$$
\begin{aligned}
\frac{\partial u'}{\partial t} - \beta y v' &= -\frac{\partial \phi'}{\partial x} + \nu \nabla_H^2 u', \\
\frac{\partial v'}{\partial t} + \beta y u' &= -\frac{\partial \phi'}{\partial y} + \nu \nabla_H^2 v', \\
\frac{\partial \phi'}{\partial t} + c^2 \left(\frac{\partial u'}{\partial x} + \frac{\partial v'}{\partial y} \right) &= Q + \nu \nabla_H^2 \phi'.
\end{aligned}
$$