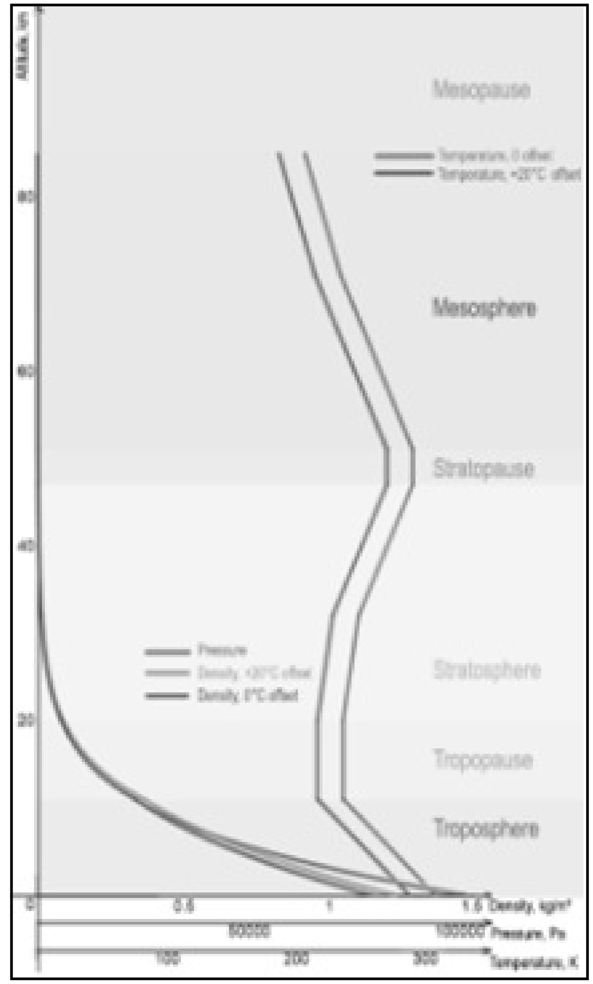
Atmospheric Density Model

Atmospheric Models

The most **commonly** employed atmospheric model is the **ISA**, shown **alongside.**

It is **adequate** for ascent mission modelling as **drag** is less than **1%** of weight beyond **75 km.**



Figures Courtesy Wikipedia

Atmospheric Density & Pressure

The **density** and pressure are the **primary** parameters that impact the **ascent** mission**.**

In the context of **pressure**, its impact is mainly on the $\mathbf{I_{sp}}$ which is specified for sea-level & **vacuum.**

Earth Geometric Model

Flat Earth Model

Ascent missions generally use a Cartesian **coordinate** system that is defined at the **launch** point**.**

In such a situation, when **motion** of vehicle is along **a radial** line, the local **tangent**, along with the **radial** line, can be used to **represent** a 2-D coordinate system.

This **approximation** results in constant **gravity direction**, but is restricted to small **distances** over Earth's surface. (E.g. **1°** change in slope $\cong$ **110 km**).

Implication of Spherical Earth

However, as rockets **typically** travel thousands of kilometers over **Earth's** surface, we need to **account** for earth's **curvature** as well as its **rotation.**

In most cases, a **polar** or spherical coordinate **system** is able to address the **issues** with reasonable **accuracy.**

Summary

To **summarize**, both atmospheric and earth's geometric **representations** are fairly simplified **forms** of more complex **models** due to their small **order** of magnitude.