$$
\begin{aligned}
c &= 1,2 && \text{(Condition)}\\
l &= 1,...,L_c && \text{(ORF)}\\
m &= 1,...,M_{cl} && \text{(Repeat)}\\
n &= 1,...,N_{clm} && \text{(Time Point)}
\end{aligned}
$$

$$
\begin{aligned}
y_{clmn} &\sim \mathrm{N}(\hat{y}_{clmn}, (e^{\upsilon_l+\nu_c})^{-1})\\
\hat{y}_{clmn} &= f(x_{clmn}; e^{K_{clm}}, e^{r_{clm}}, e^{P})
\end{aligned}
$$

$$
\begin{aligned}
K_{clm} &\sim \mathrm{N}(e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})}, (e^{\tau_{cl}^K})^{-1}) & \tau_{cl}^K &\sim \mathrm{N}(\sigma^K, (\phi^K)^{-1})\\
r_{clm} &\sim \mathrm{N}(e^{\beta_c+(r_l^o+\delta_l\omega_{cl})}, (e^{\tau_{cl}^r})^{-1}) & \tau_{cl}^r &\sim \mathrm{N}(\sigma^r, (\phi^r)^{-1})
\end{aligned}
$$

$$
\begin{aligned}
K_l^o &\sim \mathrm{N}(K^p, (e^{\sigma^{K,o}})^{-1}) & \sigma^{K,o} &\sim \mathrm{N}(\eta^{K,o}, (\psi^{K,o})^{-1})\\
r_l^o &\sim \mathrm{N}(r^p, (e^{\sigma^{r,o}})^{-1}) & \sigma^{r,o} &\sim \mathrm{N}(\eta^{r,o}, (\psi^{r,o})^{-1})\\
\nu_l &\sim \mathrm{N}(\nu_p, (e^{\sigma^{\nu}})^{-1}) & \sigma^{\nu} &\sim \mathrm{N}(\eta^{\nu}, (\psi^{\nu})^{-1})\\
\delta_l &\sim Bern(p)
\end{aligned}
$$

$$
\begin{aligned}
\gamma_{cl} &\sim \begin{cases} 0 & \text{if } c=0;\\ \mathrm{N}(0, (e^{\sigma^{\gamma}})^{-1}) & \text{if } c=1. \end{cases} & \sigma^{\gamma} &\sim \mathrm{N}(\eta^{\gamma}, \psi^{\gamma})\\
\omega_{cl} &\sim \begin{cases} 0 & \text{if } c=0;\\ \mathrm{N}(0, (e^{\sigma^{\omega}})^{-1}) & \text{if } c=1. \end{cases} & \sigma^{\omega} &\sim \mathrm{N}(\eta^{\omega}, \psi^{\omega})
\end{aligned}
$$

$$
\begin{aligned}
\alpha_c &= \begin{cases} 0 & \text{if } c=0;\\ \mathrm{N}(\alpha^{\mu}, \eta^{\alpha}) & \text{if } c=1. \end{cases}\\
\beta_c &= \begin{cases} 0 & \text{if } c=0;\\ \mathrm{N}(\beta^{\mu}, \eta^{\beta}) & \text{if } c=1. \end{cases}\\
\upsilon_c &= \begin{cases} 0 & \text{if } c=0;\\ \mathrm{N}(\upsilon^{\mu}, (e^{\sigma^{\upsilon}})^{-1}) & \text{if } c=1. \end{cases} & \sigma^{\upsilon} &\sim \mathrm{N}(\eta^{\upsilon}, (\psi^{\upsilon})^{-1})
\end{aligned}
$$

$$
\begin{aligned}
K^p &\sim \mathrm{N}(K^{\mu}, (\eta^{K,p})^{-1})\\
r^p &\sim \mathrm{N}(r^{\mu}, (\eta^{r,p})^{-1})\\
\nu^p &\sim \mathrm{N}(\nu^{\mu}, (\eta^{\nu,p})^{-1})\\
P &\sim \mathrm{N}(P^{\mu}, (\eta^{P})^{-1})
\end{aligned}
$$

$$y_{clmn} \sim \mathrm{N}(\hat{y}_{clmn}, (e^{\upsilon_l+\nu_c})^{-1})$$
$$K_{clm} \sim \mathrm{N}(e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})}, (e^{\tau_{cl}^K})^{-1})$$

$$\pi(K_{clm}|\theta) = \sqrt{\frac{e^{\tau_{cl}^K}}{2\pi}} e^{-\frac{1}{2}(K_{clm}-e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})})^2 e^{\tau_{cl}^K}} \prod_{n=1}^{N_{clm}} \sqrt{\frac{e^{\upsilon_l+\nu_c}}{2\pi}} e^{-\frac{1}{2}(y_{clmn}-\hat{y}_{clmn})^2 e^{\upsilon_l+\nu_c}}$$

Taking logs

$$l\pi(K_{clm}|\theta) = -\frac{1}{2}(K_{clm} - e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})})^2 e^{\tau_{cl}^K} - \sum_{n=1}^{N_{clm}} \frac{1}{2}(y_{clmn} - \hat{y}_{clmn})^2 e^{\nu_l+\upsilon_c} + C$$

Similarly for r_{clm}

$$l\pi(r_{clm}|\theta) = -\frac{1}{2}(r_{clm} - e^{\beta_c+(r_l^o+\delta_l\omega_{cl})})^2 e^{\tau_{cl}^r} - \sum_{n=1}^{N_{clm}} \frac{1}{2}(y_{clmn} - \hat{y}_{clmn})^2 e^{\nu_l+\upsilon_c} + C$$

$$K_{clm} \sim \mathrm{N}(e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})}, (e^{\tau_{cl}^K})^{-1})$$
$$\tau_{cl}^K \sim \mathrm{N}(\sigma^K, (\phi^K)^{-1})$$

$$\pi(\tau_{cl}^K|\theta) = \sqrt{\frac{\phi^K}{2\pi}} e^{-\frac{1}{2}(\tau_{cl}^K-\sigma^K)^2\phi^K} \prod_{m=1}^{M_{cl}} \sqrt{\frac{e^{\tau_{cl}^K}}{2\pi}} e^{-\frac{1}{2}(K_{clm}-e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})})^2 e^{\tau_{cl}^K}}$$

Taking logs

$$l\pi(\tau_{cl}^K|\theta) = -\frac{1}{2}(\tau_{cl}^K - \sigma^K)^2\phi^K + \sum_{m=1}^{M_{cl}} \frac{1}{2}(\tau_{cl}^K - (K_{clm} - e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})^2} e^{\tau_{cl}^K}) + C$$

Similarly for τ_{cl}^r

$$l\pi(\tau_{cl}^r|\theta) = -\frac{1}{2}(\tau_{cl}^r - \sigma^r)^2\phi^r + \sum_{m=1}^{M_{cl}} \frac{1}{2}(\tau_{cl}^r - (r_{clm} - e^{\beta_c+(r_l^o+\delta_l\omega_{cl})^2} e^{\tau_{cl}^r}) + C$$

$$K_{clm} \sim \mathrm{N}(e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})}, (e^{\tau_{cl}^K})^{-1})$$
$$K_l^o \sim \mathrm{N}(K^p, (e^{\sigma^{K,o}})^{-1})$$

$$\pi(K_l^o|\theta) = \sqrt{\frac{e^{\sigma^{K,o}}}{2\pi}} e^{-\frac{1}{2}(K_l^o - K^p)^2 e^{\sigma^{K,o}}} \prod_{c=1}^{2}\prod_{m=1}^{M^{cl}} \sqrt{\frac{e^{\tau_{cl}^K}}{2\pi}} e^{-\frac{1}{2}(K_{clm}-e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})})^2 e^{\tau_{cl}^K}}$$

Taking logs

$$l\pi(K_l^o|\theta) = -\frac{1}{2}(K_l^o - K^p)^2 e^{\sigma^{K,o}} + \sum_{c=1}^{2}\sum_{m=1}^{M^{cl}} \frac{1}{2}(K_{clm} - e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})^2} e^{\tau_{cl}^K} + C$$

Similarly for r_l^o

$$l\pi(r_l^o|\theta) = -\frac{1}{2}(r_l^o - r^p)^2 e^{\sigma^{r,o}} + \sum_{c=1}^{2}\sum_{m=1}^{M^{cl}} \frac{1}{2}(r_{clm} - e^{\beta_c+(r_l^o+\delta_l\omega_{cl})^2} e^{\tau_{cl}^r} + C$$

$$y_{clmn} \sim \mathrm{N}(\hat{y}_{clmn}, (e^{\upsilon_l+\nu_c})^{-1})$$
$$\nu_l \sim \mathrm{N}(\nu_\mu, (e^{\sigma^\nu})^{-1})$$

$$\pi(\nu_l|\theta) = \sqrt{\frac{e^{\sigma^\nu}}{2\pi}} e^{-\frac{1}{2}(\nu_l-\nu_\mu)^2 e^{\sigma^\nu}} \prod_{c=1}^{2}\prod_{m=1}^{M_{cl}} \sqrt{\frac{e^{\nu_l+\upsilon c}}{2\pi}} e^{-\frac{1}{2}(y_{clmn}-\hat{y}_{clmn})^2 e^{\nu_l+\upsilon c}}$$

Taking logs

$$l\pi(\nu_l|\theta) = -\frac{1}{2}(\nu_l - \nu_\mu)^2 e^{\sigma^\nu} + \sum_{c=1}^{2}\sum_{m=1}^{M_{cl}} \frac{1}{2}(\nu_l - (y_{clmn} - \hat{y}_{clmn})^2 e^{\nu_l+\upsilon_c}) + C$$

$$K_{clm} \sim \mathrm{N}(e^{\alpha_c+(K_l^o+\delta_l\gamma_{cl})}, (e^{\tau_{cl}^K})^{-1})$$
$$r_{clm} \sim \mathrm{N}(e^{\beta_c+(r_l^o+\delta_l\omega_{cl})}, (e^{\tau_{cl}^r})^{-1})$$
$$\delta_l \sim Bern(p)$$

$$\pi(y_{2lm}|, \delta_l = 1, \theta) = (p) \times \prod_{m=1}^{m_{2l}} \sqrt{\frac{e^{\tau_{2l}^K}}{2\pi}} e^{-\frac{1}{2}(K_{2lm}-e^{\alpha_c+(K_l^o+\delta_l\gamma_{2l})})^2 e^{\tau_{2l}^K}} \sqrt{\frac{e^{\tau_{2l}^r}}{2\pi}} e^{-\frac{1}{2}(r_{2lm}-e^{\beta_c+(r_l^o+\delta_l\omega_{2l})})^2 e^{\tau_{2l}^r}}$$

$$\pi(y_{2lm}|, \delta_l = 0, \theta) = (1-p) \times \prod_{m=1}^{m_{2l}} \sqrt{\frac{e^{\tau_{2l}^K}}{2\pi}} e^{-\frac{1}{2}(K_{2lm}-e^{\alpha_2+(K_l^o)})^2 e^{\tau_{2l}^K}} \sqrt{\frac{e^{\tau_{2l}^r}}{2\pi}} e^{-\frac{1}{2}(r_{2lm}-e^{\beta_2+(r_l^o)})^2 e^{\tau_{2l}^r}}$$

$$K_l^o \sim \mathrm{N}(K^p, (e^{\sigma^{K,o}})^{-1})$$
$$\sigma^{K,o} \sim \mathrm{N}(\eta^{K,o}, (\psi^{K,o})^{-1})$$
$$\pi(\sigma^{K,o}|\theta) = \sqrt{\frac{\psi^{K,o}}{2\pi}} e^{-\frac{1}{2}(\sigma^{K,o}-\eta^{K,o})^2\psi^{K,o}} \prod_{l=1}^{L} \sqrt{\frac{e^{\sigma^{K,o}}}{2\pi}} e^{-\frac{1}{2}(K_l^o-K^p)^2 e^{\sigma^{K,o}}}$$

Taking logs

$$l\pi(\sigma^{K,o}|\theta) = -\frac{1}{2}(\sigma^{K,o} - \eta^{K,o})^2\psi^{K,o} + \sum_{l=1}^{L} \frac{1}{2}(\sigma^{K,o} - (K_l^o - K^p)^2 e^{\sigma^{K,o}}) + C$$

Similarly for $\sigma^{r,o}$

$$l\pi(\sigma^{r,o}|\theta) = -\frac{1}{2}(\sigma^{r,o} - \eta^{r,o})^2\psi^{r,o} + \sum_{l=1}^{L} \frac{1}{2}(\sigma^{r,o} - (r_l^o - r^p)^2 e^{\sigma^{r,o}}) + C$$

and similarly for σ^{ν}

$$l\pi(\sigma^{\nu}|\theta) = -\frac{1}{2}(\sigma^{\nu} - \eta^{\nu})^2\psi^{\nu} + \sum_{l=1}^{L} \frac{1}{2}(\sigma^{\nu} - (\nu_l - \nu^p)^2 e^{\sigma^{\nu}}) + C$$

$$
\begin{aligned}
K_{clm} &\sim \mathrm{N}(e^{\alpha_c+(K^o_l+\delta_l\gamma_{cl})}, (e^{\tau^K_{cl}})^{-1}) \\
\gamma_{cl} &= \begin{cases} 0 & \text{if } c=0; \\ \mathrm{N}(0,(e^{\sigma^\gamma})^{-1}) & \text{if } c=1. \end{cases}
\end{aligned}
$$

$$
\pi(\gamma_{2l}|\theta) = \sqrt{\frac{e^{\sigma^\gamma}}{2\pi}} e^{-\frac{1}{2}(\gamma_{cl})^2 e^{\sigma^\gamma}} \prod_{m=1} M_{2l} \sqrt{\frac{e^{\tau^K_{2l}}}{2\pi}} e^{-\frac{1}{2}(K_{2lm}-e^{\alpha_2+(K^o_l+\delta_l\gamma_{2l})})^2 e^{\tau^K_{2l}}}
$$

Taking logs

$$
l\pi(\gamma_{2l}|\theta) = -\frac{1}{2}(\gamma_{2l})^2 e^{\sigma^\gamma} - \sum_{m=1}^{M_{2l}} \frac{1}{2}(K_{2lm} - e^{\alpha_2+(K^o_l+\delta_l\gamma_{2l})})^2 e^{\tau^K_{2l}} + C
$$

Similarly for ω_{2l}

$$
l\pi(\omega_{2l}|\theta) = -\frac{1}{2}(\omega_{2l})^2 e^{\sigma^\omega} - \sum_{m=1}^{M_{2l}} \frac{1}{2}(r_{2lm} - e^{\beta_2+(r^o_l+\delta_l\omega_{2l})})^2 e^{\tau^r_{2l}} + C
$$

σ^γ is similar to both $\sigma^{K,o}$ and $\sigma^{r,o}$

$$
l\pi(\sigma^\gamma|\theta) = -\frac{1}{2}(\sigma^\gamma - \eta^\gamma)^2 \psi^\gamma + \sum_{m=1}^{M_{2l}} \frac{1}{2}(\sigma^\gamma - (\gamma_{2l})^2 e^{\sigma^\gamma}) + C
$$

σ^ω is similar to both $\sigma^{K,o}$ and $\sigma^{r,o}$

$$
l\pi(\sigma^\omega|\theta) = -\frac{1}{2}(\sigma^\omega - \eta^\omega)^2 \psi^\omega + \sum_{m=1}^{M_{2l}} \frac{1}{2}(\sigma^\omega - (\omega_{2l})^2 e^{\sigma^\omega}) + C
$$

$$
\begin{aligned}
K_{clm} &\sim \mathrm{N}(e^{\alpha_c+(K^o_l+\delta_l\gamma_{cl})}, (e^{\tau^K_{cl}})^{-1}) \\
\alpha_c &= \begin{cases} 1 & \text{if } c=0; \\ \mathrm{N}(\alpha^\mu,\eta^\alpha) & \text{if } c=1. \end{cases}
\end{aligned}
$$

$$
\pi(\alpha_2|\theta) = \sqrt{\frac{\eta^\alpha}{2\pi}} e^{-\frac{1}{2}(\alpha_2-\alpha^\mu)^2 \eta^\alpha} \prod_{m=1} M_{2l} \sqrt{\frac{e^{\tau^K_{2l}}}{2\pi}} e^{-\frac{1}{2}(K_{2lm}-e^{\alpha_2+(K^o_l+\delta_l\gamma_{2l})})^2 e^{\tau^K_{2l}}}
$$

Taking logs

$$
l\pi(\alpha_2|\theta) = -\frac{1}{2}(\alpha_2 - \alpha^\mu)^2 \eta^\alpha + \sum_{m=1}^{M_{2l}} \frac{1}{2}(K_{2lm} - e^{\alpha_2+(K^o_l+\delta_l\gamma_{2l})})^2 e^{\sigma^{\tau^K_{2l}}} + C
$$

Similarly for β_2

$$
l\pi(\beta_2|\theta) = -\frac{1}{2}(\beta_2 - \beta^\mu)^2 \eta^\beta + \sum_{m=1}^{M_{2l}} \frac{1}{2}(r_{2lm} - e^{\beta_2+(r^o_l+\delta_l\omega_{2l})})^2 e^{\sigma^{\tau^r_{2l}}} + C
$$

$$y_{clmn} \sim \mathrm{N}(\hat{y}_{clmn}, (e^{\upsilon_l+\nu_c})^{-1})$$
$$\upsilon_c \sim \mathrm{N}(\upsilon^{\mu}, (e^{\sigma^{\upsilon}})^{-1})$$

$$\pi(\upsilon_2|\theta) = \sqrt{\frac{e^{\sigma^{\upsilon}}}{2\pi}} e^{-\frac{1}{2}(\upsilon_2-\upsilon_{\mu})^2 e^{\sigma^{\upsilon}}} \prod_{l=1}^{L} \prod_{m=1}^{M_{2l}} \sqrt{\frac{e^{\upsilon_2}}{2\pi}} e^{-\frac{1}{2}(y_{clmn}-\hat{y}_{clmn})^2 e^{\nu_l+\upsilon_2}}$$

Taking logs

$$l\pi(\upsilon_2|\theta) = -\frac{1}{2}(\upsilon_2 - \upsilon^{\mu})^2 e^{\sigma^{\upsilon}} + \sum_{l=1}^{L} \sum_{m=1}^{M_{2l}} \frac{1}{2}(\upsilon_c - (y_{clmn} - \hat{y}_{clmn})^2 e^{\nu_l+\upsilon_c}) + C$$

σ^{υ} is similar to both σ^{Z} and σ^{ν}

$$l\pi(\sigma^{\upsilon}|\theta) = -\frac{1}{2}(\sigma^{\upsilon} - \eta^{\upsilon})^2 \psi^{\upsilon} + \frac{1}{2}(\sigma^{\upsilon} - (\upsilon_2 - \upsilon^{\mu})^2 e^{\sigma^{\upsilon}}) + C$$

$$
\begin{aligned}
K_l^o &\sim \mathrm{N}(K^p, (e^{\sigma^{K,o}})^{-1}) \\
K^p &\sim \mathrm{N}(K^\mu, (\eta^{K,p})^{-1})
\end{aligned}
$$

$$
\pi(K_p|\theta) = \sqrt{\frac{\eta^{K,p}}{2\pi}} e^{-\frac{1}{2}(K^p - K^\mu)^2 \eta^{K,p}} \prod_{l=1}^{L} \sqrt{\frac{e^{\sigma^{K,o}}}{2\pi}} e^{-\frac{1}{2}(K_l^o - K^p)^2 e^{\sigma^{K,o}}}
$$

Taking logs

$$
l\pi(K_p|\theta) = -\frac{1}{2}(K^p - K^\mu)^2 e^{\eta^{K,p}} - \sum_{l=1}^{L} \frac{1}{2}(K_l^o - K^p)^2 e^{\sigma^{K,o}} + C
$$

Similarly for r_p

$$
l\pi(r_p|\theta) = -\frac{1}{2}(r^p - r^\mu)^2 e^{\eta^{r,p}} - \sum_{l=1}^{L} \frac{1}{2}(r_l^o - r^p)^2 e^{\sigma^{r,o}} + C
$$

similarly for ν_p

$$
l\pi(\nu^p|\theta) = -\frac{1}{2}(\nu^p - \nu^\mu)^2 \eta^{\nu,p} - \sum_{l=1}^{L} \frac{1}{2}(\nu_l - \nu^p)^2 e^{\sigma^{\nu}} + C
$$

similarly for υ_p

$$
l\pi(\upsilon^p|\theta) = -\frac{1}{2}(\upsilon^p - \upsilon^\mu)^2 \eta^{\upsilon,p} - \sum_{c=1}^{2} \frac{1}{2}(\upsilon_c - \upsilon^p)^2 e^{\sigma^{\upsilon}} + C
$$

$$
\begin{aligned}
y_{clmn} &\sim \mathrm{N}(\hat{y}_{clmn}, (e^{\nu_l + \upsilon_c})^{-1}) \\
P &\sim \mathrm{N}(P^\mu, (\eta^P)^{-1})
\end{aligned}
$$

$$
\pi(P|\theta) = \sqrt{\frac{\eta^P}{2\pi}} e^{-\frac{1}{2}(P^p - P^\mu)^2 \eta^P} \prod_{c=1}^{2} \prod_{l=1}^{L} \prod_{m=1}^{m_{cl}} \prod_{n=1}^{n_{clm}} \sqrt{\frac{e^{\nu_l + \upsilon_c}}{2\pi}} e^{-\frac{1}{2}(y_{clmn} - \hat{y}_{clmn})^2 e^{\nu_l + \upsilon_l}}
$$

Taking logs

$$
l\pi(P|\theta) = -\frac{1}{2}(P^p - P^\mu)^2 \eta^P - \sum_{c=1}^{2} \sum_{l=1}^{L} \sum_{m=1}^{m_{cl}} \sum_{n=1}^{n_{clm}} \frac{1}{2}(y_{lmn} - \hat{y}_{lmn})^2 e^{\nu_l + \upsilon_l} + C
$$