NATIONAL GEODETIC SURVEY

Gravity Lidar Study for 2006: Analysis of EGM's

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Towards a Continental Geoid Model and Vertical Datum
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Abstract

- Aerogravity and lidar data were collected in the littoral and onshore regions of the Florida panhandle, Alabama, Mississippi, and Louisiana as the second part of a three year study. These data were collected principally in 41 lines oriented north-south spaced at 10 km and collected at 35000 ft (greater than 10 km to mitigate aliasing). Individual lines were 500 km long, hence the full extent of the region is 400 km by 500 km. Weather conditions were fair throughout the survey, consequently most of the signal was retained along the profiles.
- These data will be used to test for long wavelength trends and biases in Earth Gravity Models derived from the GRACE gravity mission. These data provide sufficient coverage to analyze the gravity field to degree and order 100, which should be sufficient for analyzing the GRACE contribution. Additionally, they will be used to detect local systematic problems of existing surface gravity data both onshore and offshore. In last year's study, inaccurate shipborne gravity data were determined to have had decimeter impact on the coastal geoid accuracy.
- The lidar data are not expected to be ready by the time of the meeting, however, they are intended to be combined with available high-accuracy tidal models to validate the absolute accuracy of the derived gravimetric geoid for this region.

Background

- Second year of three year study of Gulf of Mexico
- Funded & flown by NOAA using NRL's gravity meter and NASA's LVIS lidar
- Collects aerogravity starting above stable onshore areas to deep offshore areas established by altimetry
- Detects systematic errors in ship and terrestrial data
- For southern Louisiana subsidence region, may be used to estimate effects of listric faulting (slumping)
- Lidar will be used in conjunction with hyper-accurate regional tide models to check geoid and MDT models

Equipment

- Aircraft: Cessna Citation II
  - NOAA AOC provided flight hours/crew
  - Dual GPS antennas and receivers
  - Independent antenna/receiver for each meter
- Lacoste-Romberg Air-Sea Gravimeter II
  - Naval Research Lab equipment/personnel
  - First Applanix POSAV mounted to collect INS
- Laser-Vegetation Imaging Sensor (LVIS)
  - NASA Remote Sensing Lab equipment/personnel
  - Second Applanix POSAV mounted to collect INS

Data Collection Parameters

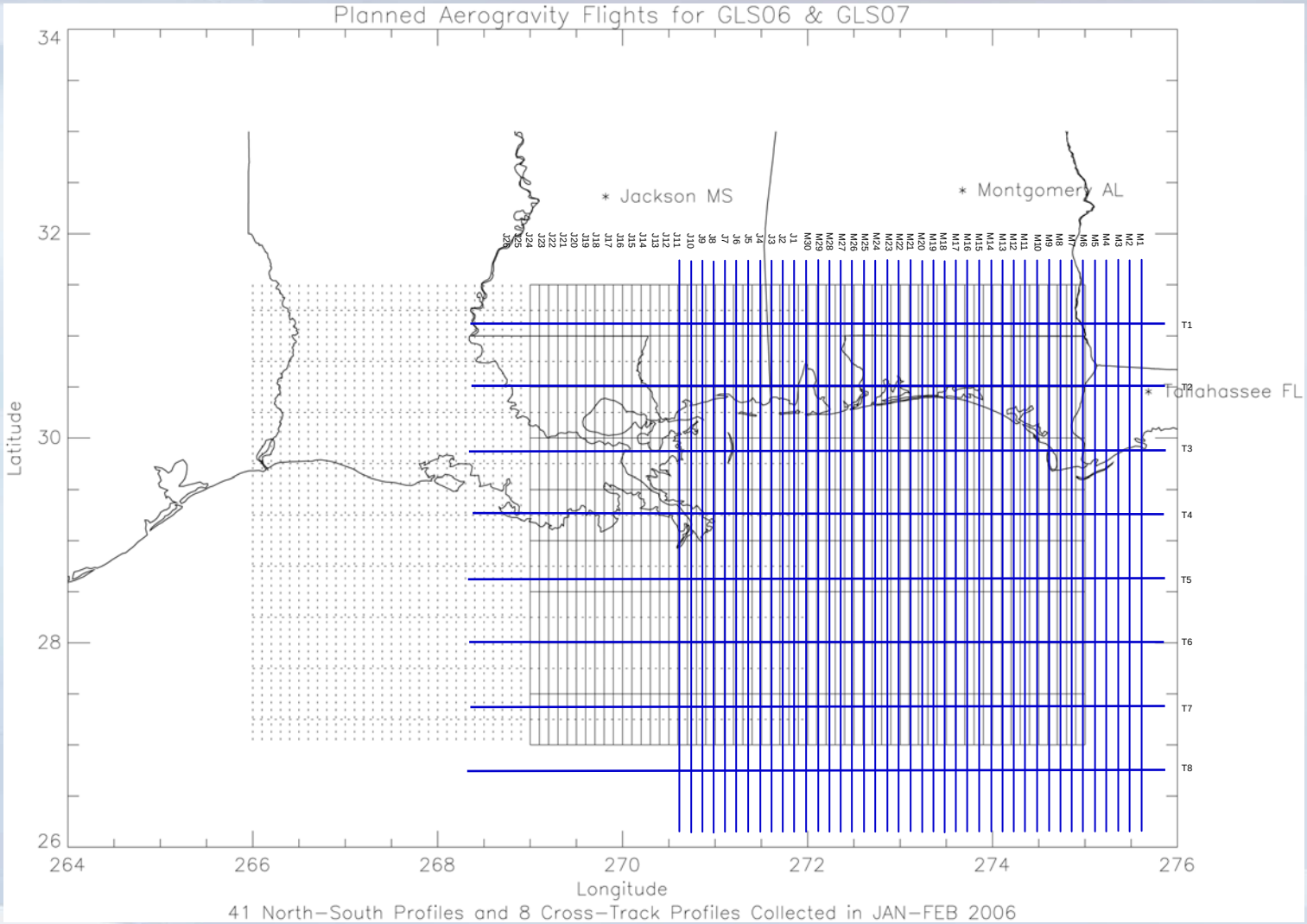
- Tracks should resolve gravity/geoid field to 20 km
  - Flights are at 35000 ft (10+ km) elevation
  - Track spacing is 10 km perpendicular to shoreline
    - Provides most of the signal
    - Avoids spectral aliasing
  - Cross-tracks at ~50 km parallel to shoreline
- Speed over Ground is around 280 kts (500 kmh)
  - Along track filtering is expected to yield 20 km
  - Flight legs expected to be between 1-2 hours

Data Collection Process

- Flight departures based on predicted PDOP spikes in GPS satellites and availability of restricted airspace
- One hour prior to take off
  - prep ground GPS stations (replace batteries, etc.)
  - Spin up gravity meter/calibrate
  - Predetermine Eotvos correction for inflight
  - Load memory cards
- During flight:
  - Calibrate LVIS in clear skies over open ocean
  - Minimize bank in turns for both meters

Data Collection Process (cont.)

- Principal flight legs are 500 km long at 500 kmh
  - Take-off, line up for first run, fly one hour
  - Easy turn (Williamson) to minimize banking
  - One hour back up return leg then land
  - Most flights in around the three hour mark
- While on ground for about an hour
  - Swap out batteries/memory cards
  - Keep GPS on! Both onboard and ground stations
  - Helps to calibrate the antennas later
- If time, weather, and airspace access permit – do it again



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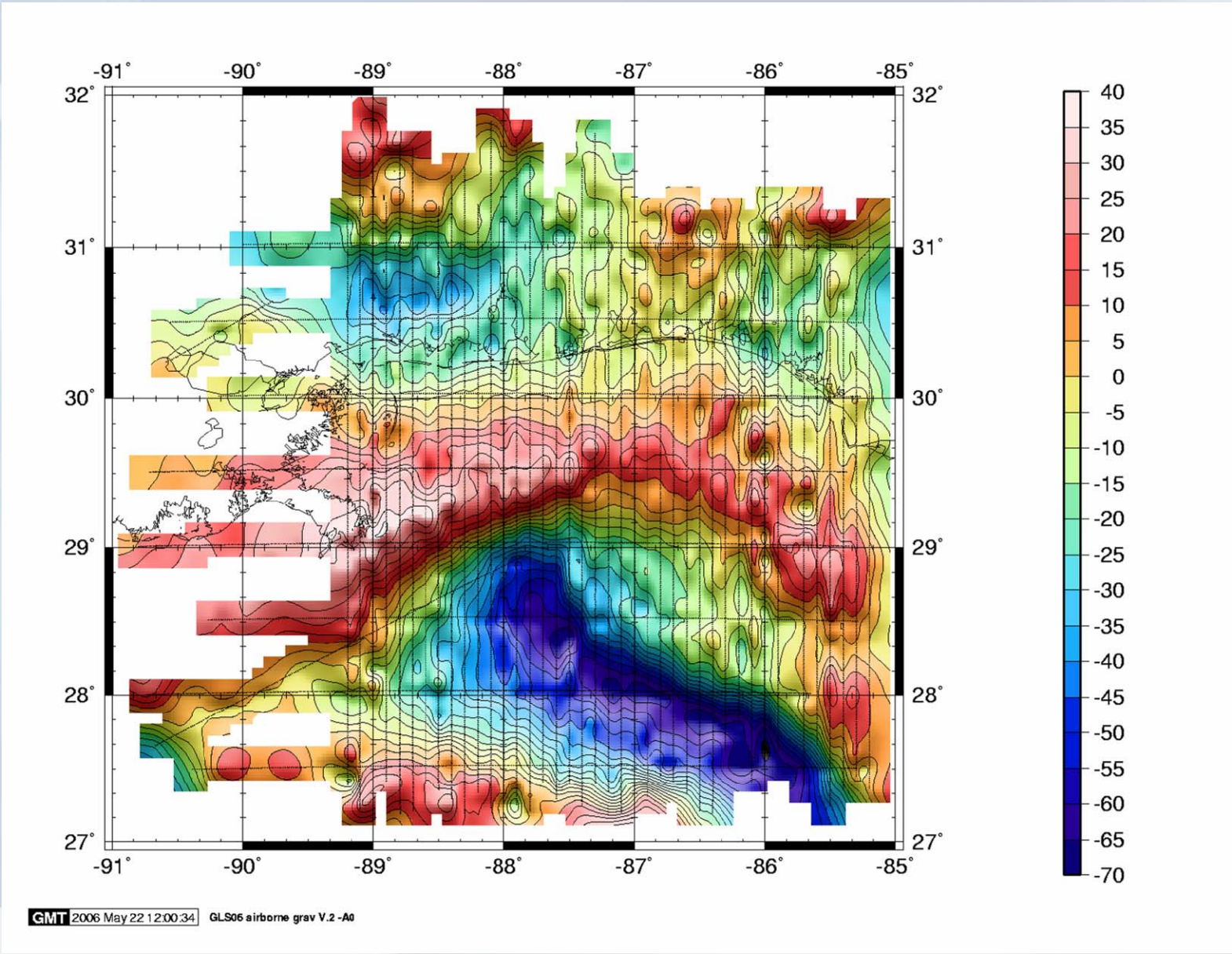

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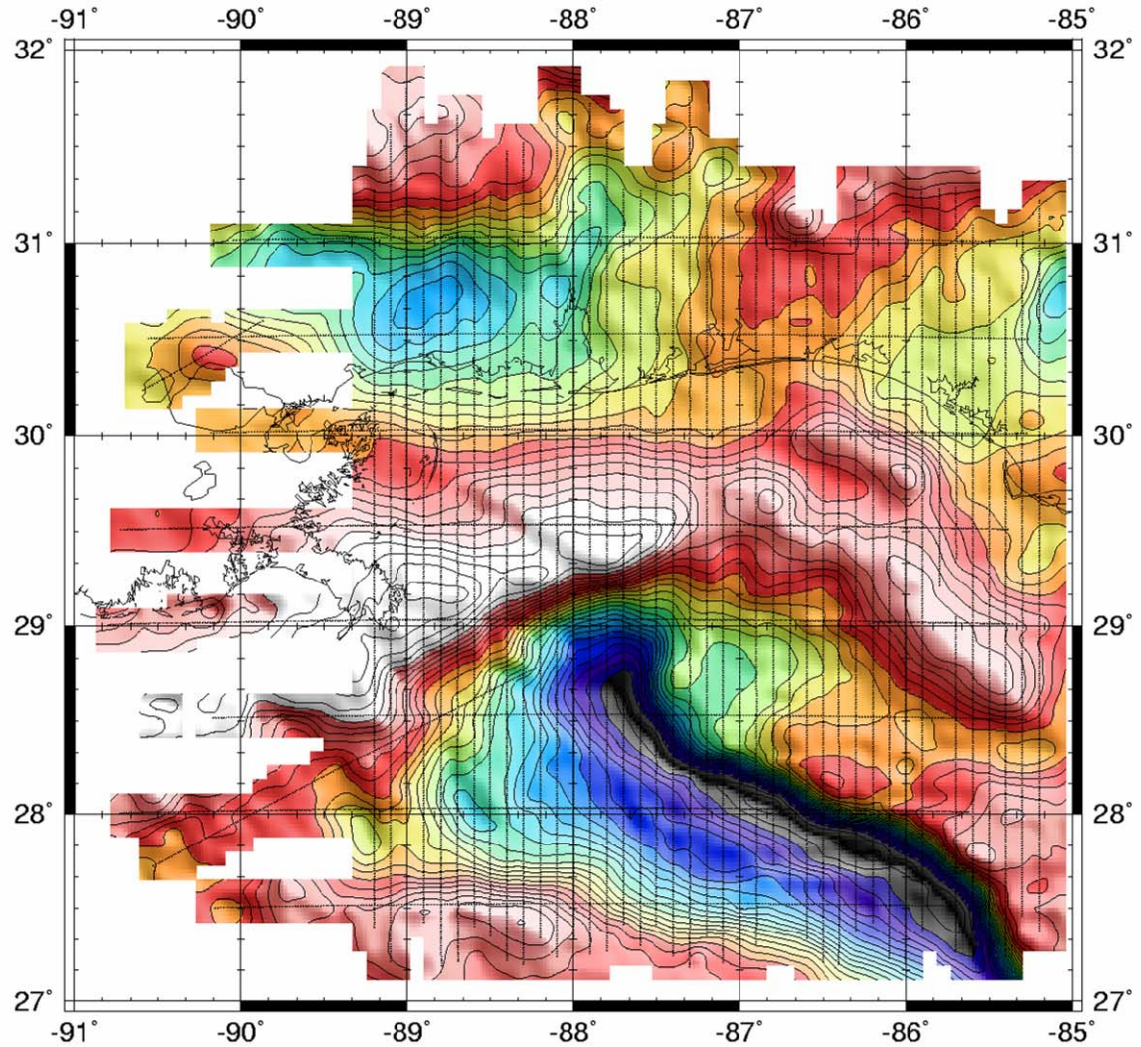

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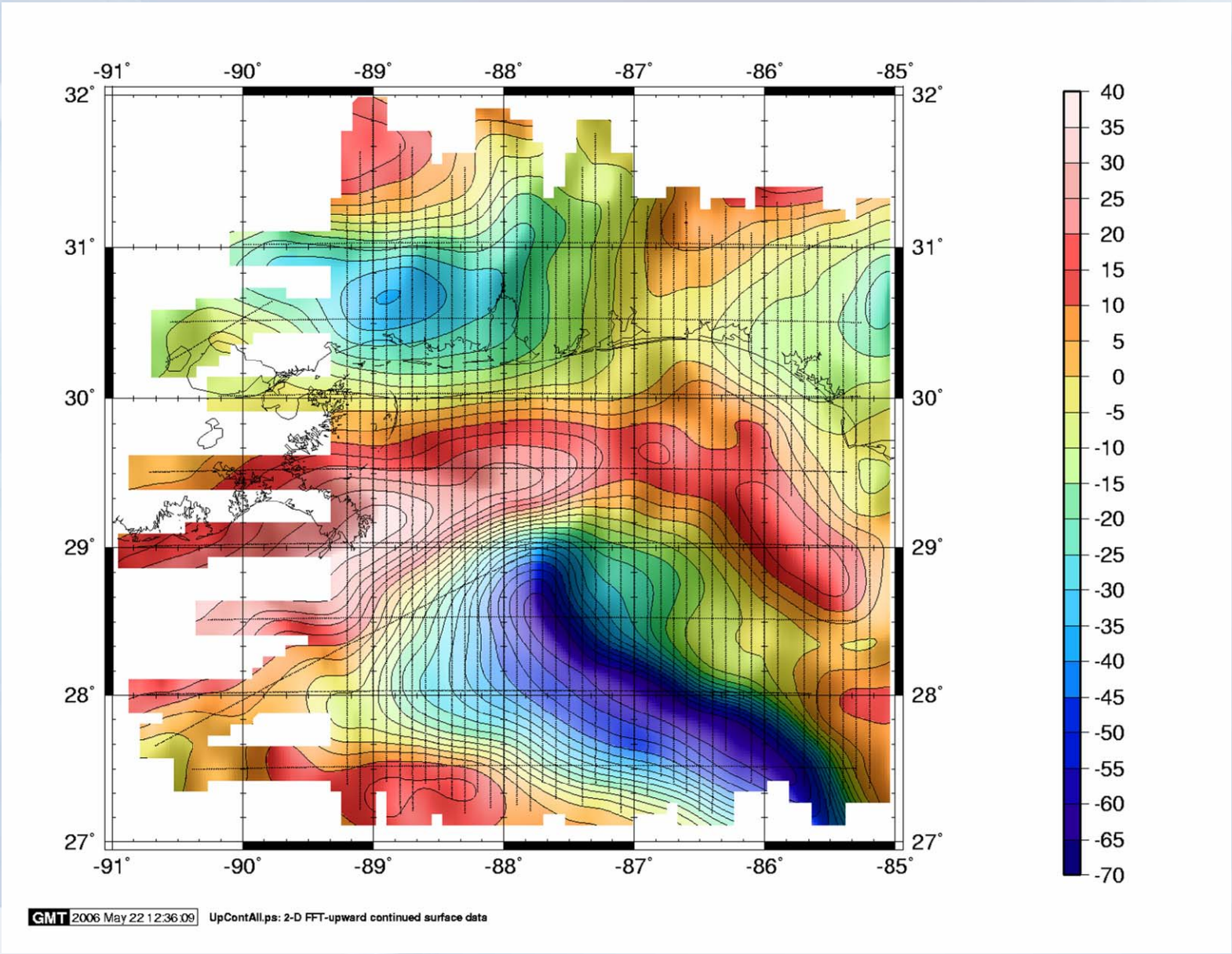
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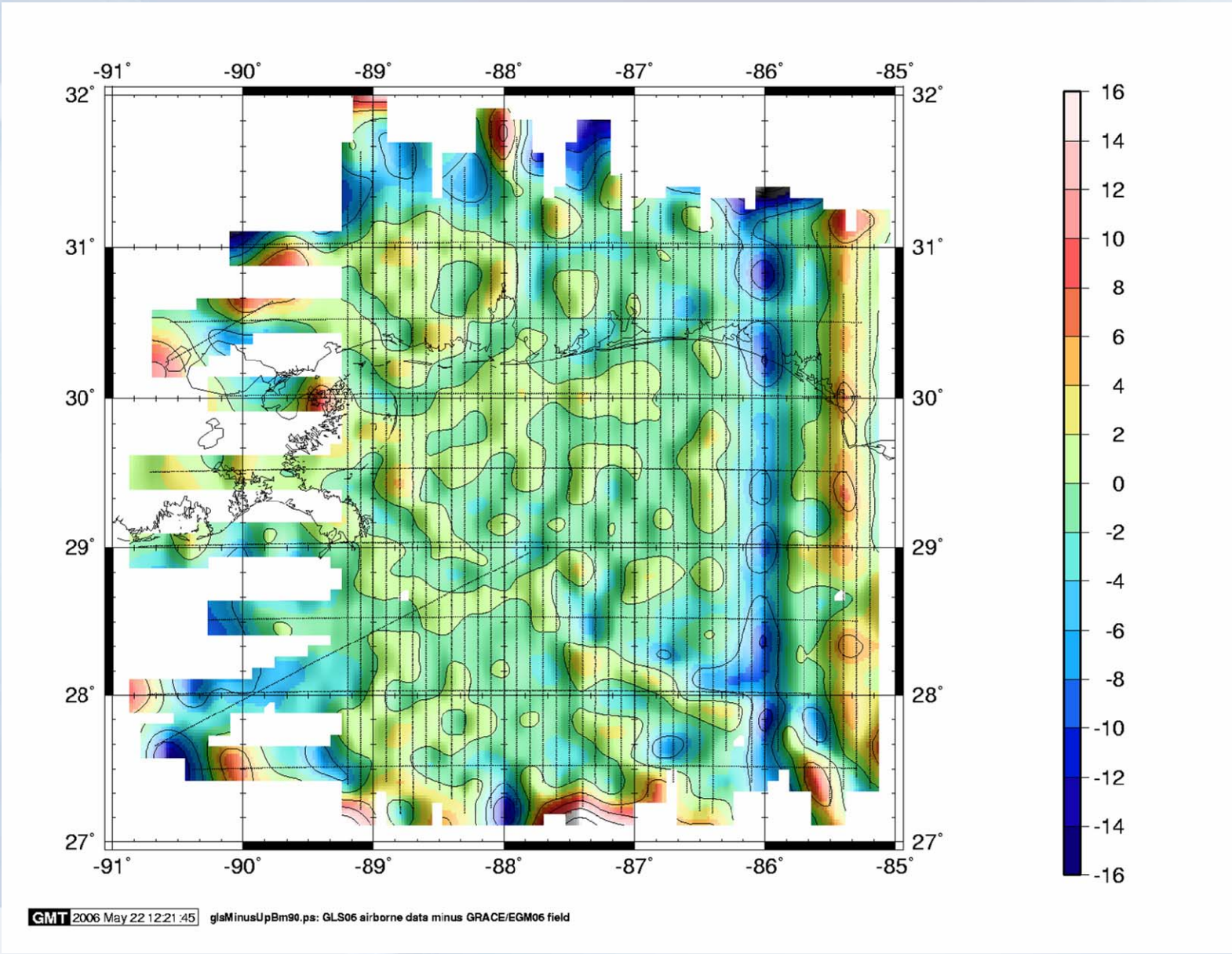

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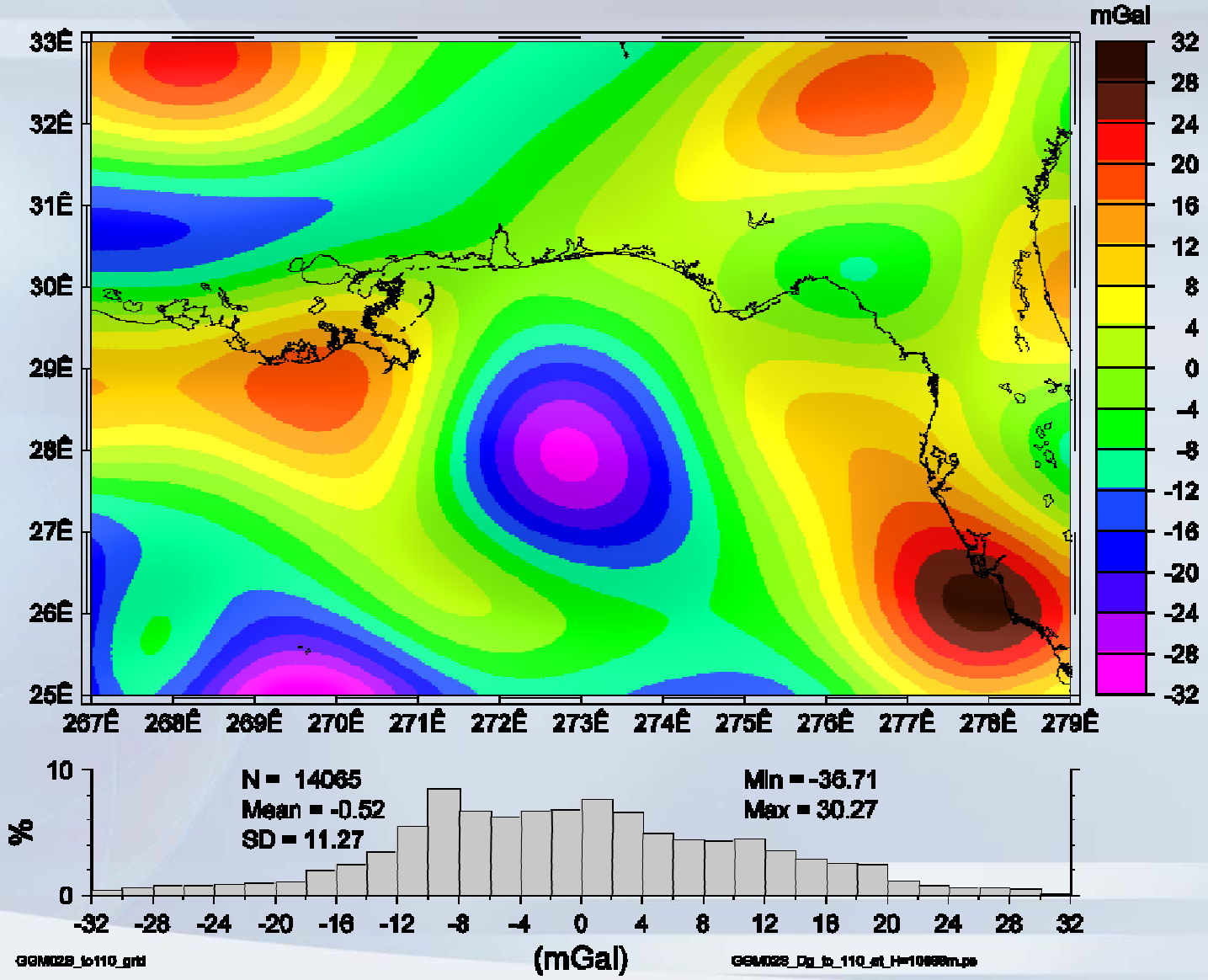
GGM02S Gravity Anomalies to N = 110 At Elevation = 10668m



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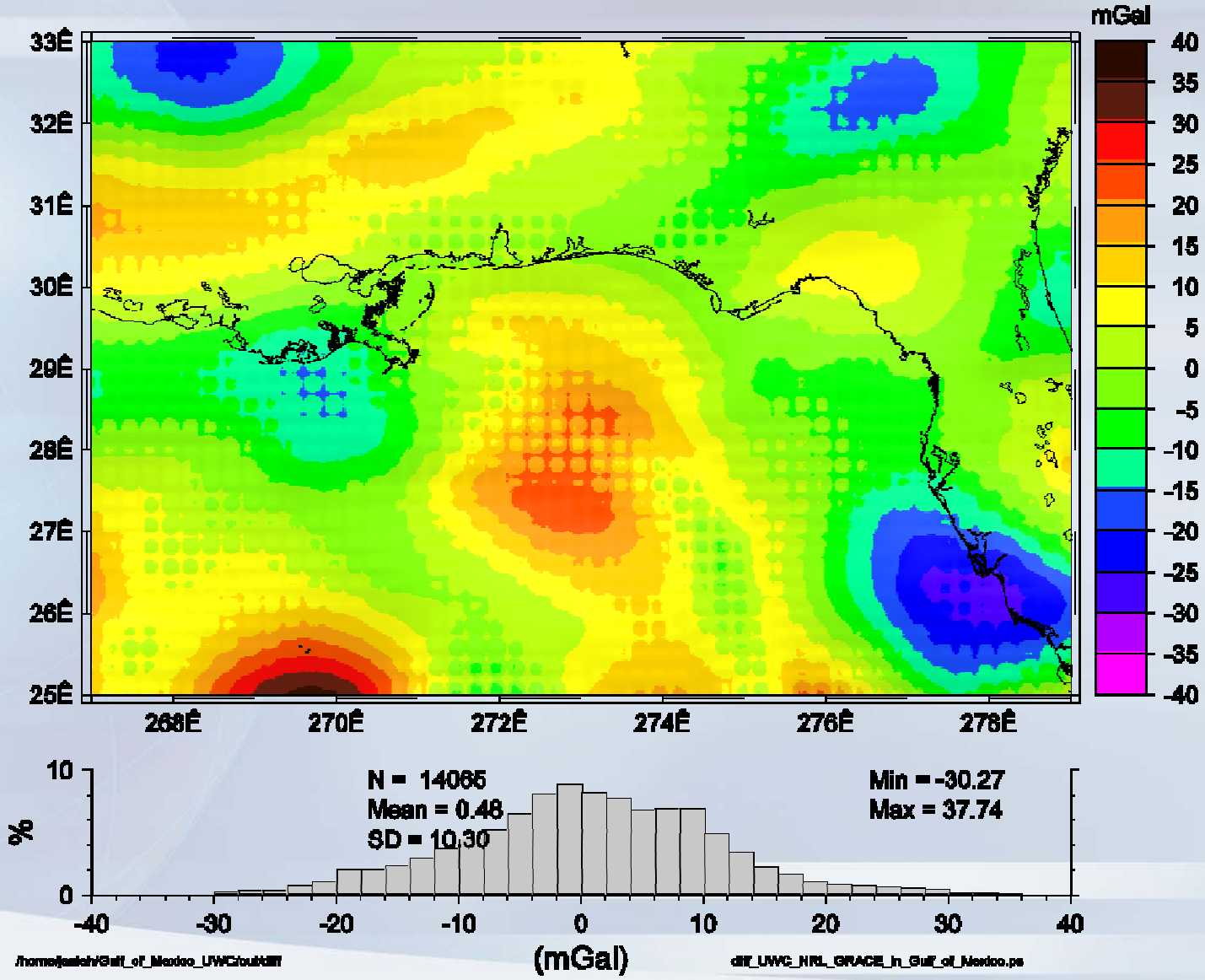
Diff UWC NRL Dg - GRACE Dg Over the Gulf of Mexico



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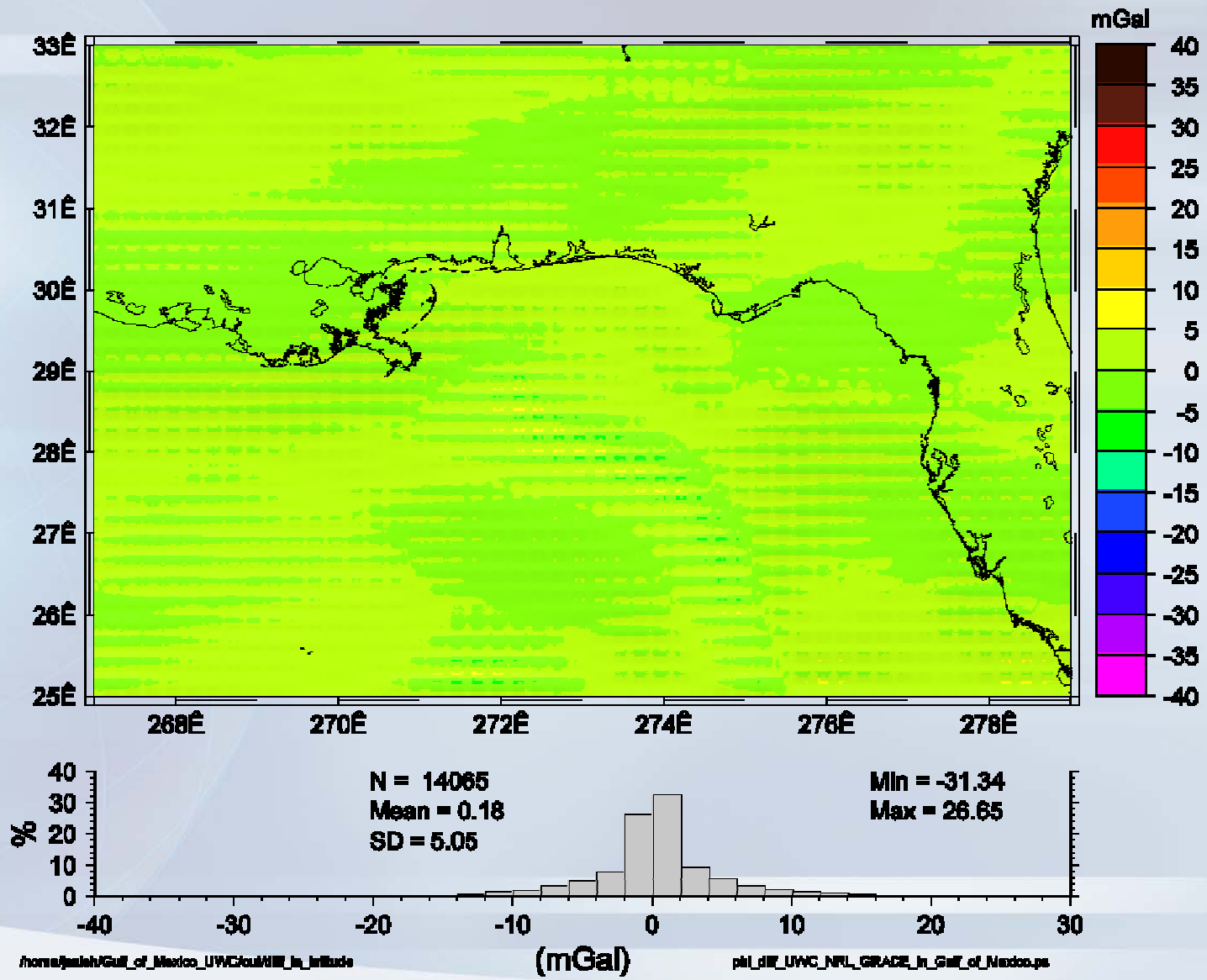

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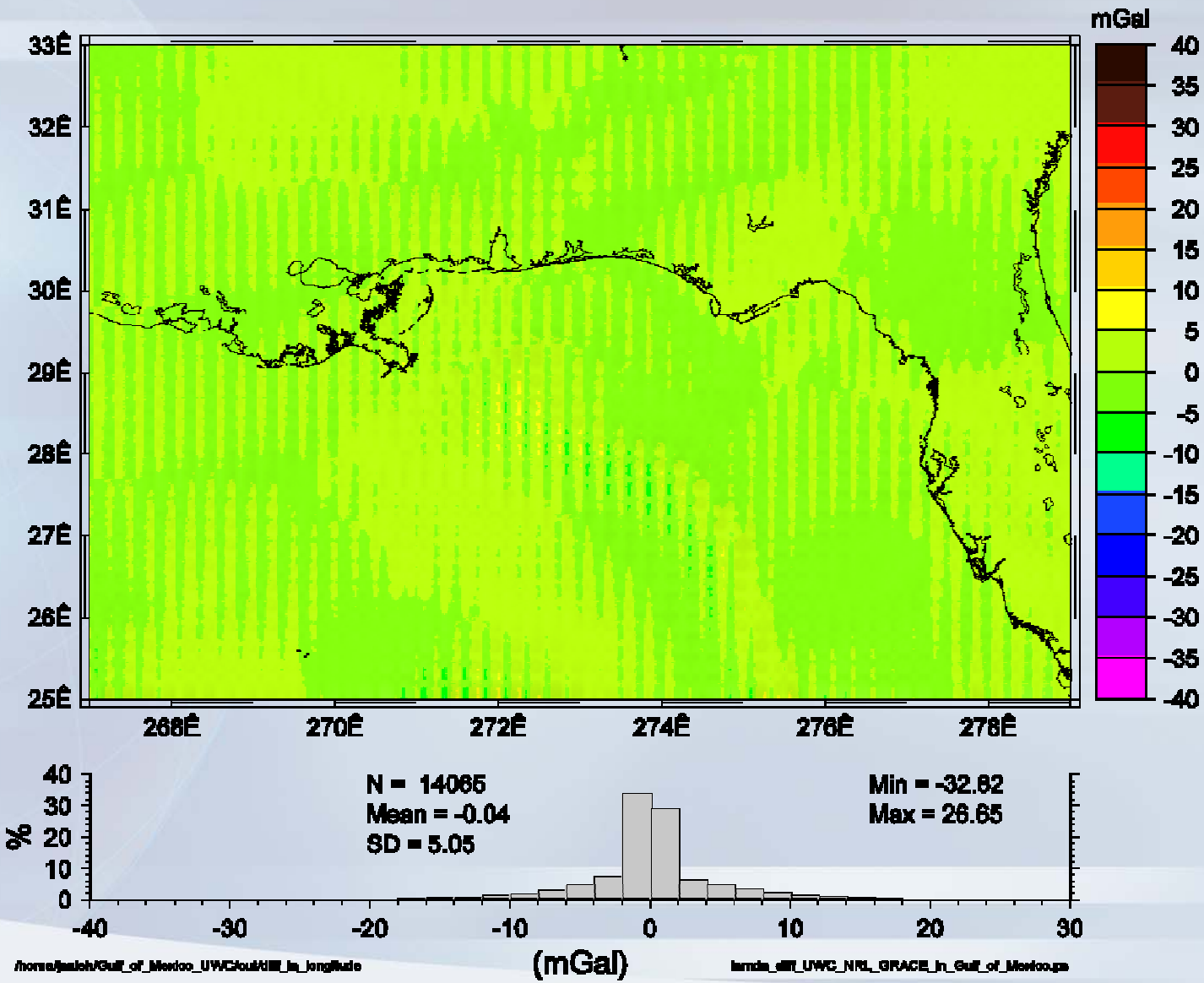

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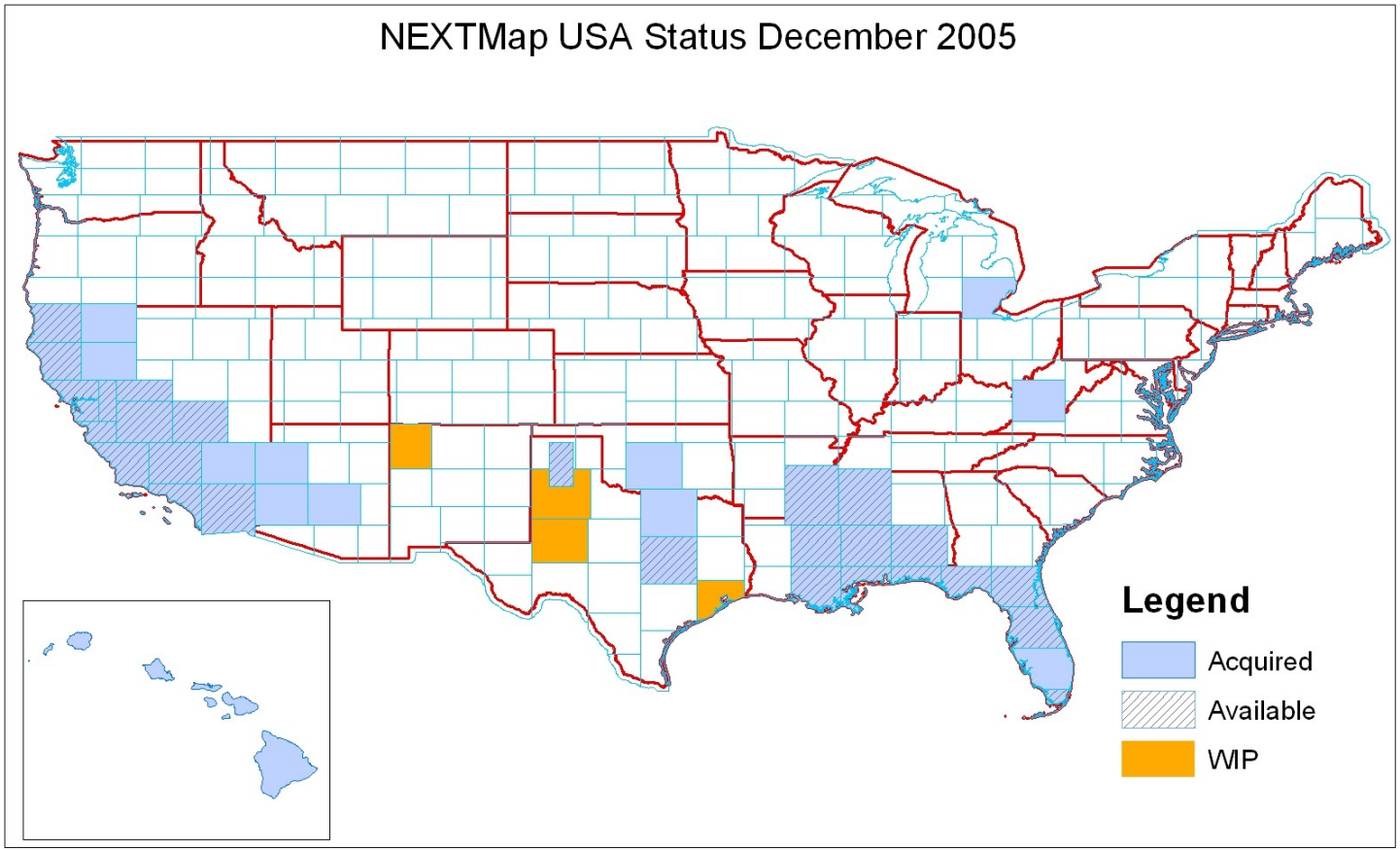
Possible Comparison: INTERMAP



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QUESTIONS?


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U.S. DEPARTMENT OF COMMERCE