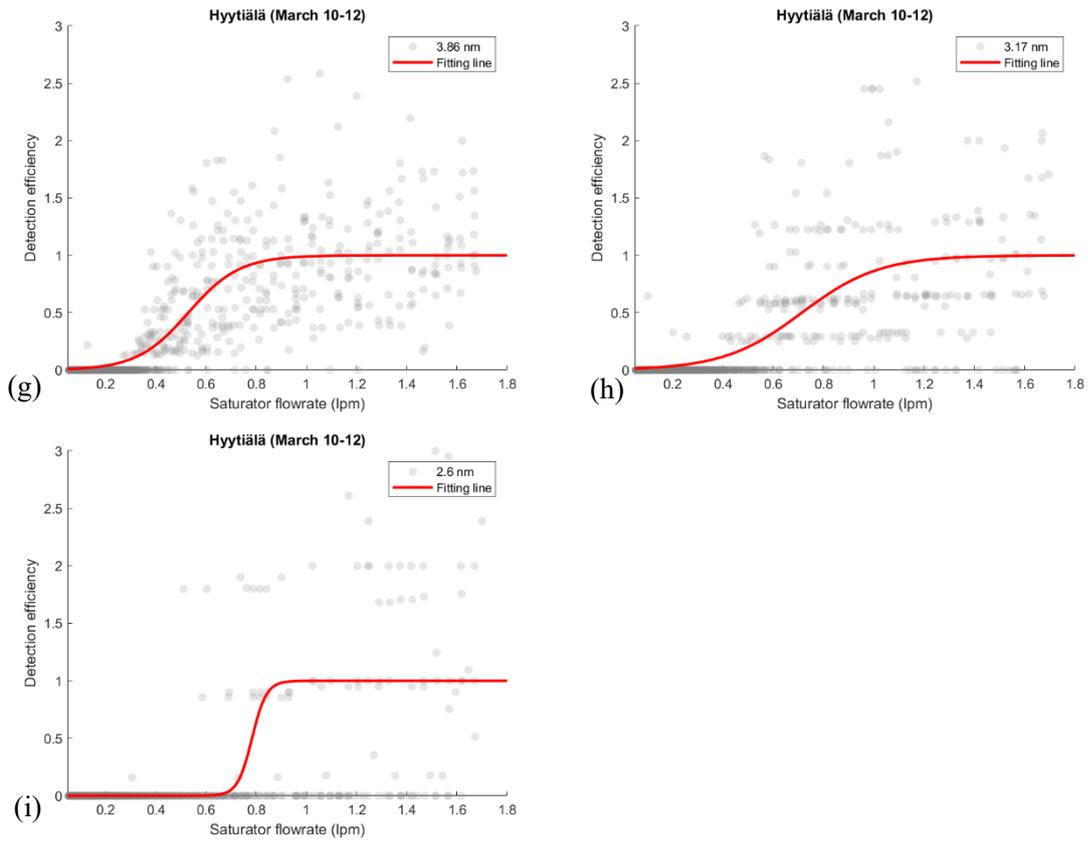


Figure S3. Detection efficiency curve for particles of different sizes collected during NPF events in Hyytiälä on 10 to 12 March. The fitting line is derived from all measurement points.