- Let O be the matrix of optimally combined (OC) data, of shape (v, t) (where v is the number of voxels in the brain mask and t is the number of timepoints in the run).
- Let M be the mixing matrix from the MEICA decomposition, of shape (c, t), where c is the number of components.
- Let n be the index of all non-ignored components in M, i.e., all accepted (BOLD-like) and rejected (non-BOLD) components.
- Let a be the index of accepted (BOLD-like) components in M.

1. The voxel-wise means (μ_O) and standard deviations (σ_O) of the optimally data are computed.
2. The optimally combined data are z-normalized.

$$O_z = \frac{O - \mu_O}{\sigma_O} \tag{1}$$

3. The betas B for the MEICA mixing matrix M fitted to the normalized data O_z are computed.

$$O_z = B \cdot M + \epsilon \tag{2}$$

4. The residuals R using only the non-ignored components (indexed in n) are computed using the normalized data O_z, the betas B, and the mixing matrix M.

$$R = O_z - (B[:, n] \cdot M[n, :]) \tag{3}$$

5. The time series of BOLD-like components P is constructed from the betas B, the mixing matrix M, and the index of accepted components a.

$$P = B[:, a] \cdot M[a, :] \tag{4}$$

6. The voxel-wise minimum map of the T1-like effect T (of shape v) is computed from the BOLD time series P, and is then mean-centered.

$$T_i = \min_{j \in J} x_{ij}, i = 1, ..., m \tag{5}$$

$$T = T - \mu_T \tag{6}$$

7. The volume-wise global signal timeseries g based on the T1-like effect is computed with least squares regression.

$$O_z = Tg + \epsilon \tag{7}$$

8. This global signal is removed from the BOLD timeseries P with least squares regression to create F, which is multiplied by g to create a predicted T1-like BOLD timeseries.

$$P^T = g^T F + \epsilon \tag{8}$$

$$P_c = P - (F \cdot g) \tag{9}$$

9. The BOLD timeseries (ME-HK+MIR, H), scaled to match the real data, is constructed from P_c and σ_O.

$$H = \sigma_O P_c \tag{10}$$

10. The denoised timeseries (ME-DN+MIR, D) is constructed from P_c, σ_O, μ_O, and R.

$$D = \sigma_O(P_c + R) + \mu_O \tag{11}$$

Symbol	Shape	Description
v		Number of voxels after masking
t		Number of volumes
c		Number of components from MEICA
O	v, t	Optimally combined data
O_z	v, t	Z-normalized optimally combined data
M	c, t	Mixing matrix (component timeseries) from MEICA
n	<c	Index of all non-ignored (accepted and rejected) components in M
a	<c	Index of accepted, BOLD-like components in M
B	v, c	Voxel-wise beta values for components in M fitted to O_z
R	v, t	Data not accounted for by accepted and rejected MEICA components fitted to O_z
P	v, t	Reconstructed BOLD-like component timeseries
T	v	Map of T1-like effect
g	t	Time series of T1-like global signal
P_c	v, t	Predicted T1-like BOLD timeseries
H	v, t	High-Kappa (aka BOLD) timeseries, minus impact of T1-like effect
D	v, t	Denoised (BOLD + ignored, but no rejected) timeseries, minus effect of T1-like effect