Advance forces that affect our bullets flight.

By Jim See

Have you ever gone to the range and confirmed your long range data and found it to have elevational errors?

Have you ever had a solid grasp of your rifles data at your home range, but when traveling to other ranges your data no longer lines up?

Well if you can answer yes to either one of these questions this article is for you.

I will highlight some of the common and advance forces that can affect the flight path of your bullet in the form of elevation deviations, from day to day and location to location. Let's get started with the most common and know causes of elevational errors.

Environmental conditions:

Our shooting **altitude** and **temperature** can greatly affect our elevation corrections, because these two factors are the biggest cause of air pressure deviations from what might be your "standard" shooting conditions. The higher the temperature, and/or the higher the elevation, the thinner the air density. Less dense air produces less resistance to our bullet, thus the bullet will decelerate at a slower rate causing a flatter trajectory then "thick air". The term Density Altitude is a calculation of Elevation temperature and humidity which in turn gives us the relative altitude number which our bullet reacts to.

Wind induced elevation errors:

Here we have a few ways wind can play with our elevation corrections. The first would be the way wind travels over the **terrain** creating up or down drafts. For example a wind forced up a long continuous slope is compressing air and driving it up over the terrain. A projectile traveling in that updraft for a period of time will rise with the lifting wind.

Our projectile can also raise or fall off its established trajectory path when it encounters a cross wind. Commonly referred to **Aerodynamic Jump**, AJ can lift or drop a projectile depending on the wind direction and barrel twist direction. For most right hand twist production barrels you will see a lift from a 3 o'clock wind and a drop from a 9 o'clock wind.

Coriolis/ Eotvos Effect:

Coriolis/Eotvos is a displacement of our bullets intended impact from the **rotation of the earth** when shooting long range. Now the effect is minimal and may need to be calculated for extreme long range shooting but when shooting inside of 1000 yards the effect is minimal, usually accounting for just 3-4" of displacement at 1000 yards with modern long range cartridges. When combined with other elevational errors listed above we are just adding to the significance of the existing error. Coriolis describes the horizontal shift in the impact while Eotvos is descriptive of the vertical shift.

Spin drift:

I would be neglect to not comment on spin drift in this article, although it does not affect our elevation it does create a deviation that increases with distance. Spin Drift also called gyroscopic drift, occurs when a force is applied to the spinning bullet. The force of gravity acting on the bullet sends it slightly to the right or left of the original trajectory. The direction of the drift corresponds to the direction of the barrel's twist. Typically our right twist barrels will create a 5-7” drift to the right at 1000 yards. This effect is often not noticed unless shooting in true no wind conditions, simply because even a slight 1-2 mph wind can cancel out the noticeable drift.

The take away:

To understand why our drop data does not always line up with what worked on this day or that location we need to understand these common forces that can affect our true elevation calculations. If you have to constantly change velocity or BC in your ballistic calculator, from day to day under different conditions, it may be time to research and account for these conditions that you may not be aware of.

If you run a current weather station combination ballistic calculator some of these things are corrected based on the atmospheric conditions the unit is live time measuring. Others can be corrected by inputting the wind direction and direction of fire into the calculator. The key is to know why those inputs are important and when they are necessary to give you an accurate firing solution.

Shooting long range involves a constant learning curve as you progress from beginner to intermediate to advance. I hope this article has helped you to recognize that just because your ballistic solver gives you a number, there may be other things out there to recognize and account for.