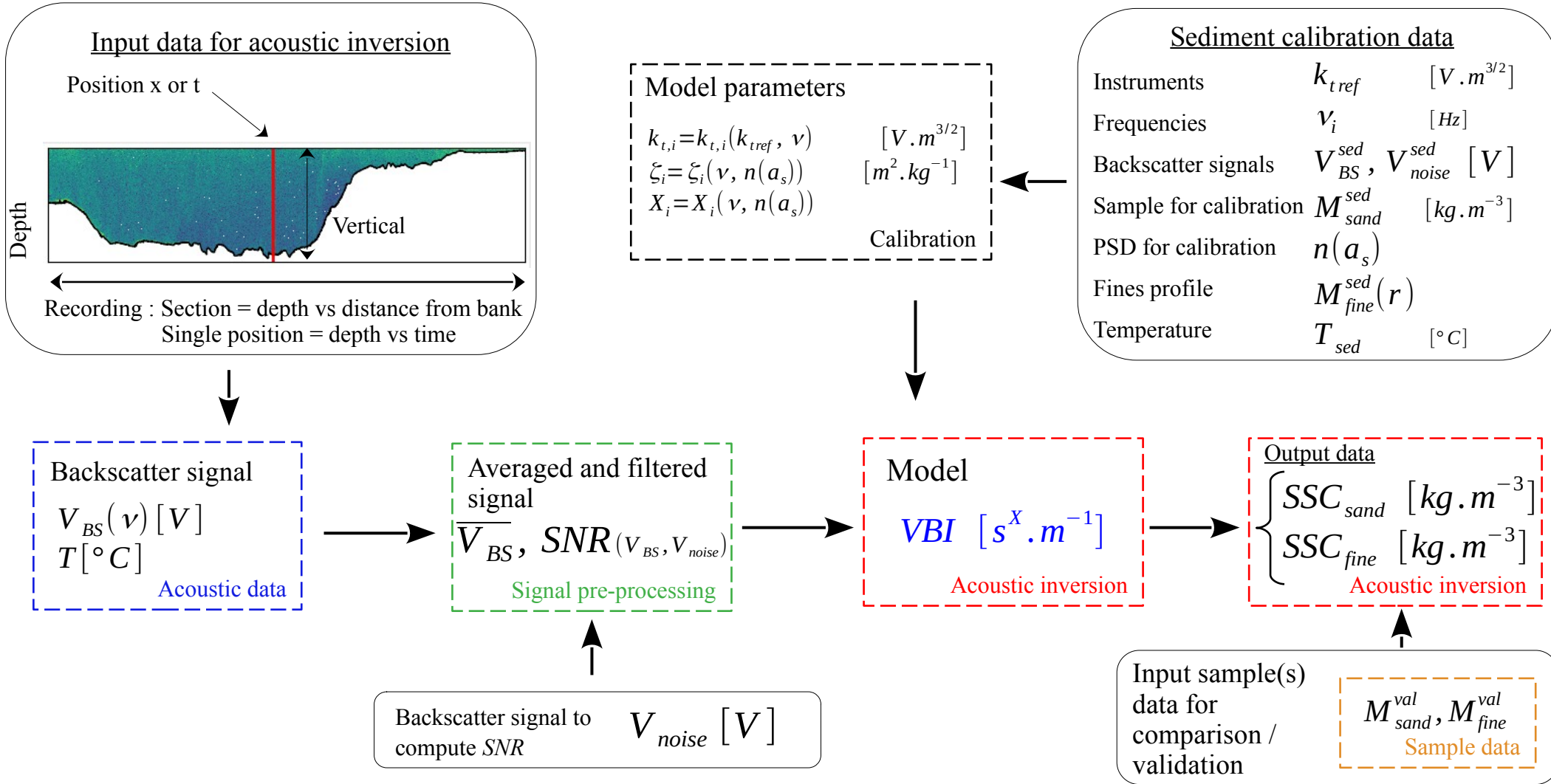
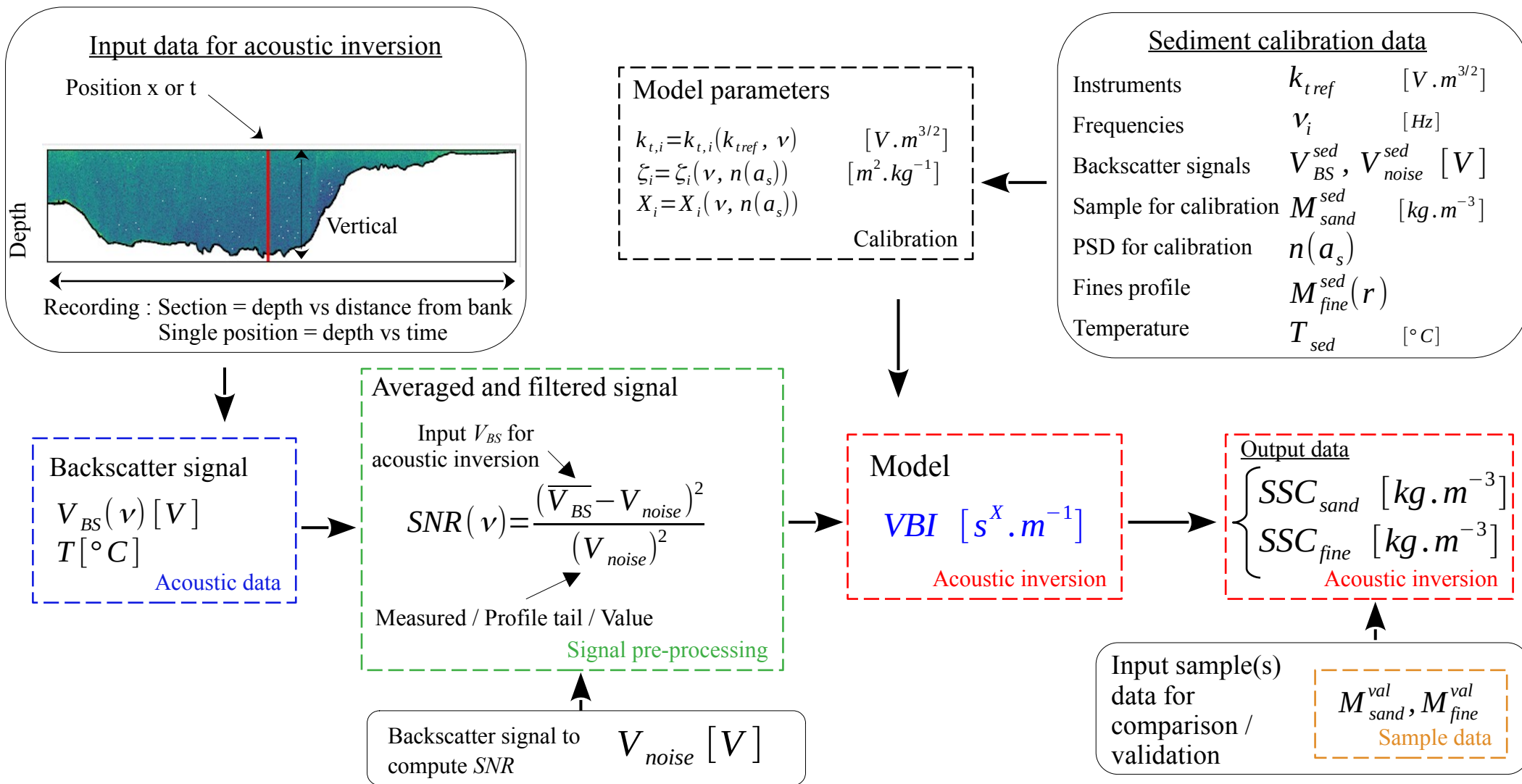


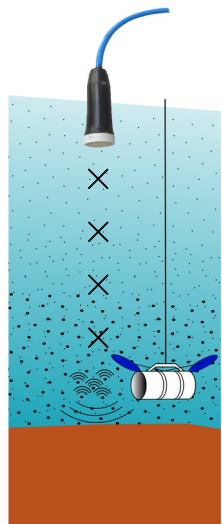
AcouSed general layout with physical dependencies of inversion method for high concentration



AcouSed general layout with Signal/Noise Ratio (SNR) details



AcouSed general layout with sediments calibration details



Model parameters

form function: $f_{\infty} = f_{\infty}(T, \nu_i, a_s) + \text{sand PSD} : n(a_s)$

$$k_s = \left[\frac{\int_0^{\infty} a_s^2 f_{\infty}^2(a_s) n(a_s) da_s}{\rho_s \int_0^{\infty} a_s^3 n(a_s) da_s} \right]^{1/2} \rightarrow s_v = \frac{3}{16\pi} k_s^2 M_{sand}^{sed}$$

$$k_t = k_{tref} \sqrt{\frac{\tau(T_{sed}, \nu) c}{\tau_{ref} c_{ref}}} \leftarrow c(T_{sed})$$

$$J^{sed} = \frac{3}{16\pi} \frac{(\overline{V_{BS}^{sed}})^2 r_s^2}{k_t^2}$$

$$\alpha_s = \frac{\log(s_v / J^{sed})}{4 r_s} - \alpha_{\omega} \leftarrow \alpha_{\omega}(T_{sed}, \nu_i)$$

$$\mathbf{X} = \left(\frac{\log(s_{v,i} / s_{v,j})}{\log(\nu_i / \nu_j)} \right)_{(i \neq j)}$$

$$\xi = \frac{\alpha_s}{\frac{1}{r_s} \int_0^{r_s} M_{fine}^{sed}(r) dr}$$

Calibration

Sediment calibration data

$$k_{tref} \quad [V \cdot m^{3/2}]$$

$$\nu_i \quad [Hz]$$

$$V_{BS}^{sed}, V_{noise}^{sed} \quad [V]$$

$$M_{sand}^{sed} \quad [kg \cdot m^{-3}]$$

$$n(a_s)$$

$$M_{fine}^{sed}(r)$$

$$T_{sed} \quad [^{\circ}C]$$

Input data for acoustic inversion

Backscatter signal

$$V_{BS}(\nu) [V]$$

$$T [^{\circ}C]$$

Acoustic data

Averaged and filtered
signal

$$\overline{V_{BS}}, SNR(V_{BS}, V_{noise})$$

Signal pre-processing

Backscatter signal to
compute SNR

$$V_{noise} [V]$$

Model

$$VBI [s^X \cdot m^{-1}]$$

Acoustic inversion

Output data

$$\begin{cases} SSC_{sand} [kg \cdot m^{-3}] \\ SSC_{fine} [kg \cdot m^{-3}] \end{cases}$$

Acoustic inversion

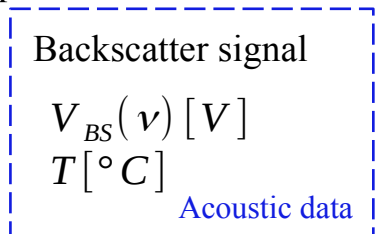
Input sample(s)
data for
comparison /
validation

$$M_{sand}^{sed}, M_{fine}^{sed}$$

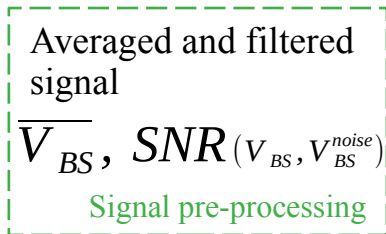
Sample data

AcouSed general layout with inversion calibration details

Input data for acoustic inversion



Backscatter signal to compute SNR

$$V_{BS}^{noise} [V]$$


Model

$$\left\{ \begin{aligned} \log(VBI) &= \frac{\zeta_2 \log(J_1 e^{(4r\alpha_{\omega_1})} / \nu_1^X) - \zeta_1 \log(J_2 e^{(4r\alpha_{\omega_2})} / \nu_2^X)}{\zeta_2 - \zeta_1} \\ (\nu_1, \nu_2), (J_1, J_2), (\alpha_{\omega_1}, \alpha_{\omega_2}) \end{aligned} \right.$$

Acoustic inversion



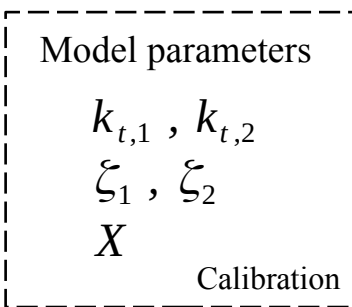
Output data

$$\left\{ \begin{aligned} SSC_{sand} &= \frac{16\pi \times VBI \times \nu_2^X}{3k_s^2} \\ SSC_{fine} &= \frac{1}{\zeta_2} \left[\frac{1}{4r} \log\left(\frac{VBI \times \nu_2^X}{J_2}\right) - \alpha_{\omega} \right] \end{aligned} \right.$$

Acoustic inversion

Input data for method calibration

Backscatter signal $V_{BS}^{sed} [V]$
 Sample for calibration $M_{sand}^{sed} [kg \cdot m^{-3}]$
 PSD for calibration $n(a_s)$
 Fines profile $M_{fine}^{sed}(r)$
 Frequencies $\nu_i [Hz]$



Input sample(s) data for comparison / validation

$$M_{sand}^{val}, M_{fine}^{val}$$

Sample data

