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

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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 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.
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://wwwwest.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

\[ \text{vertical RMS} = \frac{3.7}{\sqrt{T}} \]

\[ \text{horizontal RMS} = \frac{1.0}{\sqrt{T}} \]
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

3D RMS error = 15 cm + 0.6 ppm
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.
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-calibrated tide gauge data indicate that the rate of sea level rise around North America was 1.8 +/- 0.2 mm/yr during the 1900-1999 time interval.
NOAA’s Earth Systems Research Laboratory uses CORS data to produce nowcasts of precipitable water vapor, once every 30 minutes.

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.
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.