P 521 Lecture 7: Motion in Noninertial Frame

\[ m \left( \frac{d^2 \vec{r}}{dt^2} \right) = \vec{F} - 2m \vec{\omega} \times \left( \frac{d\vec{r}}{dt} \right) - m \vec{\omega} \left( \frac{d\vec{\omega}}{dt} \right) \]

**Coriolis Force**

**Centrifugal Force**

\[ \omega = \frac{2\pi}{1 \text{ day}} = 7.29 \times 10^{-5} \text{ s}^{-1} \]

For rotating Earth. Above assumes \( \frac{d\omega}{dt} = 0 \)

**Note:** \( T_e \neq 24 \text{ hours because of rotational motion around sun} \)

\[ T_e = 8.62 \times 10^4 \text{ s} \text{ and } 24h = 8.64 \times 10^4 \text{ s} \]

Hurricane

Air flow is to the north moves south and \( \vec{w}_n \cdot \vec{v} \) is to the East. Therefore, \( F_{coriolis} = -2m \vec{w}_n \vec{v} \)
Therefore, hurricanes rotate counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.