1. INTRODUCTION
Lightning nitrogen oxides (LNOx) indirectly influences our climate since these molecules are important in controlling the concentration of ozone (O3) and hydroxyl radicals (OH) in the atmosphere [Huntrieser et al., 1998]. In support of the National Climate Assessment (NCA) program, satellite Lightning Imaging Sensor (LIS; Christian et al. [1999]; Cecil et al. [2014]) data is used to estimate LNOx production over the southern portion of the conterminous US for the 16 year period 1998-2013.

2. METHODOLOGY

LIS measures a small fraction of flash energy from the kth flash:

\[ \beta_k = \frac{E_k}{Q_o} \]

where \( \beta_k \) is the LIS-detected flash: optical energy, \( E_k \) is the total energy of the flash, and \( Q_o \) is the LNOx yield from the flash. The yield is \( Y = 10^7 \) molecules / J.

Flash LNOx Production:

\[ P_k = \frac{Y}{N_d} E_k = \frac{Y}{N_d} \beta_k \]

where \( P_k \) is the LNOx production from the kth flash, \( N_d = 6.022 \times 10^{23} \) is Avogadro's constant, \( N_d \) is the number of flashes at the flash location, and \( Y = 10^7 \) molecules / J.

Total LNOx Production \( P_t \) in a Region:

\[ P_t = \sum_{k=1}^{N_f} P_k + (N_o - N_f) \left( \frac{1}{N_o} \sum_{k=1}^{N_f} P_k \right) \]

where \( N_f \) is the total number of flashes in a region, and \( N_o \) is the total number of flashes observed within the region.

3. ANNUAL GEOGRAPHICAL VARIATIONS
Below is the annual geographical variations of the total LNOx production \( P_t \) described in the previous section. The value of beta has been calibrated so that the mean LNOx production per flash in 1998 (reference year) is 250 moles.

4. LNOx TREND
The trend in the total LNOx (summed up across the entire southern CONUS region) and associated flash counts are provided here. Keeping in mind that LIS is regarded as a very stable instrument [Buechler et al., 2014], note that there is a downward trend in the LIS-inferred total LNOx production.

5. REFERENCES