



Applications of the U.S. Continuously Operating Reference Station (CORS) System



Richard Snay & Giovanni Sella
NOAA's National Geodetic Survey

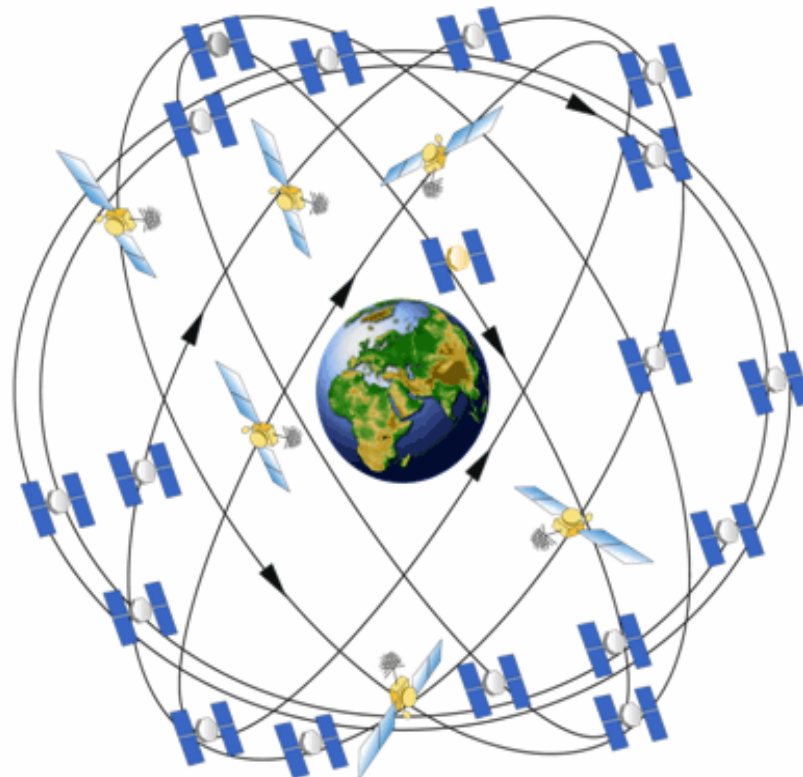
International CGSIC Meeting
Toulouse, France
April 2008



The Global Positioning System (GPS)



Unaugmented GPS enables positioning with accuracies ranging from 1 to 10 meters.

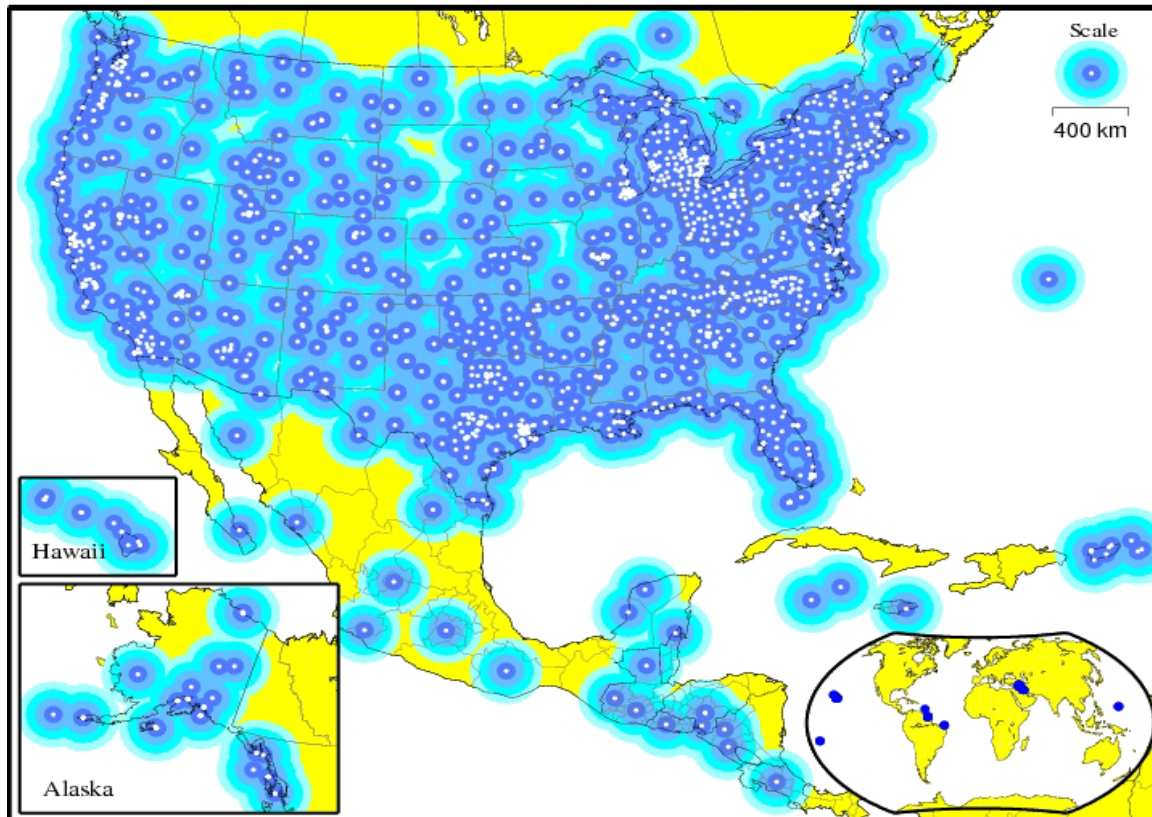




Continuously Operating Reference Stations (CORS)



*The CORS network enables **differential** GPS positioning with accuracies from 1 to 10 centimeters, or better.*





Sample CORS Sites





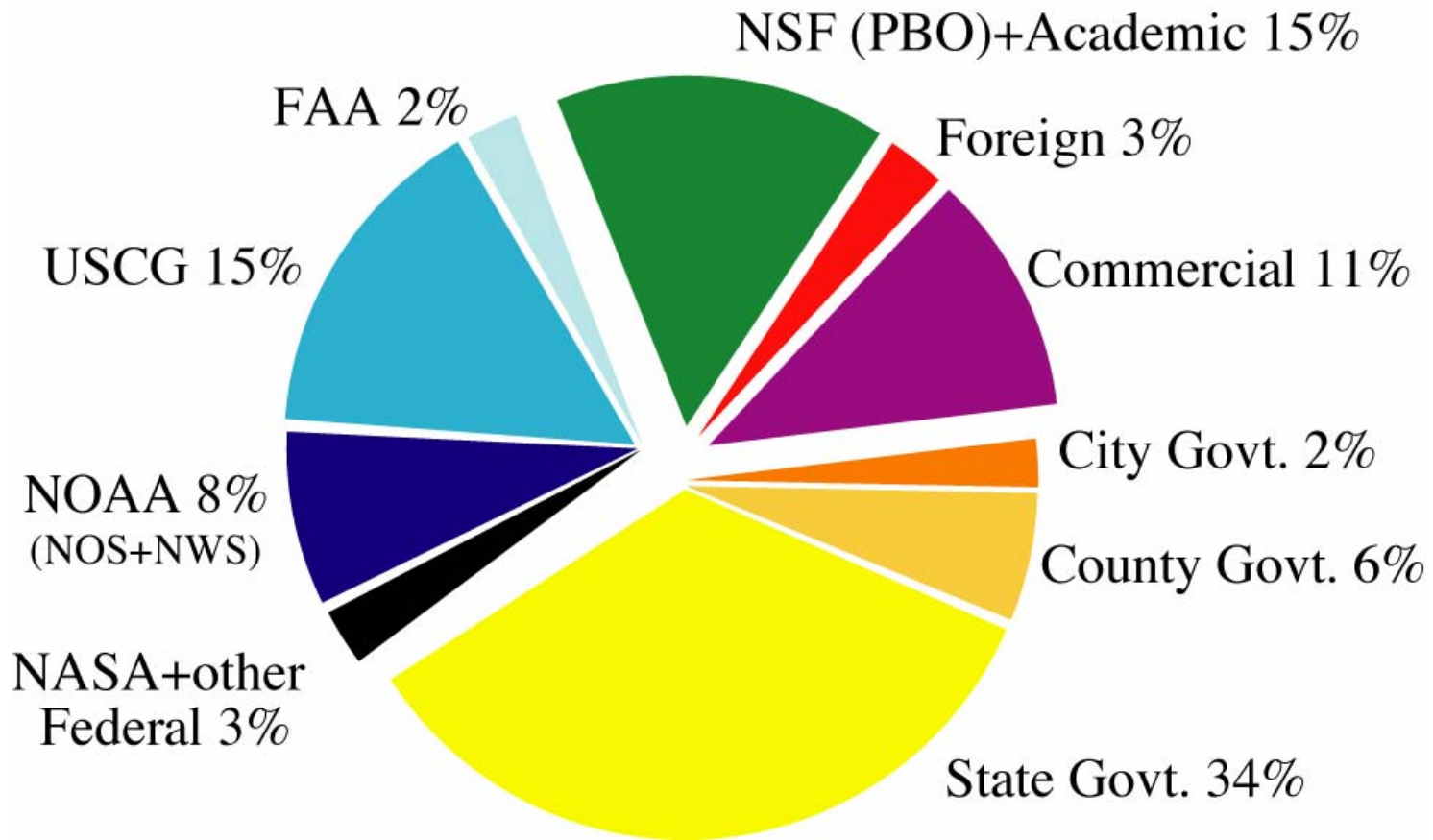
CORS Information



- CORS network contains over 1,300 stations as of April 2008.
- Growing at rate of about 200 stations per year.
- Each station collects GPS signals, and NOAA makes these data freely available to the public via the Internet for **post-processing applications**.
- More than 200 organizations participate in the CORS program by sponsoring and operating one or more stations.



CORS Partners





Access to CORS Data



In Silver Spring, Maryland (CORS-East)

- Anonymous File Transfer Protocol (FTP)
<ftp://cors.ngs.noaa.gov>
- UFCORS - User Friendly CORS
<http://www.ngs.noaa.gov/UFCORS>

In Boulder Colorado (CORS-West)

- Parallel and independent data collection and on-line storage at NOAA's National Geophysical Data Center
Anonymous FTP <ftp://wwwest.ngs.noaa.gov>



CORS Supports Precise Positioning



Before CORS: Accurate differential GPS positioning with multi-person field crew.



After CORS: Accurate differential GPS positioning with one-person field crew.



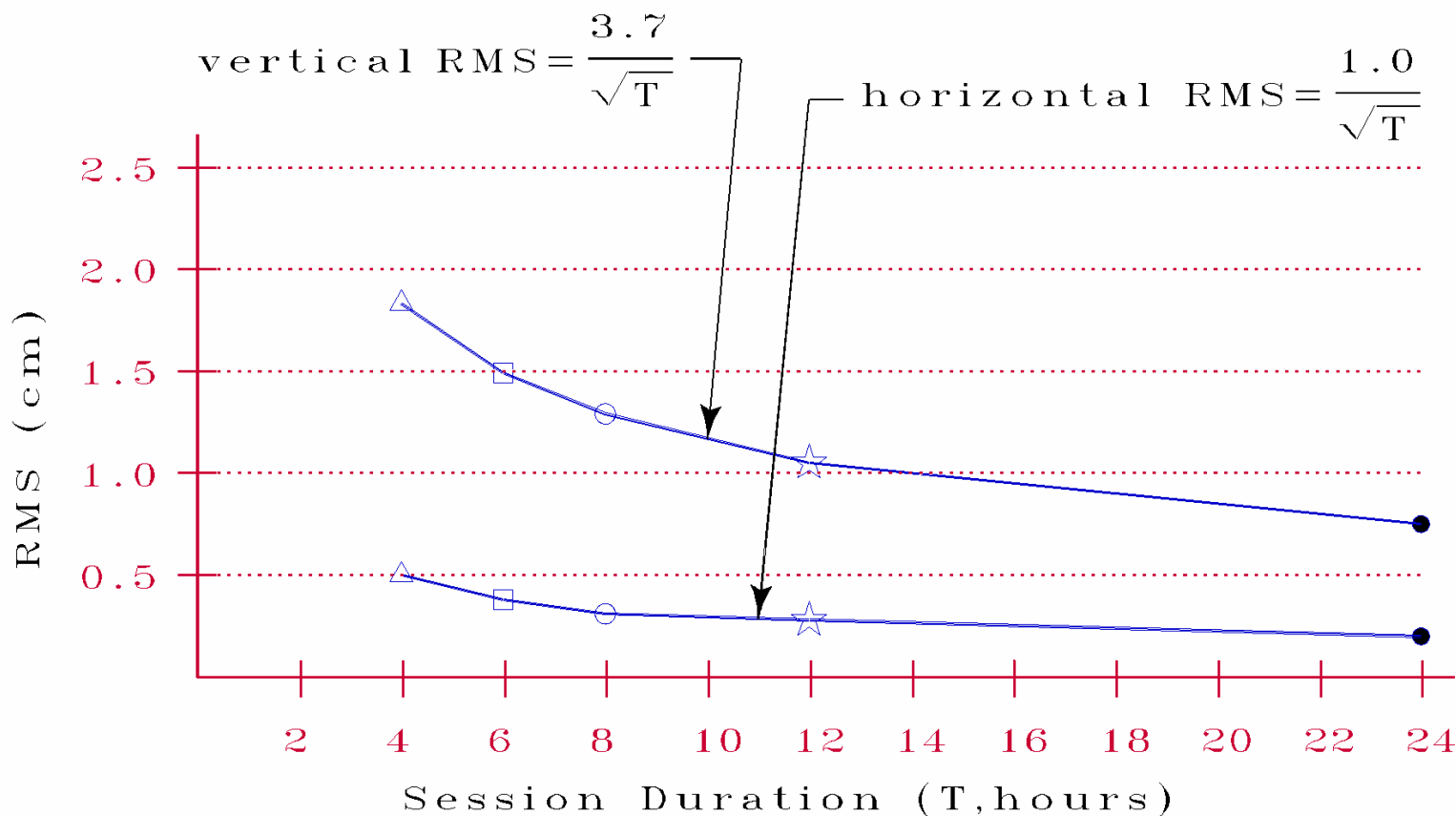
Online Positioning User Service (OPUS)



- Collect at least 15 minutes of dual-frequency GPS data
- Submit data to www.ngs.noaa.gov/OPUS/
- Data are processed automatically using NOAA computers & software
- Corresponding positional coordinates computed with respect to 3 suitable CORS or IGS sites
- Computed coordinates returned via email (usually in minutes)

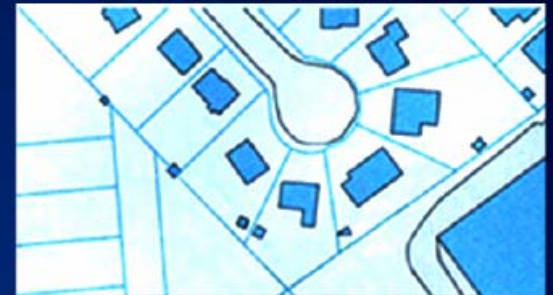


Positioning Error vs. Duration of the Observing Session



Geographic Information Systems (GIS)

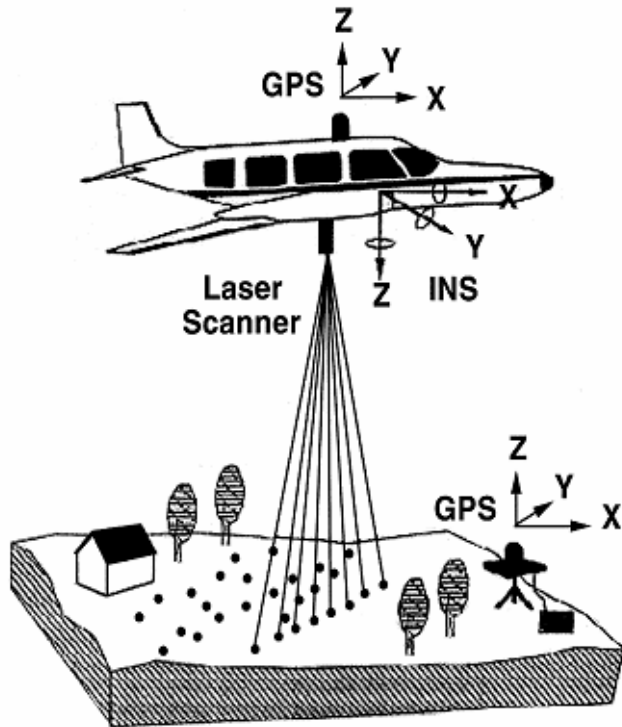
Wards and Precincts
Demographics
Structures
Water Utilities
Sewerage
Electrical Utilities
Roads
Boundaries
Land Use
Hydrology
Soils
Topography



CORS enables sub-meter differential positioning with less than a minute of GPS data

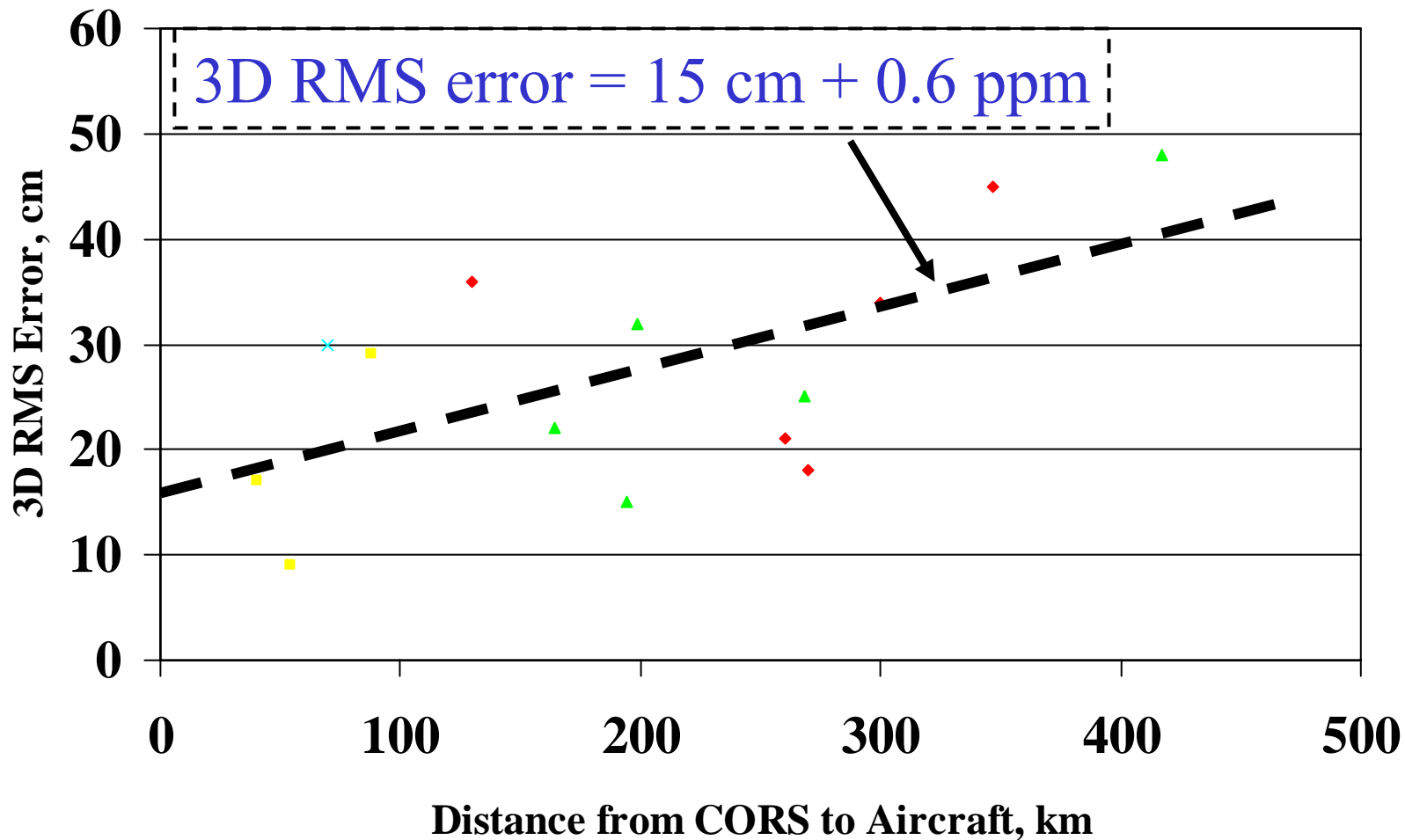


CORS Enables Users to Determine the Travel Path of a Moving Platform



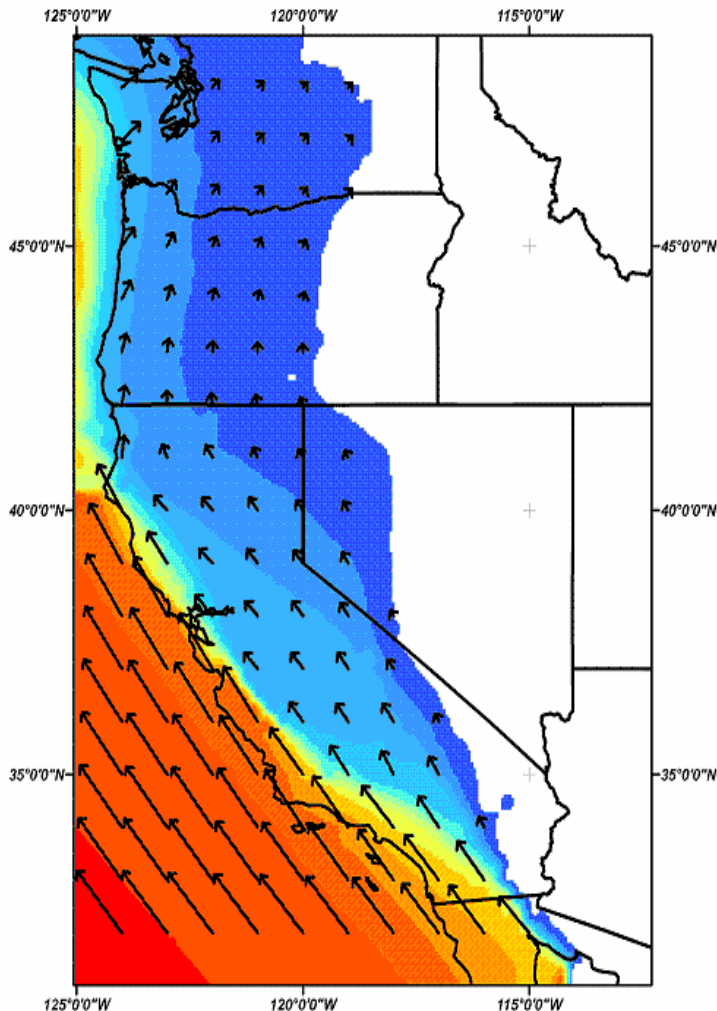


Aircraft Positioning with CORS



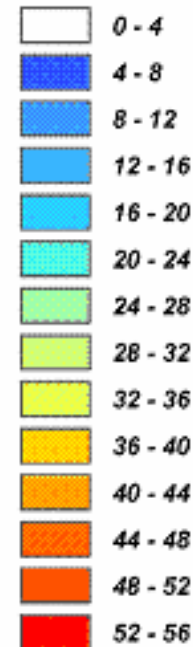


CORS for Monitoring Horizontal Crustal Motion

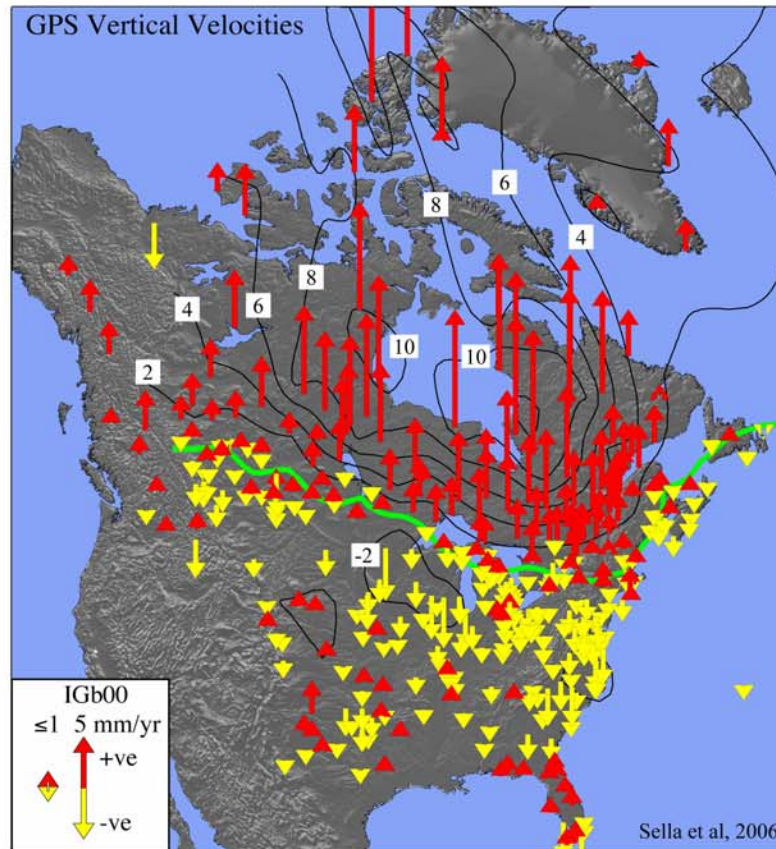


Horizontal velocities in the western U.S. relative to the North American Datum of 1983 as derived from geodetic observations.

Horizontal Velocities in mm/yr



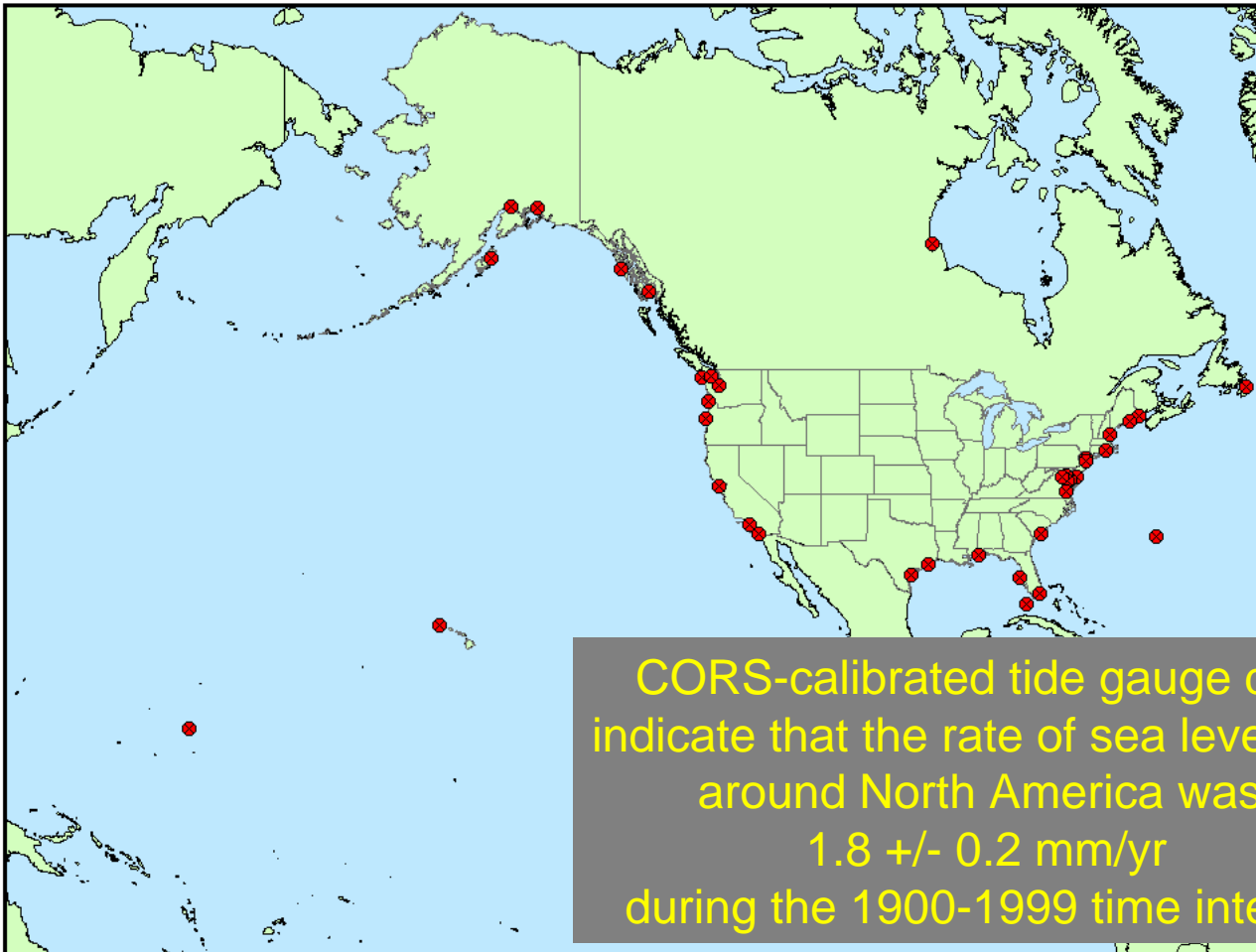
CORS for Monitoring Vertical Crustal Motion



Vertical velocities associated with Glacial Isostatic Adjustment



Tide Gauges Located Near a CORS Whose Vertical Crustal Velocity Has Been Accurately Determined

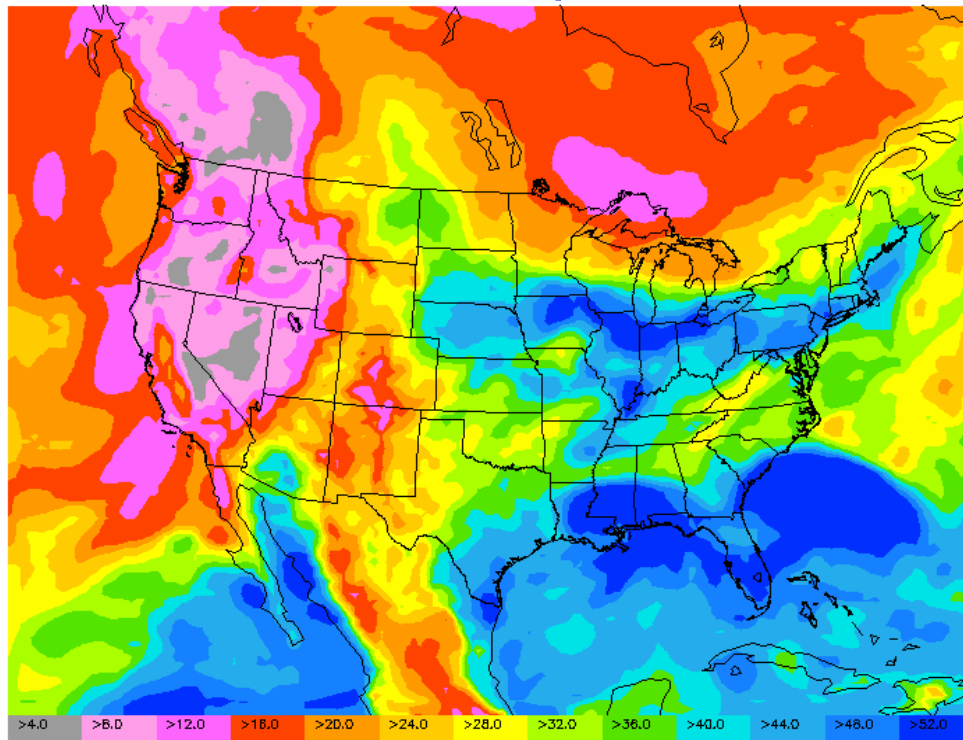




CORS for Monitoring Precipitable Water Vapor



NOAA's Earth Systems Research Laboratory uses CORS data to produce nowcasts of precipitable water vapor, once every 30 minutes.



Precipitable water (mm)

Analysis valid 05-Aug-02 16:00Z

Transitioning to operational status starting in 2010.

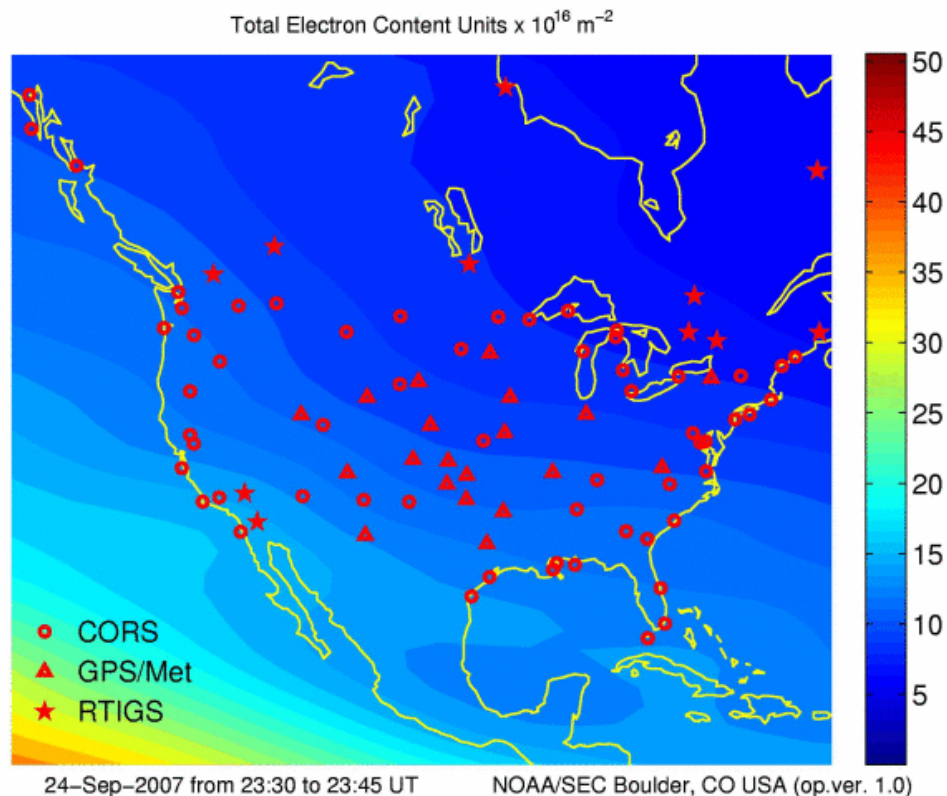
NOAA will seek to install “robust” CORS on Caribbean islands and on oil platforms in the Gulf of Mexico to better anticipate the effect of an active hurricane or tropical storm.



CORS for Monitoring Space Weather



NOAA's Space Weather Prediction Center uses CORS data to map the distribution of free electrons in the ionosphere, once every 15 minutes.



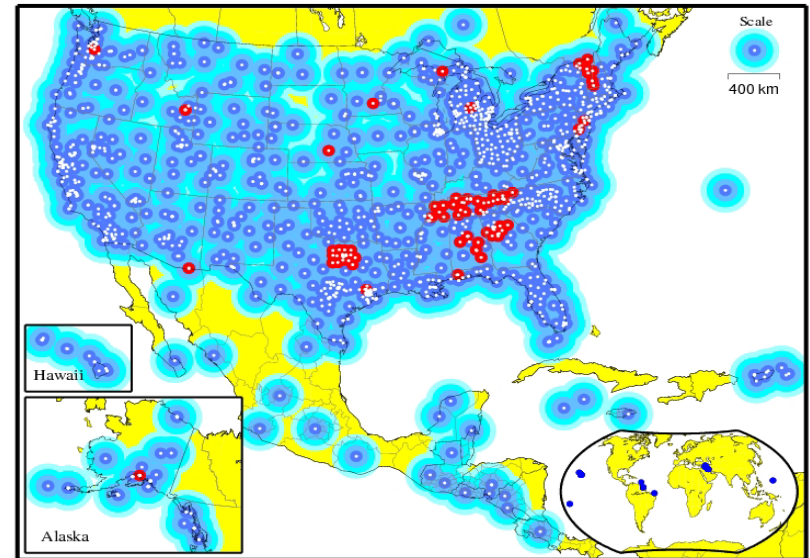


Just Around the Corner



Starting later in 2008, the CORS system will:

- Provide GPS L2C data
- Provide GLONASS data
- Broadcast GNSS data via the Internet in real-time (on an experimental basis). (For selected sites only.)



Red dots identify locations of CORS sites that collect both GPS and GLONASS data.