Two definitions of magnetization

M represents the thermodynamic (or macroscopic) magnetization: it is a function of macrostate (e.g. $M(S,H)$ or $M(T,H)$).
$\mathcal{M}$ represents the microscopic magnetization: it is a function of microstate (e.g. $\mathcal{M}(\mathsf{x})$).

From thermodynamics using the master function $E(S,H)$:

$$dE = T\,dS - M\,dH \qquad \text{whence} \qquad M(S,H) = -\left.\frac{\partial E}{\partial H}\right)_S.$$

Execute a Legendre transformation to

$$F(T,H) = E - TS,$$

giving

$$dF = -S\,dT - M\,dH \qquad \text{whence} \qquad M(T,H) = -\left.\frac{\partial F}{\partial H}\right)_T.$$

But the statistical mechanical magnetization is

$$\langle \mathcal{M} \rangle = \frac{\sum_{\mathsf{x}} \mathcal{M}(\mathsf{x}) e^{-\beta \mathcal{H}(\mathsf{x})}}{\sum_{\mathsf{x}} e^{-\beta \mathcal{H}(\mathsf{x})}}.$$

Here the Hamiltonian is $\mathcal{H}(\mathsf{x}) = \mathcal{H}_0(\mathsf{x}) - H\mathcal{M}(\mathsf{x})$, where $\mathcal{H}_0(\mathsf{x})$ is the part of the Hamiltonian independent of H. Thus

$$\langle \mathcal{M} \rangle = \frac{\sum_{\mathsf{x}} \mathcal{M}(\mathsf{x}) e^{-\beta \mathcal{H}_0(\mathsf{x}) + \beta H \mathcal{M}(\mathsf{x})}}{\sum_{\mathsf{x}} e^{-\beta \mathcal{H}_0(\mathsf{x}) + \beta H \mathcal{M}(\mathsf{x})}} = \frac{1}{\beta}\frac{\partial}{\partial H}\left(\ln \sum_{\mathsf{x}} e^{-\beta \mathcal{H}_0(\mathsf{x}) + \beta H \mathcal{M}(\mathsf{x})} \right),$$

where we've used the "slick trick" of parametric differentiation. (The derivative is taken with constant β, i.e. constant T, but it's clumsy to use our "subscript T" notation here.)

Thus

$$\langle \mathcal{M} \rangle = \frac{\partial}{\partial H}\left(k_B T \ln \sum_{\mathsf{x}} e^{-\beta \mathcal{H}(\mathsf{x})} \right),$$

or, because $F = -k_B T \ln(Z)$,

$$\langle \mathcal{M} \rangle = -\left.\frac{\partial F}{\partial H}\right)_T.$$

We conclude that the thermodynamic magnetization is the same as the statistical mechanical magnetization.