

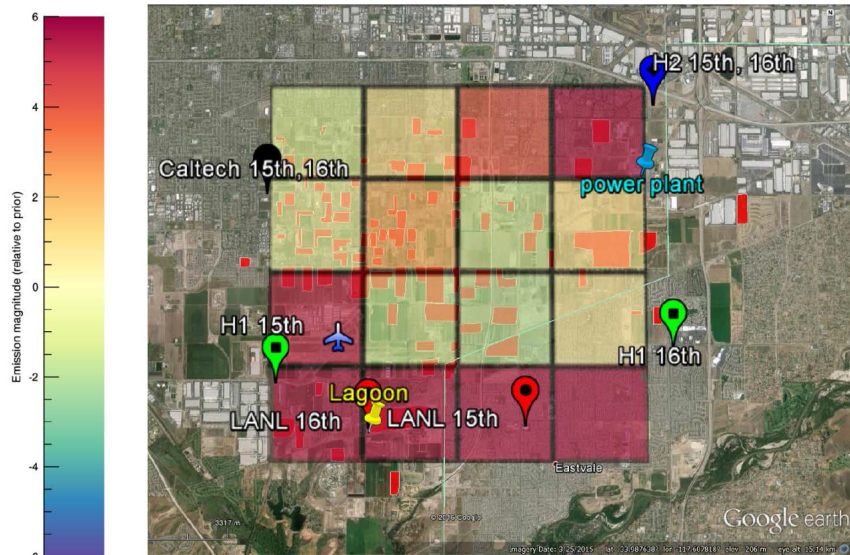


# Regional Column $\text{CH}_4$ (& $\text{CO}_2$ ) Observations by Off-the-Shelf Mobile Solar Spectrometers Detect Reductions in Dairy Emissions in Chino *Dubey CMS-PI*



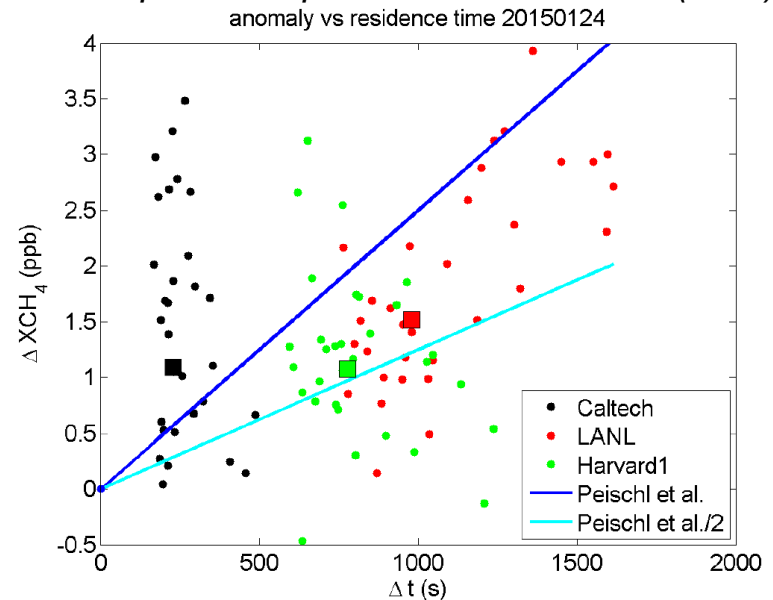
Viatte et al ACP, 2016; Chen et al ACP, 2016; Hedelius et al AMT, 2016

- Satellite  $\text{CH}_4$  &  $\text{CO}_2$  observations can evaluate estimated fluxes & help monitor progress on COP21 goals. Currently, LEO has limited time & spatial coverage that GEO should soon overcome. These promising space applications demand validation by ground based high resolution solar spectrometers (TCCON).
- However, TCCONs are large, expensive, complex and stationary with limited global coverage
- Affordable off-the-shelf compact low resolution solar spectrometers were calibrated consistently and with the TCCON standard to show they have the precision & stability for verification.
- We deployed 4 mobile spectrometers in Los Angeles and observed downwind-upwind column concentration gradients and use them to evaluate bottom-up  $\text{CH}_4$  emissions and trends from dairy and fossil fuels in Chino



4 spectrometers (LANL, Caltech & Harvard) made distributed column  $\text{CH}_4$  &  $\text{CO}_2$  measurements to evaluate dairy (red) & fossil emissions (yellow) inventory in Chino (2 km grid)

*Downwind-Upwind column  $\text{CH}_4$  anomaly vs residence time or (wind speed) $^{-1}$  & their means (box) for the 3 instrument pairs compared with in situ data (lines).*



- Affordable differential  $\text{CH}_4$  &  $\text{CO}_2$  column observations to constrain fluxes in isolated areas are feasible
- Our top-down  $\text{CH}_4$  emissions are on low end of '10 estimates indicating urban growth & less dairy in '15