LA-UR-20-21852
Approved for public release; distribution is unlimited.

Title: TRACER Overview 200220

Author(s): Powers, Heath Hamilton

Intended for: Presentation for local municipality

Issued: 2020-02-25

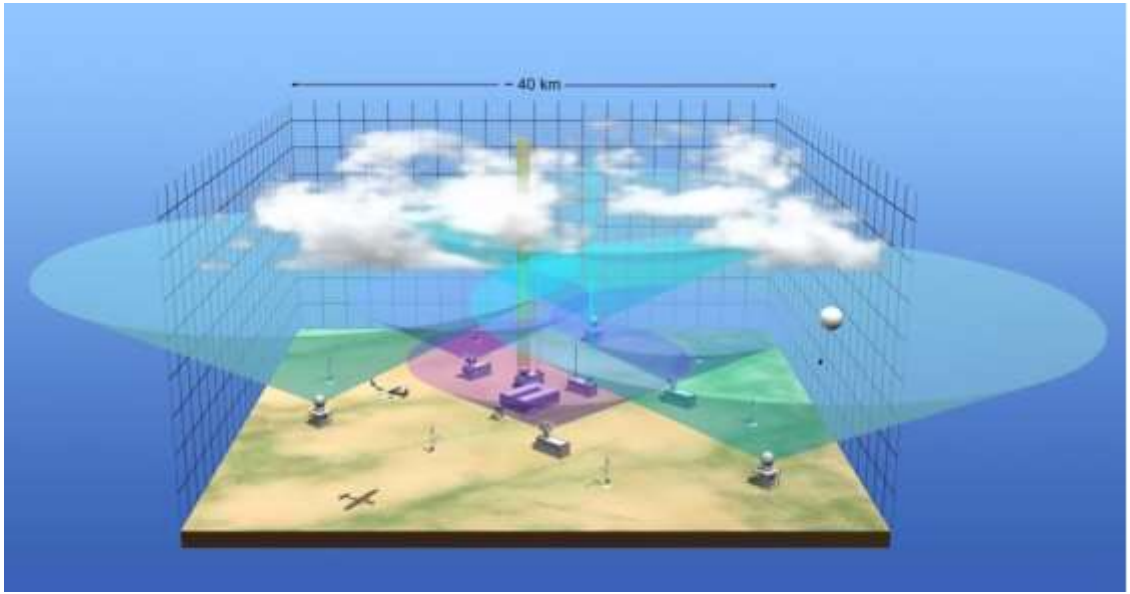
Disclaimer:
Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

LANL DOE ARM PROGRAM

Los Alamos National Laboratory
Earth & Environmental Sciences Division

THE ARM MISSION

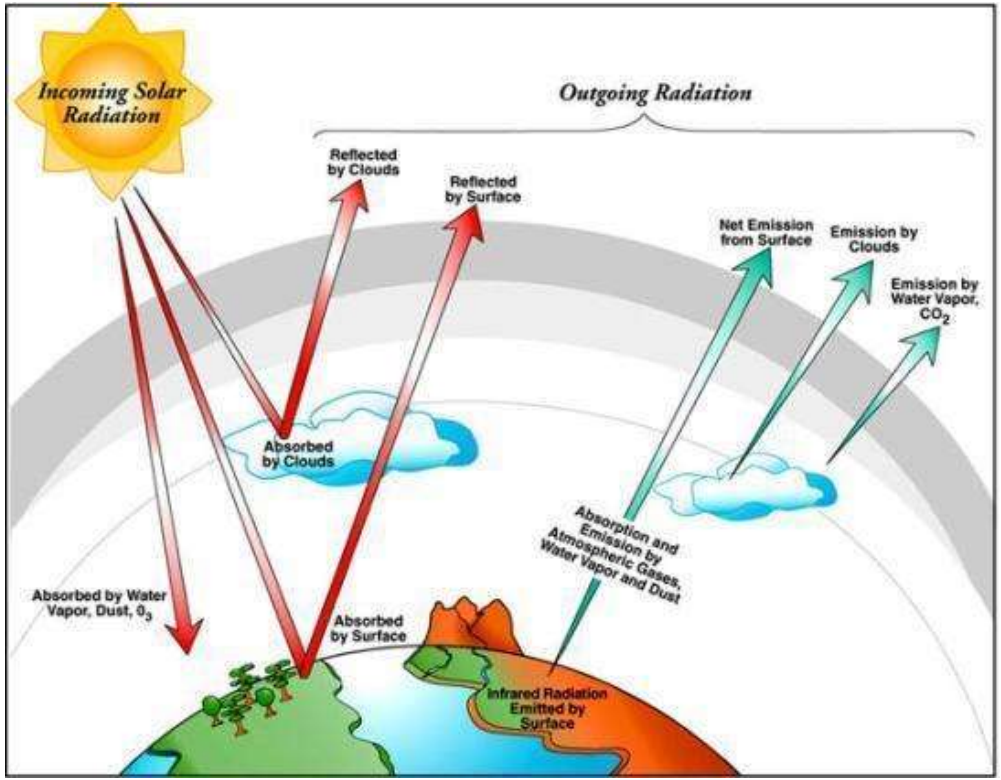
- The **Atmospheric Radiation Measurement (ARM)** User Facility is a U.S. Department of Energy Office of Science asset to be used by scientists to further our scientific knowledge about the atmosphere



Depiction of ARM mobile facility site and instrument range.

- The DOE ARM program has maintained facilities for use by the scientific community for 25 years
- Data is freely available at www.arm.gov

Objectives of the US DOE ARM Program



- *A national user facility for the US Department of Energy Office of Science*

ARM Science Objective

Provide a detailed and accurate description or the Earth's atmosphere to resolve uncertainties in earth system models

LANL Oversees ARM Mobile Facilities

ARM Mobile Facilities (AMF): These facilities are mobile observatories with state-of-the-art instruments and equipment for collecting data about the earth's atmosphere. The are moved to a new location about every year.

Containerized Instruments

Field Instruments

Equipment and Instruments

- ~ 8 Instrument containers
- Doppler radars
- Lidars
- 30’ Meteorological Tower
- Remote Sensing instruments

Construction

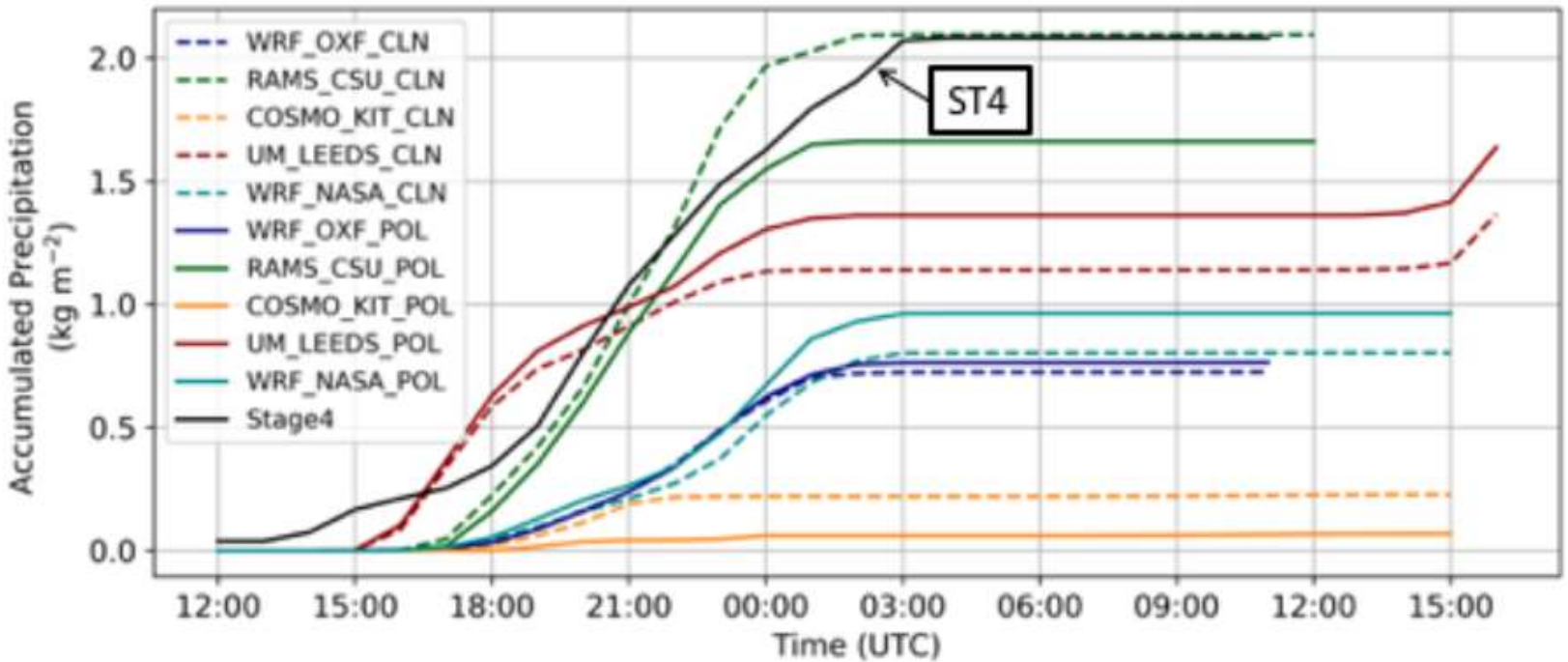
Construction

Operations: 24/7 Measurements for 1 Year

- 24/7 measurements (mostly automated)
- 3 Full time Technicians
- Balloon Launch personnel
- Weather Balloon Launches (4 to 12 per day)
- Maintain grounds
- Ship/receive equipment
- Low impact

TRACER: TRacking Aerosol Convection Interations Experiment

Simulations for rainfall over Houston



Courtesy van den Heever

- Comparison of accumulated precipitation
- Simulations for 19 June 2013 Houston, TX
- ST4 (black) is from NEXRAD observations

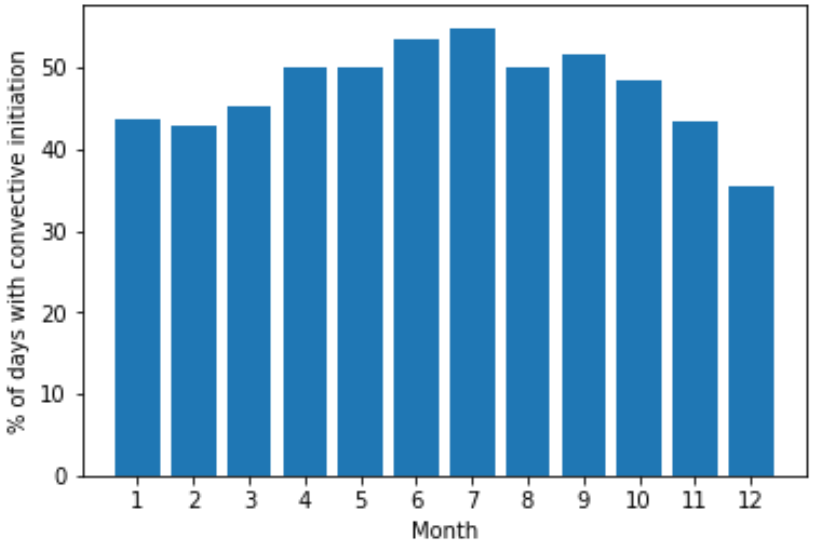
Scientific Interest

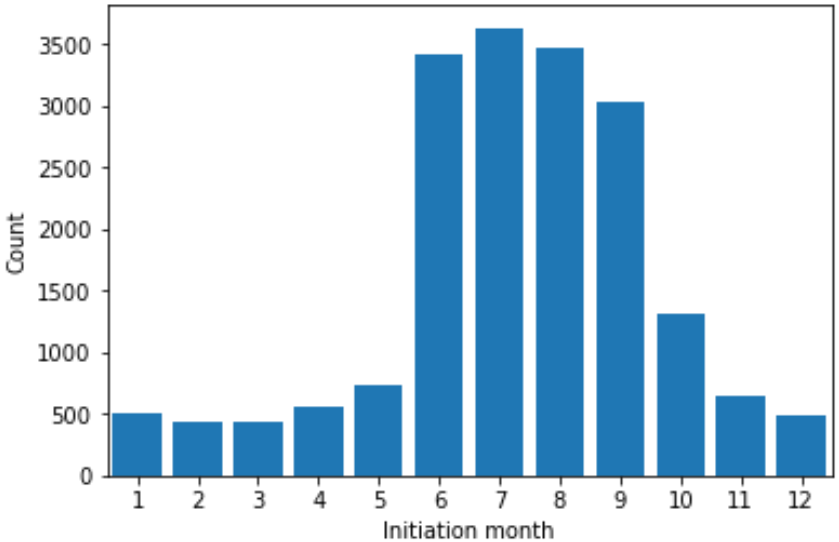
Simulations of convection and convective thunderstorms is difficult!

- We don’t have enough detailed measurements of specific processes to improve forecasting
- The Houston area experiences a lot of convection and has a lot of supporting measurements

Why Houston? Convective Clouds are Abundant

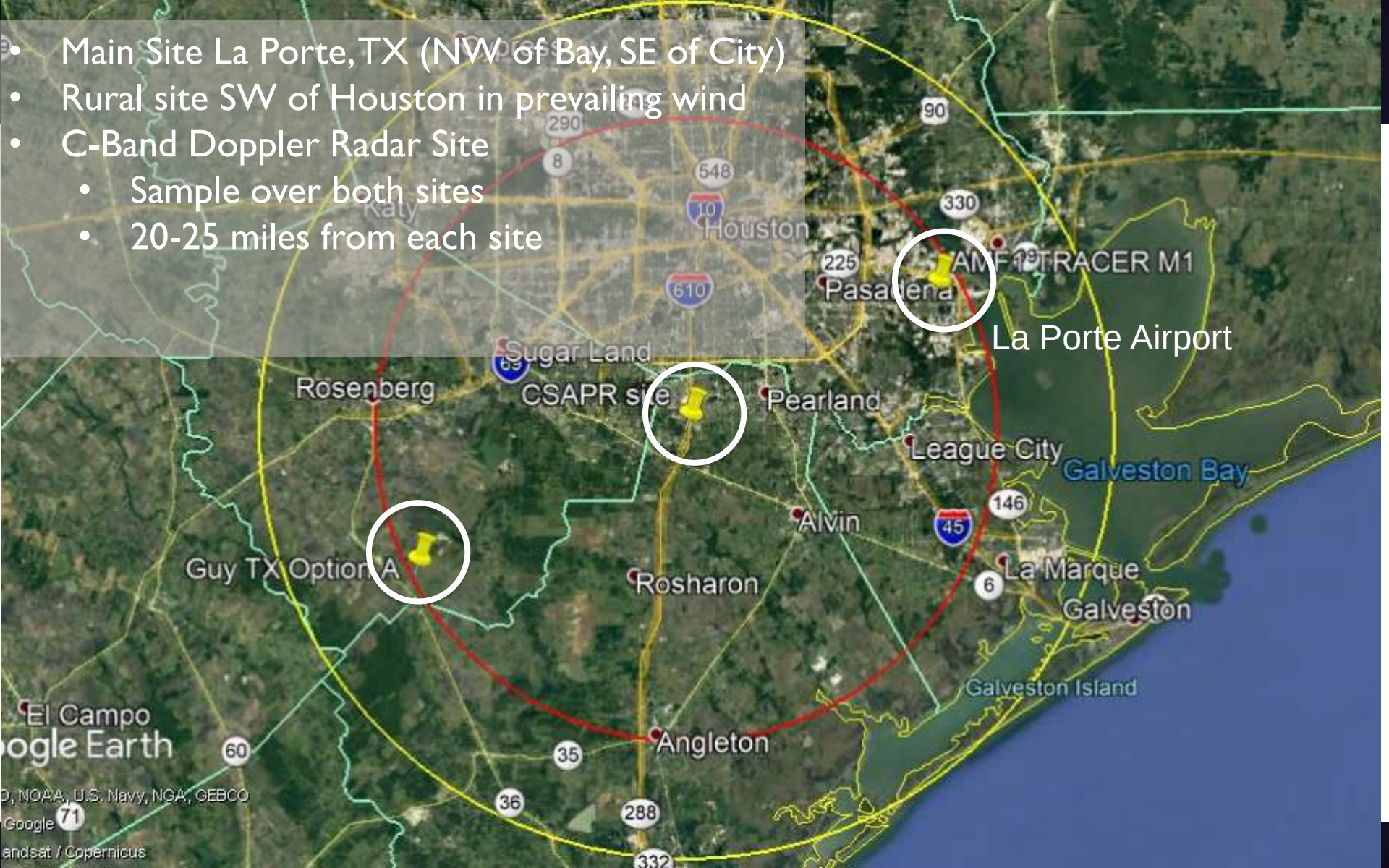
- 4 years of Houston/Galveston NEXRAD (KGHX) observations

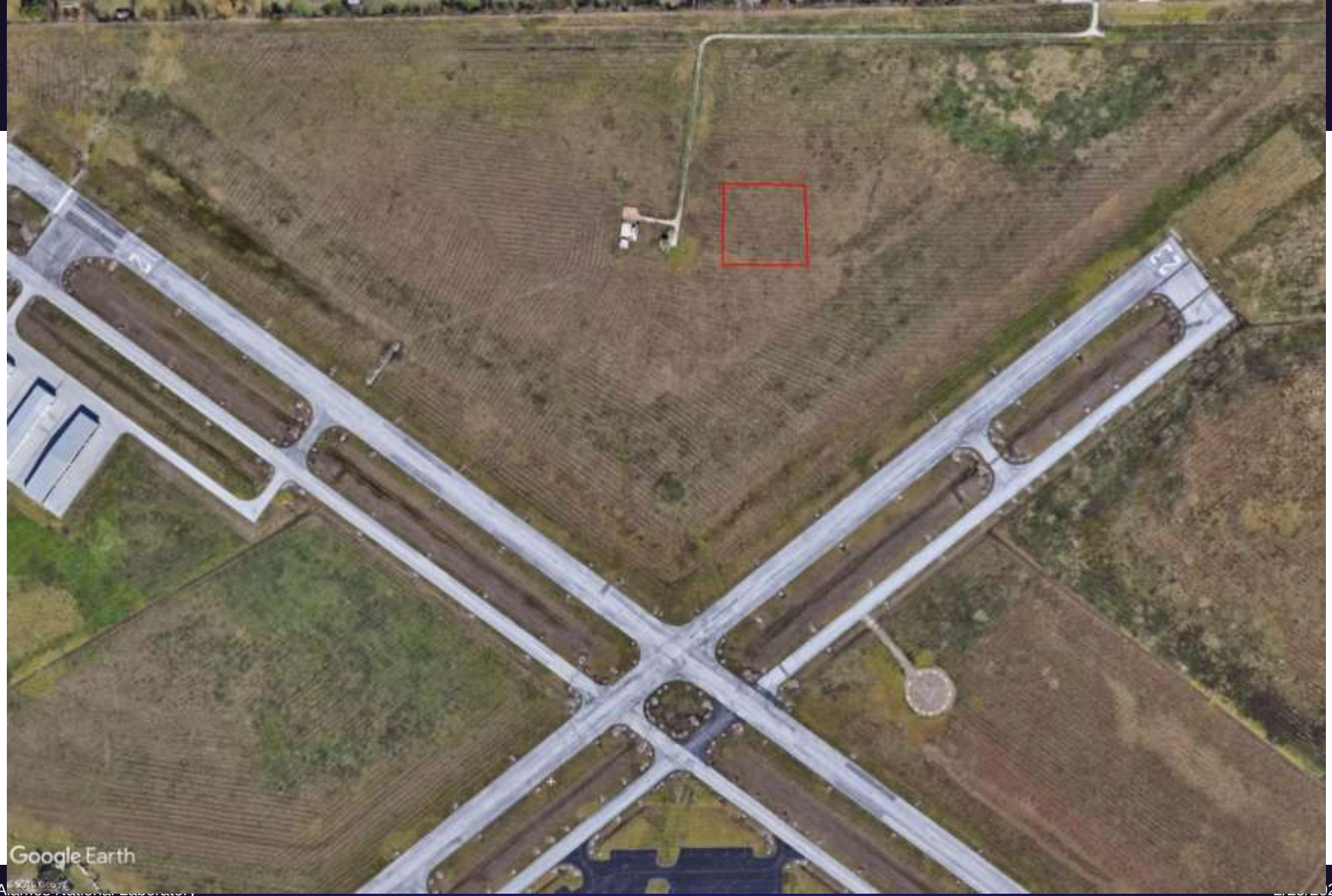




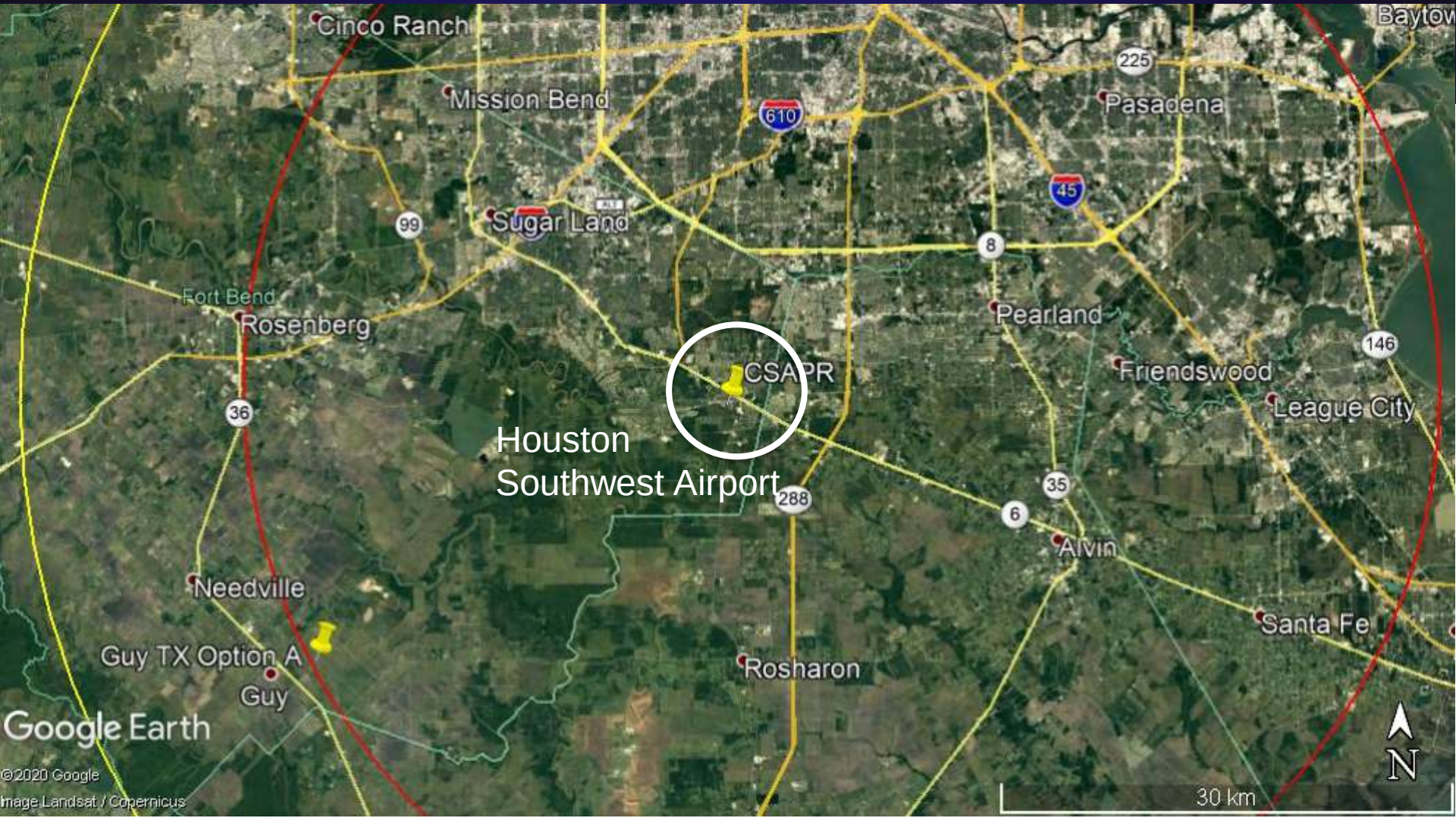
- (left) Percent of days/month where convection was observed
- Convection observed ~40-50% of days through entire year
- (right) total number of convective cells in NEXRAD domain
- Peak occurrence of convection occurs June-Sept (IOP)

- Main Site La Porte, TX (NW of Bay, SE of City)
- Rural site SW of Houston in prevailing wind
- C-Band Doppler Radar Site
  - Sample over both sites
  - 20-25 miles from each site




Google Earth

Parking Lot (Gravel)
Google Earth


Cinco Ranch
Mission Bend
610
225
Pasadena
45
Sugar Land
99
8
Fort Bend
Rosenberg
Pearland
146
CSAPR
Friendswood
League City
36
Houston
Southwest Airport
288
35
6
Alvin
Needville
Santa Fe
Guy TX Option A
Guy
Rosharon
Google Earth
©2020 Google
Image Landsat / Copernicus
N
30 km

CSAPR
N

C-Band Radar Site

2nd generation C-band Scanning ARM Precipitation Radar (CSAPR2)

- Provides polarimetric observations of convective clouds
- Implement focused-scanning cell tracking during IOP period

Estimated Schedule

- **October 2020:** Planning, Agreements, Permissions (NEPA, RF, FAA)
- **December 2020**: Have the details figured out
  - Access/security concerns addressed
  - Aircraft safety concerns addressed (mitigation plan for tall objects: 30' towers, Radars, Weather Balloon Ops)
  - Operations plan in place
- **January 2021:** Construction Work
  - Ground work begins: build a pad, improve road, install drainage.
  - Improve/install utility power, internet
- **February 2021:** Installation
  - Bring in containers
  - Crane on site for 1 week
  - Installation crew: ~15 – 20 people

Estimated Schedule (Continued)

- **March 2021:** Begin operations
  - 3 site technicians
  - weather balloon training
- **April 2021:** Official measurements begin
  - 3 site technicians + 6 balloon launch personnel
- **June – September 2021:** Intensive Operations Period (IOP)
  - Convective thunderstorm season – lots of measurements
  - Probably extra people
  - Extra balloon launches (up to 12 per day)
  - Maybe NASA research aircraft or other aircraft
- **April 15 2022:** End of measurements. Begin pack up
- **June 2022:** Site remediated, everything is back to normal!

Field Instrument Deployments & Operations

Los Alamos NATIONAL LABORATORY EST. 1943

ARM