Climate Change Induced Migrations from a Cell Phone Perspective

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CDR Context

La Guajira
- Department in Colombia
- Population: 900,000
- Area: 20,848 km^2
- Drought induced state of emergency declared Feb. 2014
- State of emergency focused on the municipality of Uribia

Data set
- 6 months of data: Dec. 2013 through May 2014
- Filtered to include all calls made by any user that made >0 calls in La Guajira during the period
- 150,000 total users
- XXX total calls

Home Detection

Home tower
- Calculated on a weekly basis
- Tower most contacted during "home hours"
- Could be located anywhere in Colombia

Home hours
- Considered weekday calls only
- Calls made between 5AM-7AM
- Calls made between 7PM-10PM
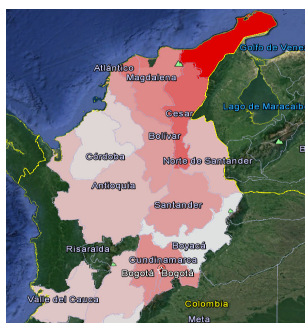
Number of Homes by Week

- Homes assigned according to home detection
- Weeks without enough data are assumed to maintain previous home location
- Weeks prior to initial call are assumed to have the home location of the first call

- 10% drop in number of homes in La Guajira
- R^2=0.93
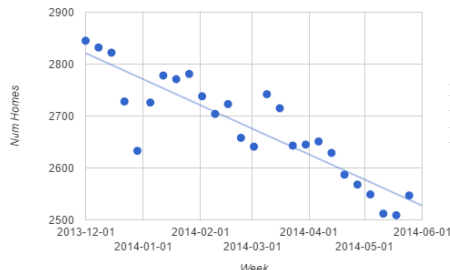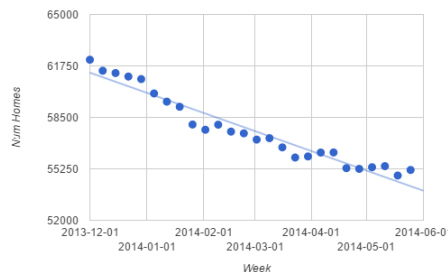
- 10% drop in number of homes in Uribia
- R^2=0.78

Migration Destinations

- 90% of people that leave their home, remain in La Guajira
- Generally, migrants stay close to their original home
- High density cities (e.g., Bogota) are disproportionately popular new homes locations

Migration destinations for the second week of January. Darker red areas indicate higher number of new homes.

## Efficacy of Mobility Models

Mobility Model Parameters
- Population of 1,000+ municipalities taken from 2014 projections from 2005 census
- Distances taken from centroid of each municipality

Mobility Models Considered
- Gravity Law with exponential distance decay
- Gravity Law with power function decay
- Radiation Law
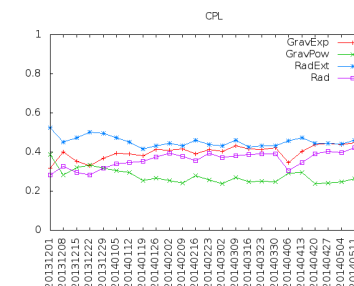- Radiation Law extended w/ intervening opportunities

Common Part of Commuters
- Percentage of good predictions for those that migrate.
- Min: 0.16 (GravPow)
- Max: 0.60 (RadExt)
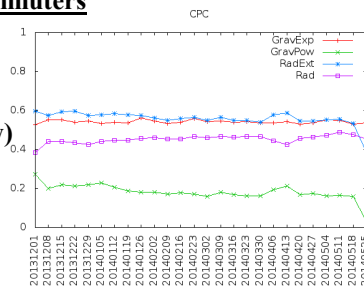
Common Part of Links
- Percentage topological structure maintained for those that migrate.
- Min: 0.24 (GravPow)
- Max: 0.52 (RadExt)

Conclusions

- Climate changed inducted migration is visible in CDRs
  - Migration occurs strongly linearly over time
  - ~10% decrease in homes over 6 month period
- Migration only loosely follows comminuting models
  - Extended Radiation model performs best
  - Only fits about 60% of the data