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| **Component** | **Equation** | **Description** |
| Continuity equation | where ρ= water density, velocity vector, ∇=gradient operator | Account for the flux of mass going into a defined area and the flux of mass leaving the defined area |
| The momentum equations | where g=gravitational force, p=water pressure,  = Laplacian operator, Ω=angular velocity of the earth, F=external forces, ν=kinematic viscosity | Navier–Stokes equation, valid for incompressible Newtonian flows |
| The advection equation | where Ja=advective flux density, C=pollutant concentration | Provide information for the horizontal transport by flows of pollutants; this is a primary transport process in the longitudinal direction in the rivers and estuaries |
| The dispersion equation | where J=dispersive mass flux density, D=diffusion coefficient, x=the distance | Provide information for the horizontal spreading by reducing the gradient of material concentration |
| Tidal equation | where η(t)= tidal elevation, t= time, a0=mean value of η(t), ak and bk=constant, Tk= the tidal period of kth tidal constituent, N=number of tidal constituents, η0(t)= residual signal other than the periodic components | Provide information of water level over the tidal cycle in the tidal estuaries |