

# Air Turbulence Effects on Lasers

Air turbulence is one of the main enemies of accurate alignments for both lasers and [optics](#). It is not air turbulence, per se, that affects lasers and optics but different temperature gradients between the laser and target, or the scale and optical instrument. Although dust and humidity may degrade the accuracy somewhat, it is extremely minor compared to temperature gradients. Wind also does not usually affect the laser accuracy unless that wind has a different temperature than the area around the laser, such as when someone opens the door in the winter.

Temperature gradients affect alignment accuracy mainly by causing the laser beam to “bounce” around. This exactly the same effect you see when looking down a paved road on a hot summer day and you see the air “boiling”.

Temperature gradients affect the laser data by creating excess “noise” in the measurement. In other words, the reading on the display will fluctuate by as much as +/- .020" (0.4 mm) in 100 ft. (30 m) in very poor conditions. The same thing happens with optics where the operator sees the marks on the scale “jump” around in his scope.



The good news is the laser beam tends to fluctuate in a circle and can be minimized by using 2 simple techniques:

1. *Use data averaging* – Our readouts and software all have the capability of continuously averaging multiple data points and then showing the averaged value in our display boxes. The number of data points averaged can be easily changed to account for more severe conditions. Typically the averaging is set to 8 but can go as high as 64 if needed. The only downside of this technique is it will tend to slow down the response time to adjustments of the surface being aligned. In other words, when adjusting a measurement point to bring it into alignment, the readout will take 2-3 times longer to update.
2. *Use fans to mix the air around the laser beam* - When using fans to minimize the air turbulence, it is important to point them along the same path as the laser beam. Pointing the fan perpendicular to the line between laser and target will result in the fluctuations increasing rather than decreasing.

Other tips to minimize air turbulence include: keeping building doors closed that are near the laser, pointing air conditioning vents away from the area, blocking or redirecting the air from exhaust vents from other machines, etc.

Following these simple steps can mean the difference between a successful alignment and long, long day "chasing your tail."