*The USDA-ARS Aerial Application Technology Group (AAT) publishes almost 20 papers a year in peer-reviewed scientific journals. The following Applied Research Summary and others like it have been boiled down to a few quick takeaway messages and will be appearing regularly in Agricultural Aviation. Full reports are available at AAT's revamped website, apmru.usda.gov/aerial.*

## Low-Level Atmospheric Temperature Inversions and Atmospheric Stability: Characteristics and Impacts on Agricultural Applications

Aerial Application Technology

Original Citation: Fritz, B.K., Hoffmann, W.C., Lan, Y., Thomson, S.J., and Huang, Y. 2008. Agricultural Engineering International: the CIGR Ejournal. Manuscript PM 08 001. Vol X.

**Research Objective:** To examine characteristics associated with low-level temperature inversions, commonly associated with increased drift potential, and to determine when they occur, how long they last, and general guidelines for avoiding them. Inversions are a normal part of the daily cycle of heating and cooling of the Earth's atmosphere. An inversion occurs when a layer of cooler air is trapped below a layer of warmer air preventing vertical air mixing as the cool air cannot rise into the warmer air above it.

**Research Methods:** Meteorological monitoring towers were constructed to measure vertical wind speed and direction profile, vertical temperature profile and solar radiation. The towers were located at two locations in Texas, one in the central part of the state and one nearer to the coastal region. Conditions were monitored for a six-month period spanning the months of May through October. The collected data was analyzed to determine the strength and duration of existing temperature inversions as well as the time of day they occurred and the wind speed conditions associated with them.

**Research Results:** For the two locations monitored, daytime inversions tended to occur in the early mornings and the late evenings. During early mornings the nighttime inversion still exists, and with the rising sun, the ground heats up and in turn heats the nearest layer of air which in turn heats the next nearest layer of air, slowly heating the full vertical profile. The inversions during this period tend to be shorter in duration with less difference in vertical temperature gradient than evening inversions. During the late afternoon, as the sun sets, the ground begins to cool which in turn cools the nearest layer of air and so on until the full nighttime inversion profile exists. The late afternoon inversions tend to be longer in duration and stronger in vertical temperature gradient as conditions are developing into the inversion rather than working out of them, as with the morning. There were very minimal differences seen between the two monitoring locations as the periods of inversions at both locations tended to be associated with wind speeds of less than 4 mph.

Research Application:

- Morning inversion conditions tend to dissipate quickly as the ground heats up and wind speeds increase. As a general rule of thumb, if wind speeds are at or above 4 mph, a low-level inversion likely does not exist.
- Caution should be taken during evening applications when wind speeds begin to drop below 4 mph, as inversion conditions are likely developing, and will continue to strengthen and develop through the evening. ■