

CO, CO₂ and Methane Measurements from the NSF/NCAR G-V

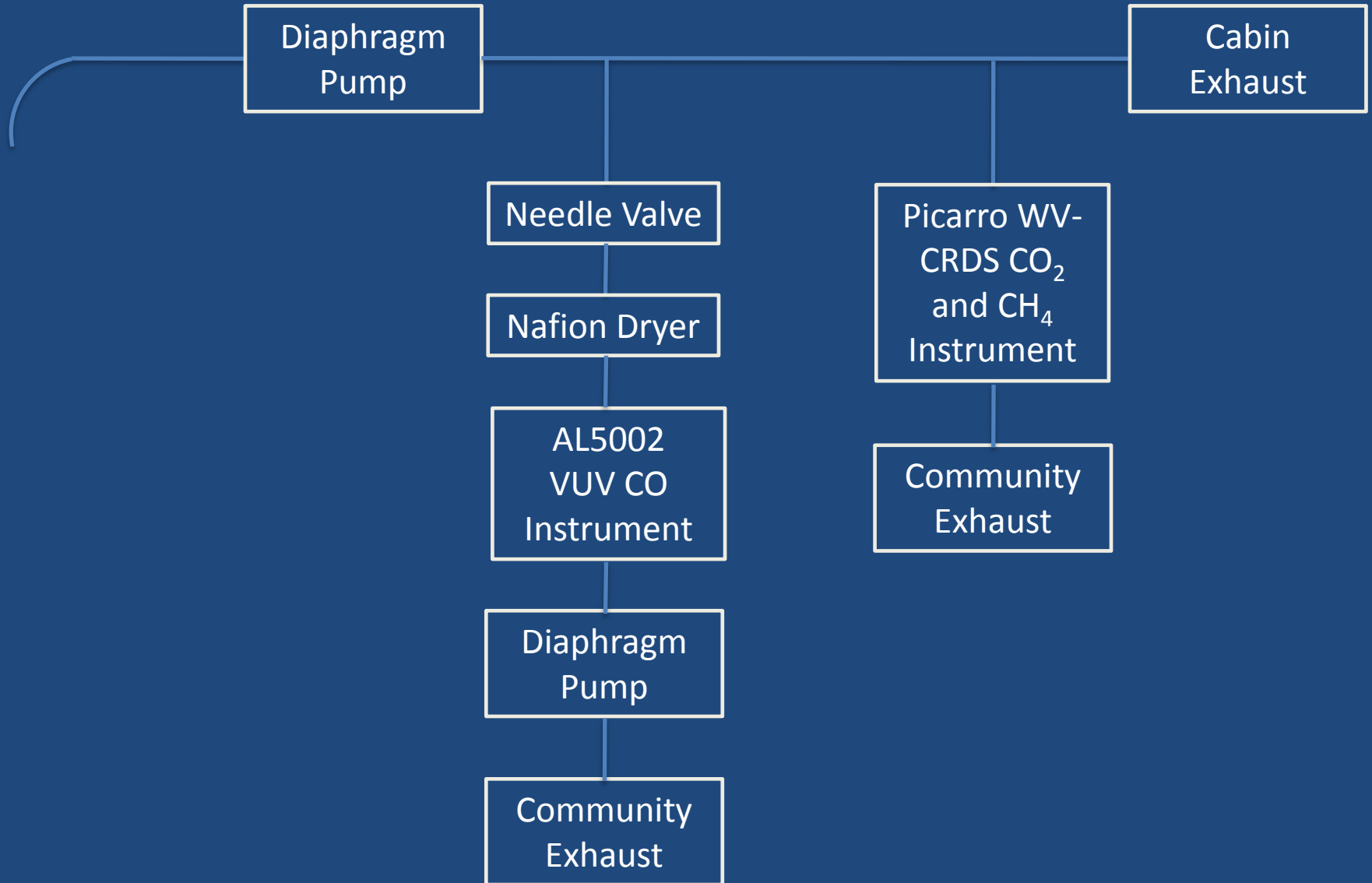
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Ru-Shan Gao, NOAA ESRL/CSD

- **Carbon Monoxide by VUV Fluorescence**
 - Aero-Laser VUV resonance fluorescence
 - 2 ppbv precision (1-s averaging time)
 - .5-Hz frequency response
 - 2 ppbv ± 3% accuracy
- **CO₂ and Methane by WS-CRDS**
 - Fast-response commercial instrument (Picarro)
 - Precision (0.2-s averaging time):
 - 250 ppbv CO₂
 - 3 ppbv CH₄
 - Claimed 5-Hz frequency response

TORERO Inlet configuration



Calibration Approach

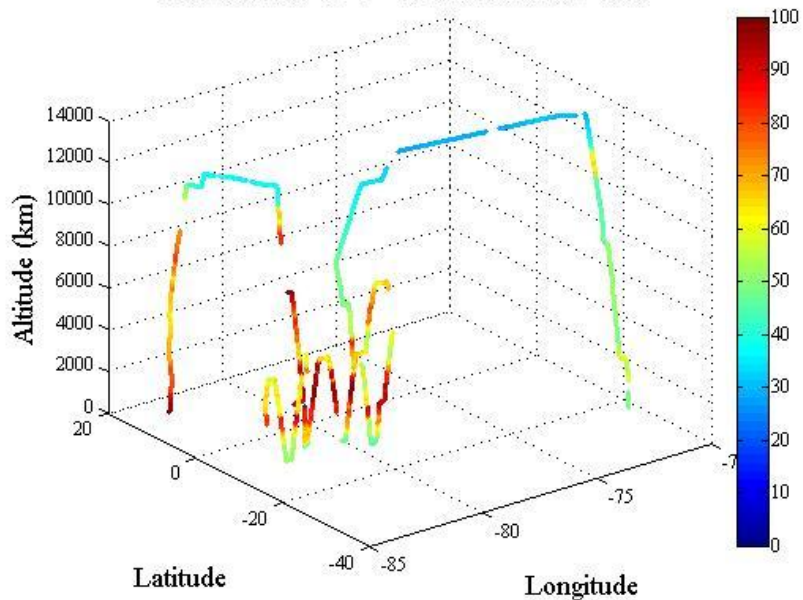
- In-flight Calibrations
 - single working standard: CO, CO₂, and CH₄ in natural air
 - CO zero measurements by catalytic removal of ambient CO;
 - calibration duration: 4 minutes
 - sequence frequency: approximately half hourly
- Time dependent sensitivity and zero offset by linear interpolation
- Working standard concentrations compared to multiple NOAA GMD/CCGG primary standards before and after field phase

Instrument Performance and Data Status

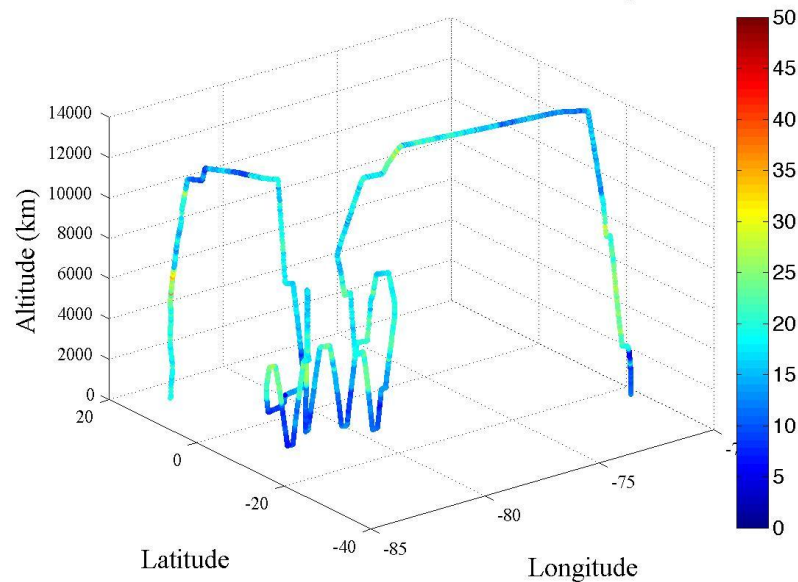
Measurement	Data Coverage	Status	Remaining Tasks
CO	100%	Processed to level 1 quality	Remove calibrations from 4 flights
CO ₂	40% of flights	Processed to level 1 quality	Apply water correction; Remove calibrations from output
CH ₄	40% of flights	Processed to level 1 quality	Remove calibrations from output

- The Picarro instrument failed during RF03, and was returned to the vendor.
- The failure was attributed to an unstable USB cable configuration.
- After repair, the instrument was shipped to Costa Rica, re-installed, and functioned successfully for the final 5 research flights.
- A high altitude leak in the inlet compressor compromised the high precision CO₂ and CH₄ measurements for all research flights.
- Data acquired above 7km will not be reported.
- Post-project modifications solved the problem. No problems observed during the DC-3 experiment.

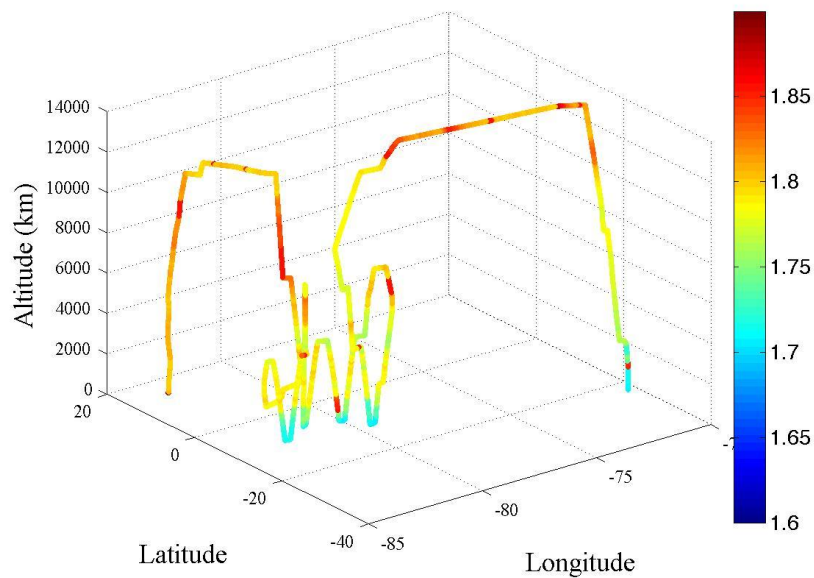
TORERO G-V 120119RF01 CO



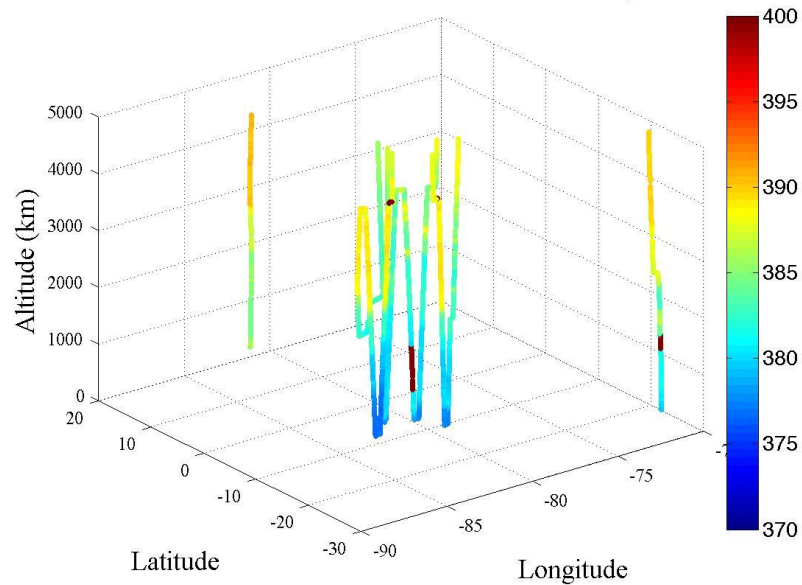
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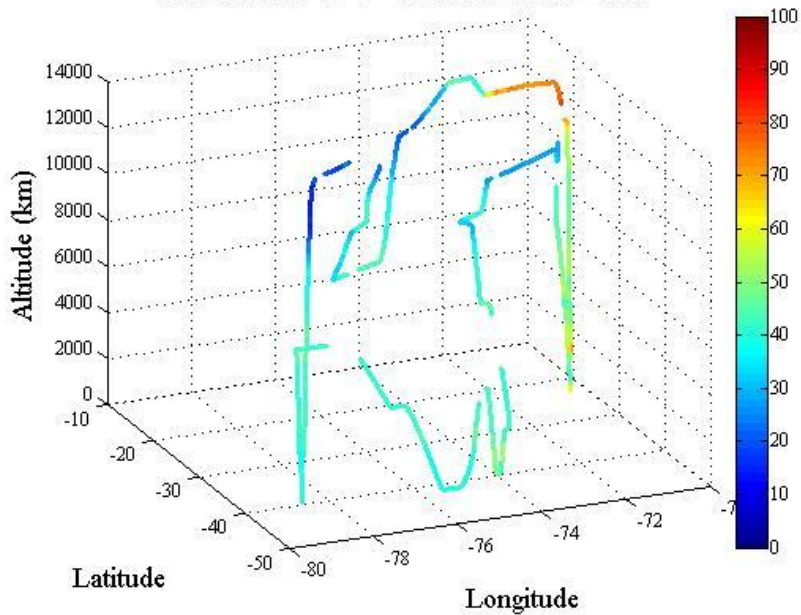
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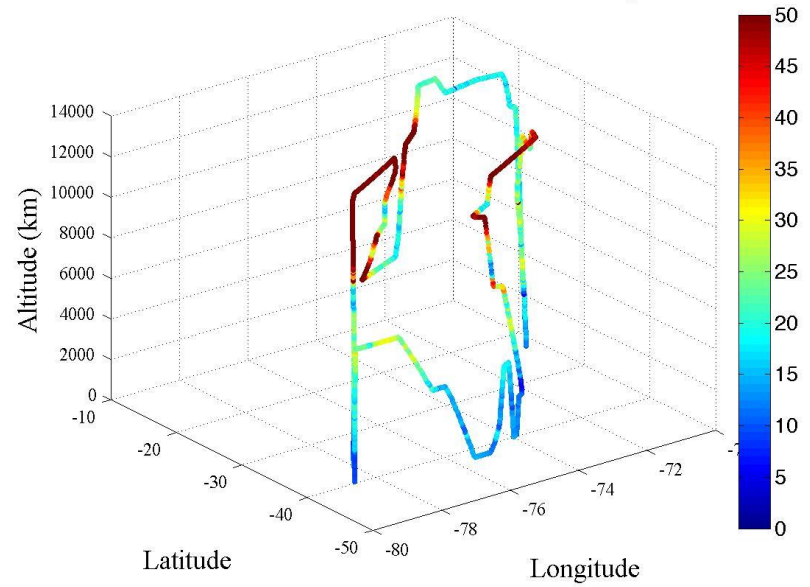
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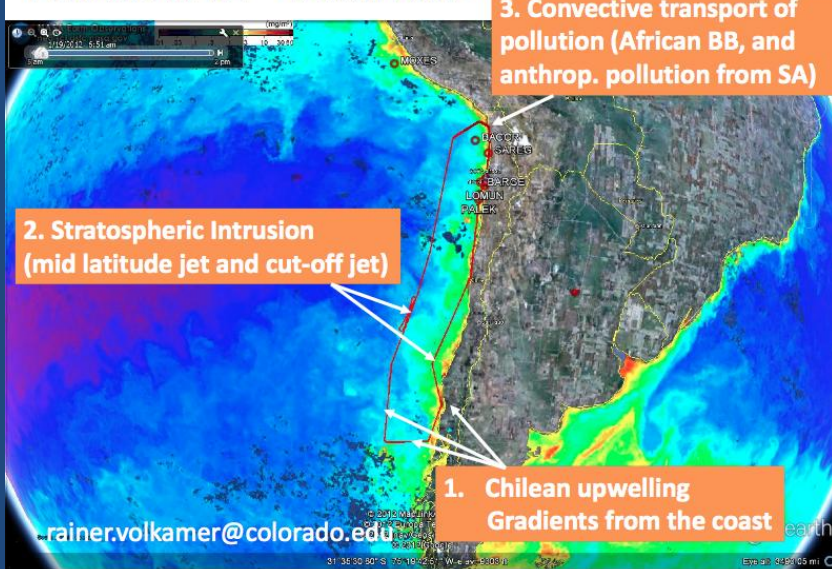
TORERO G-V 120121RF02 CO



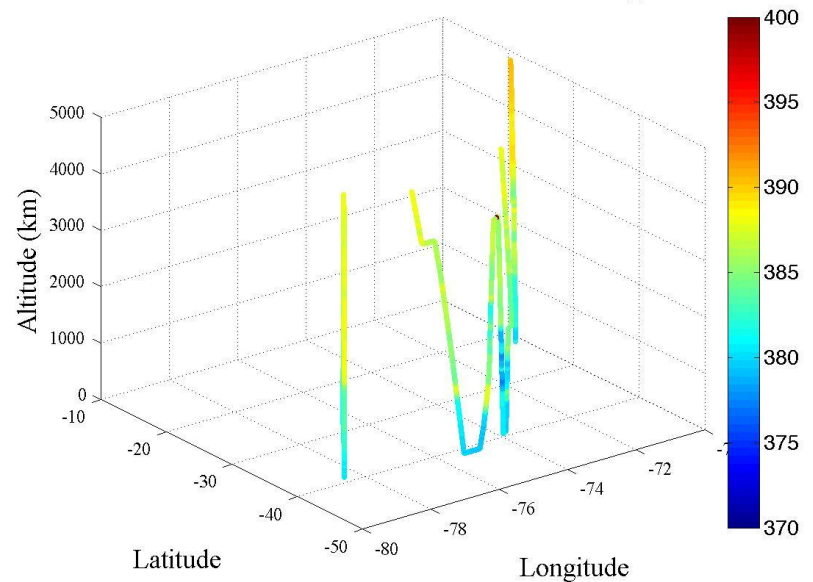
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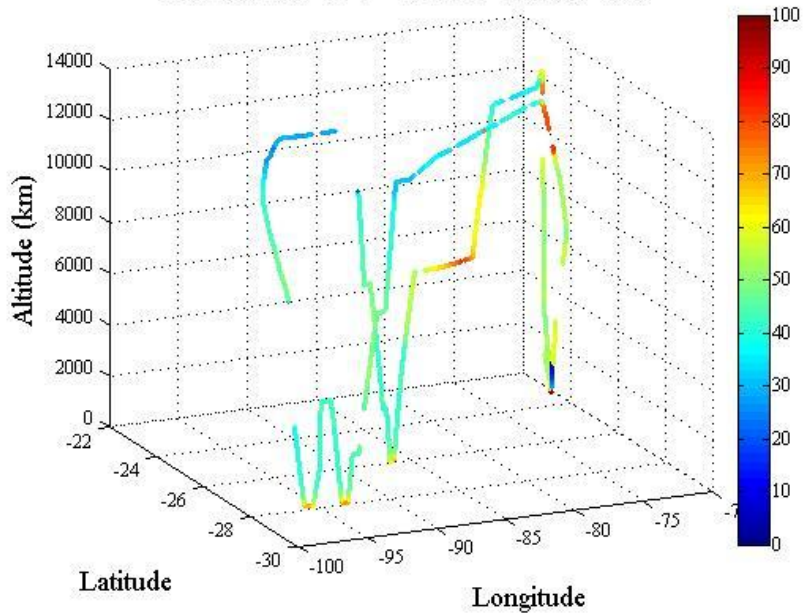
TORERO RF02 – 21 Jan 2012



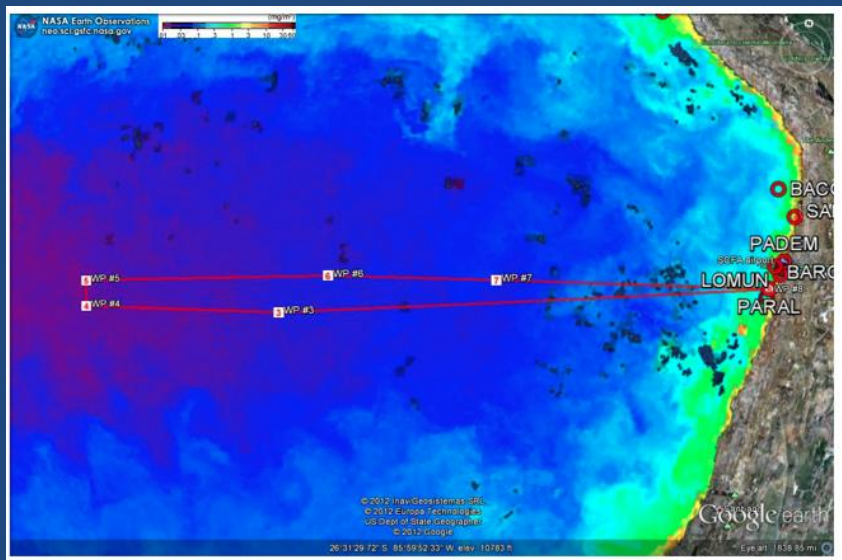
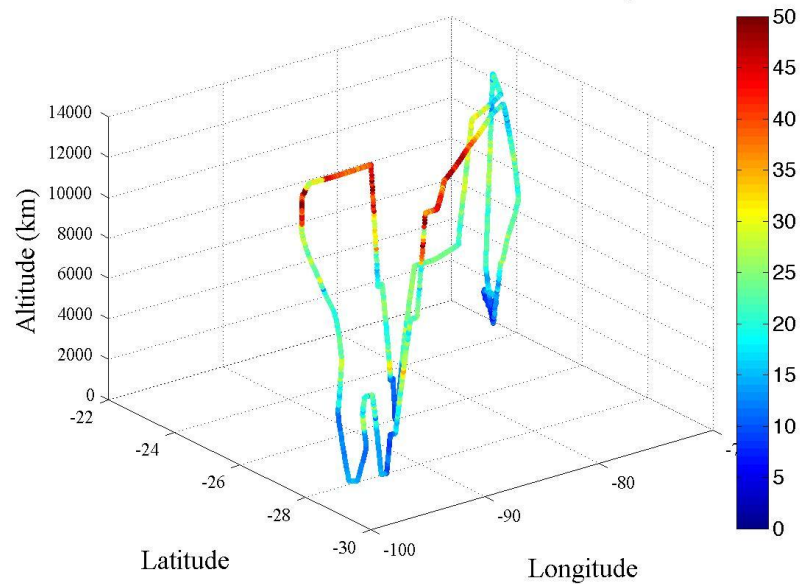
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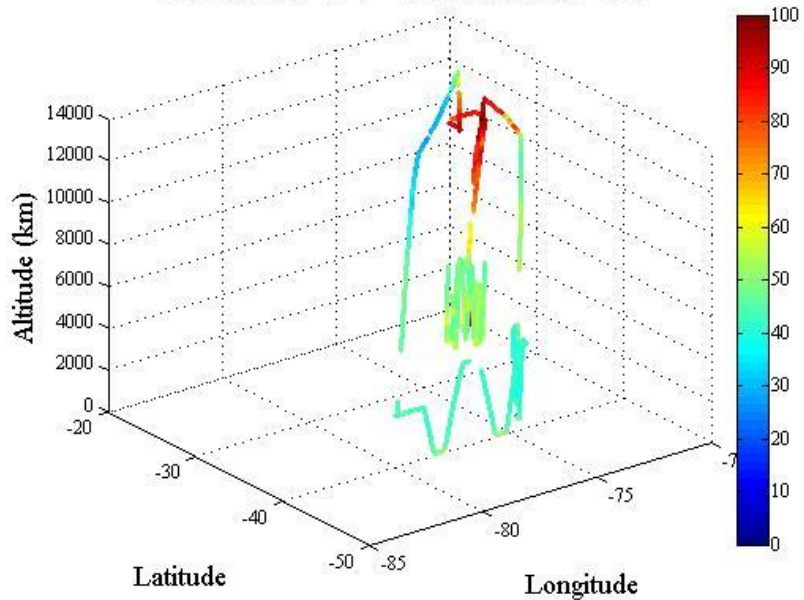
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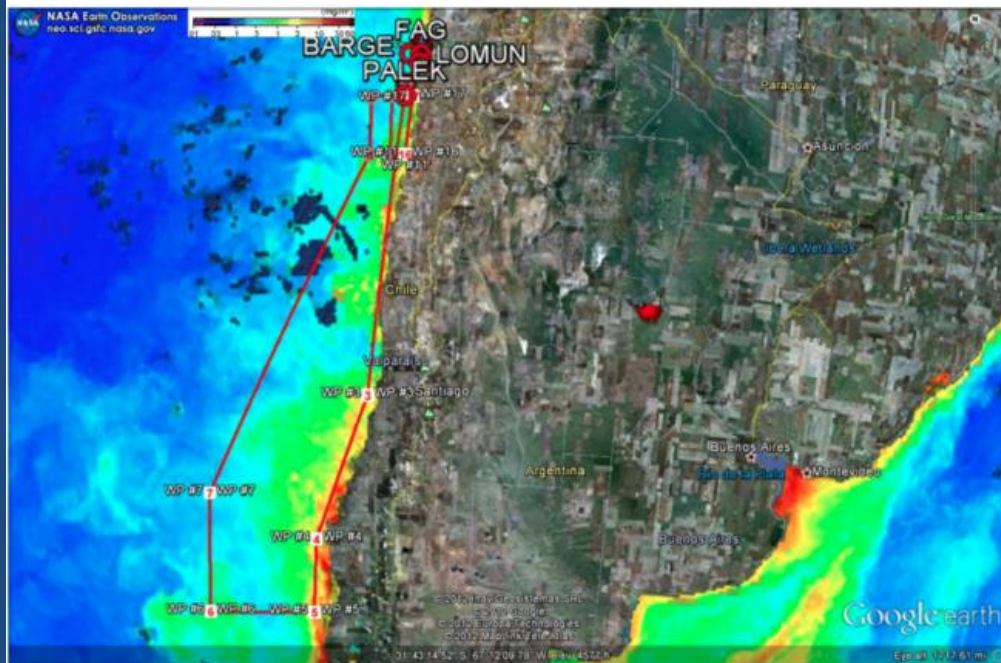
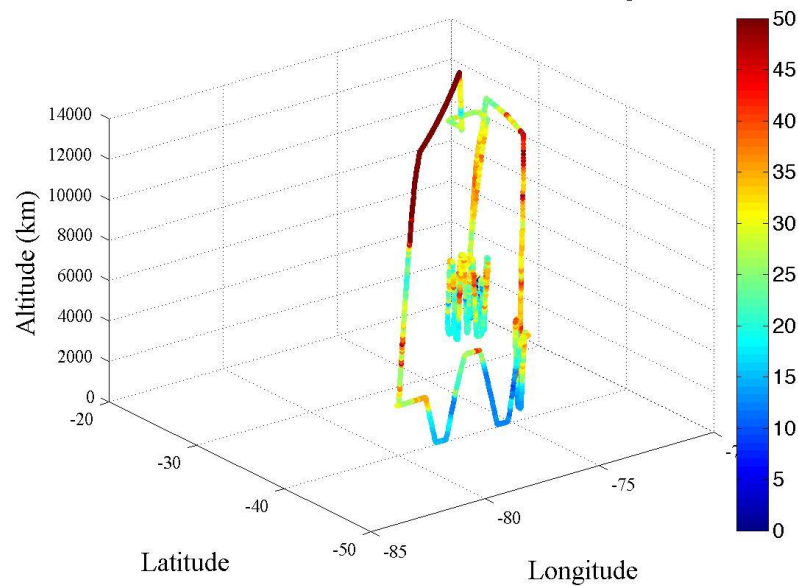
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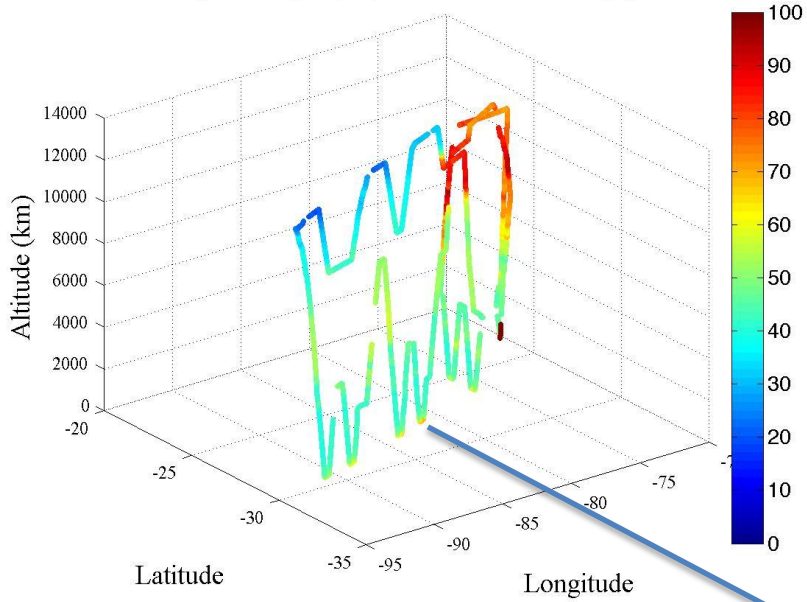
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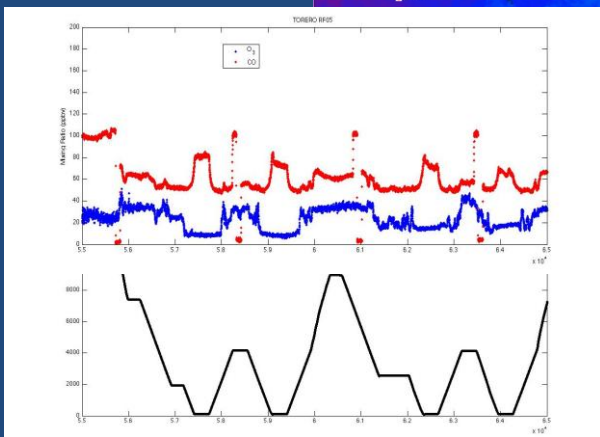
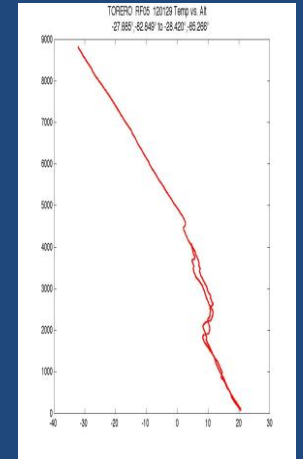
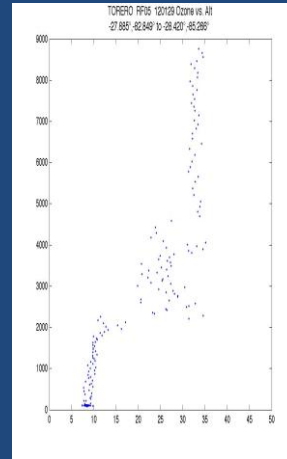
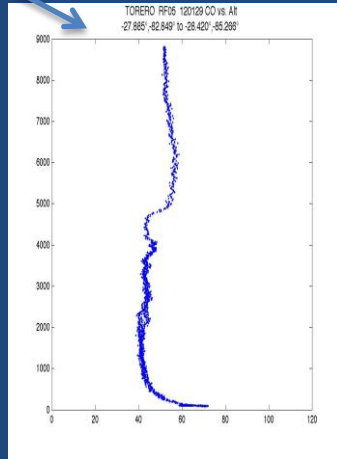
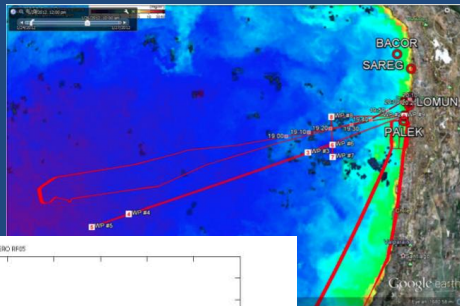
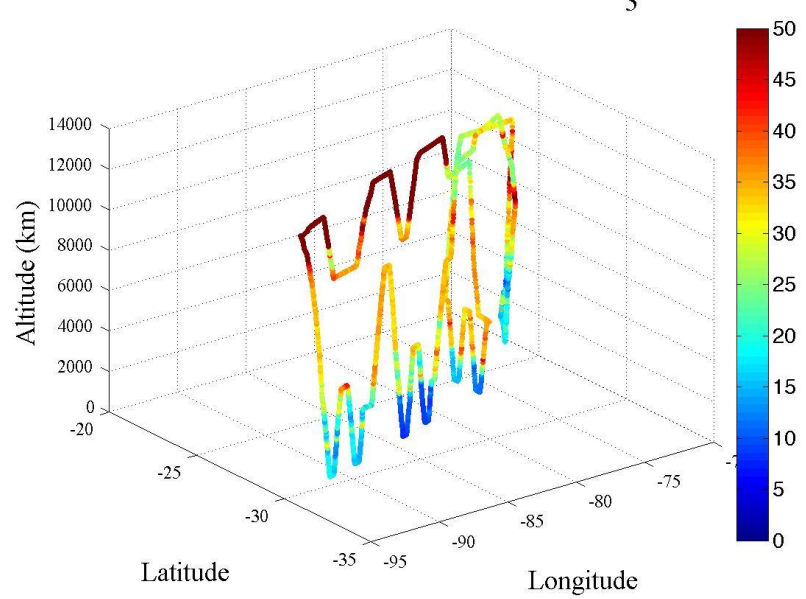
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TORERO G-V 120129RF05 CO

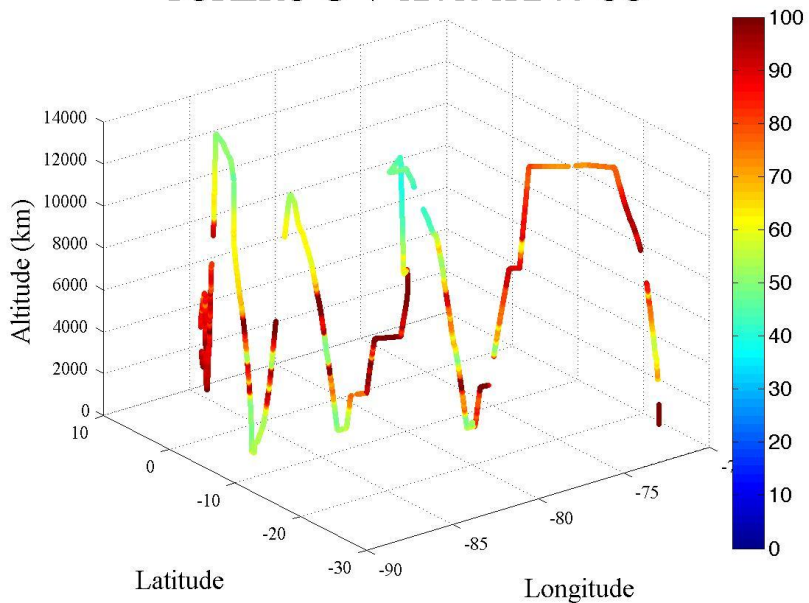


TORERO G-V 120129RF05 O₃

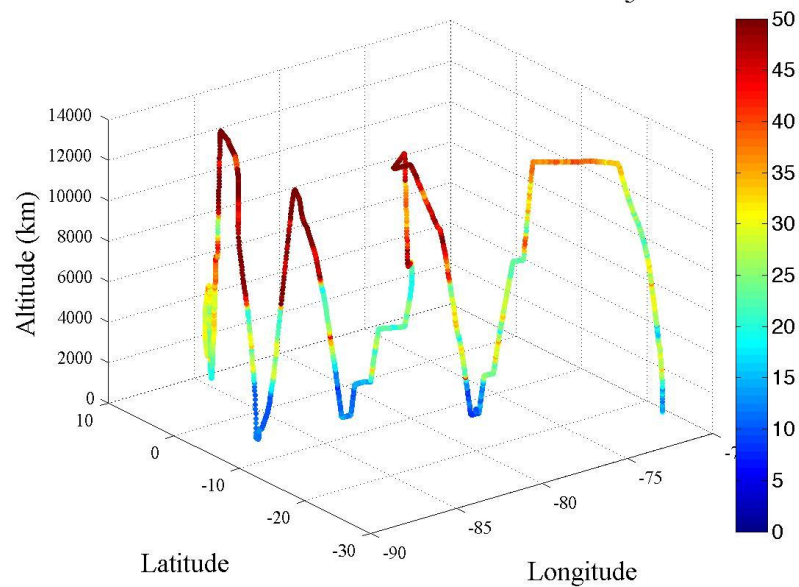


2 profiles of CO, O₃, and Temperature

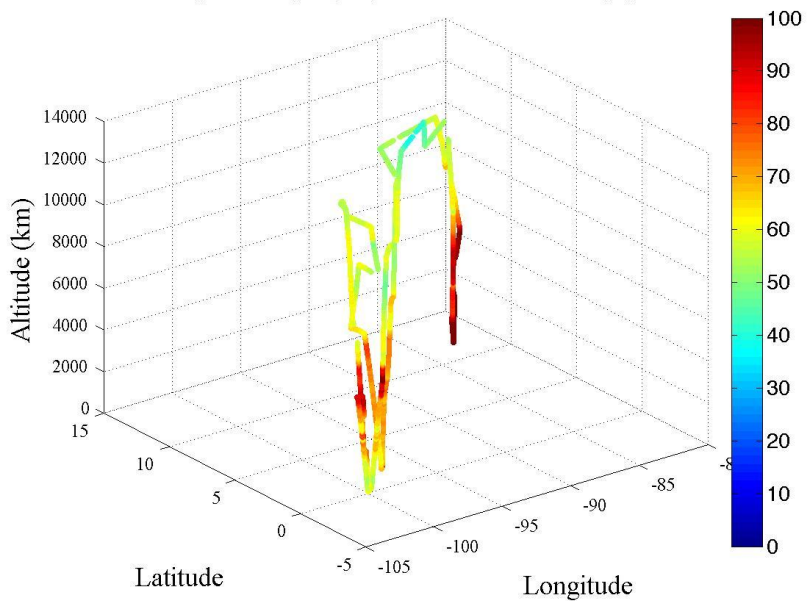
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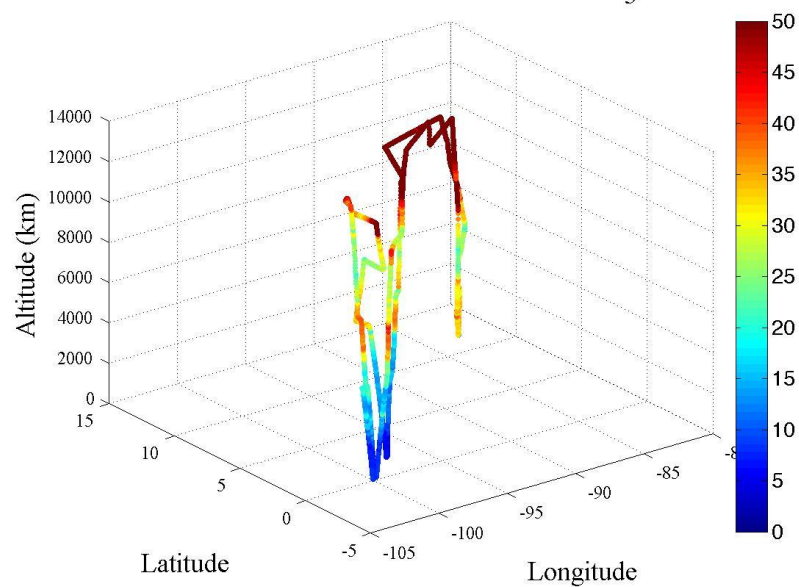
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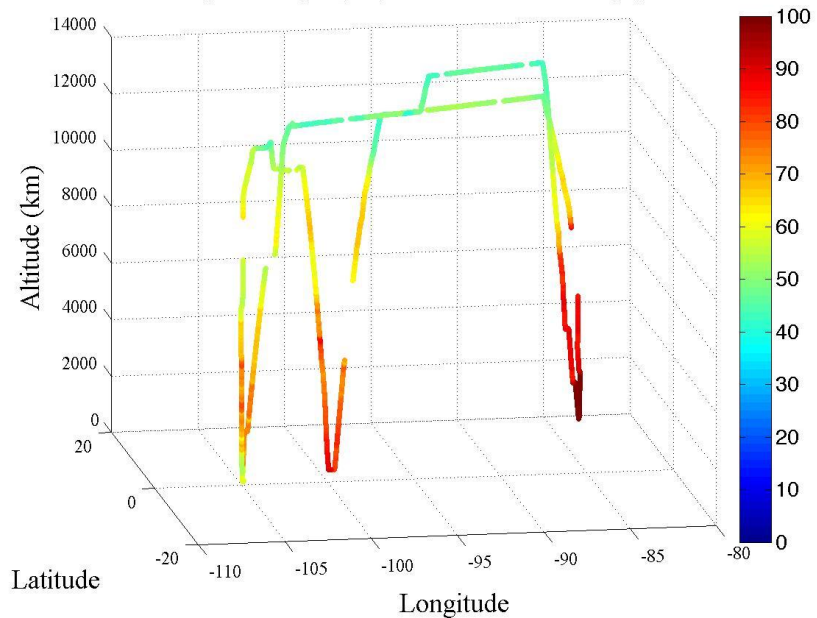
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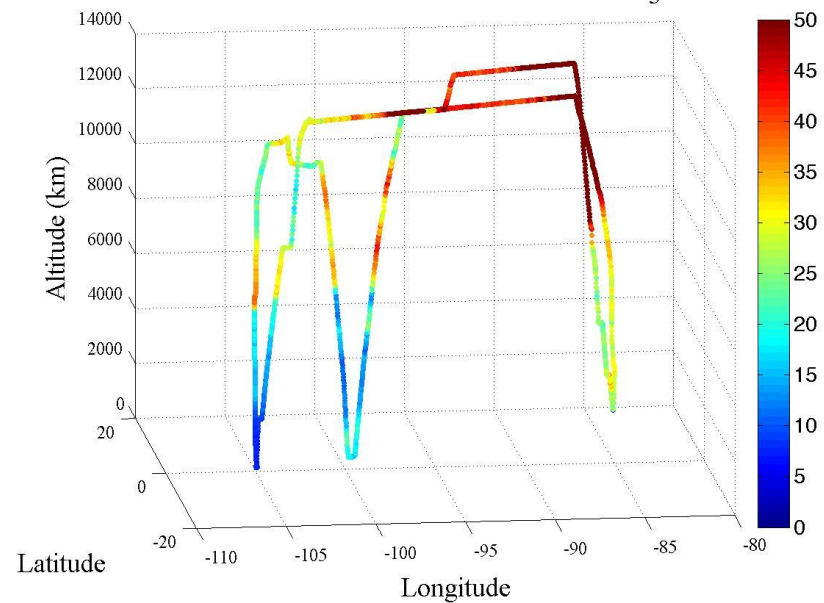
TORERO G-V 120203RF07 O₃



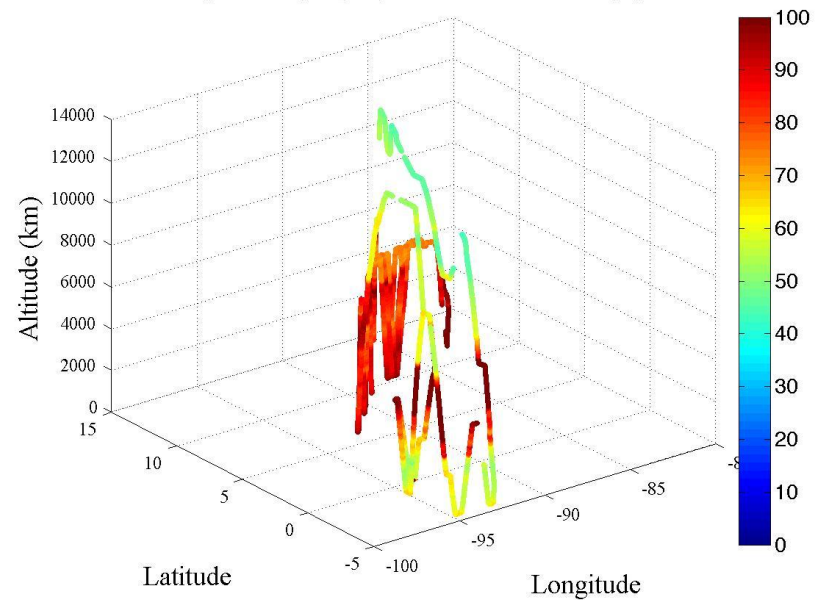
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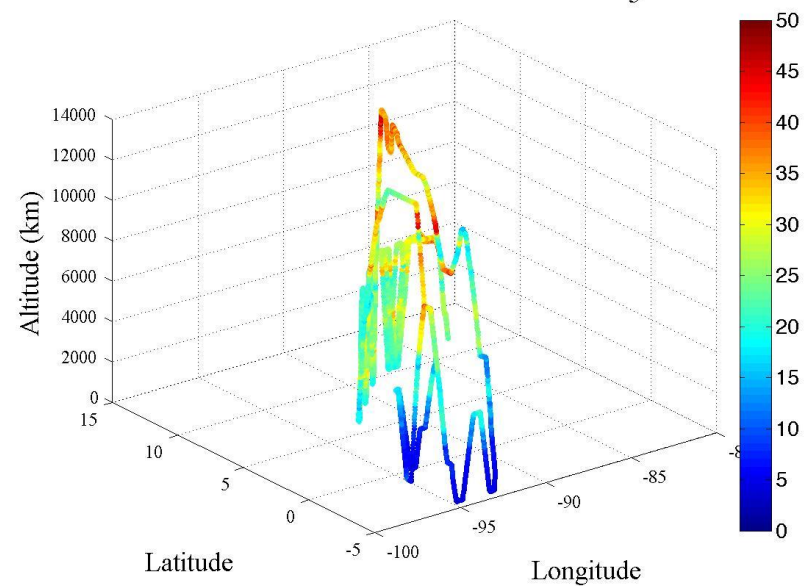
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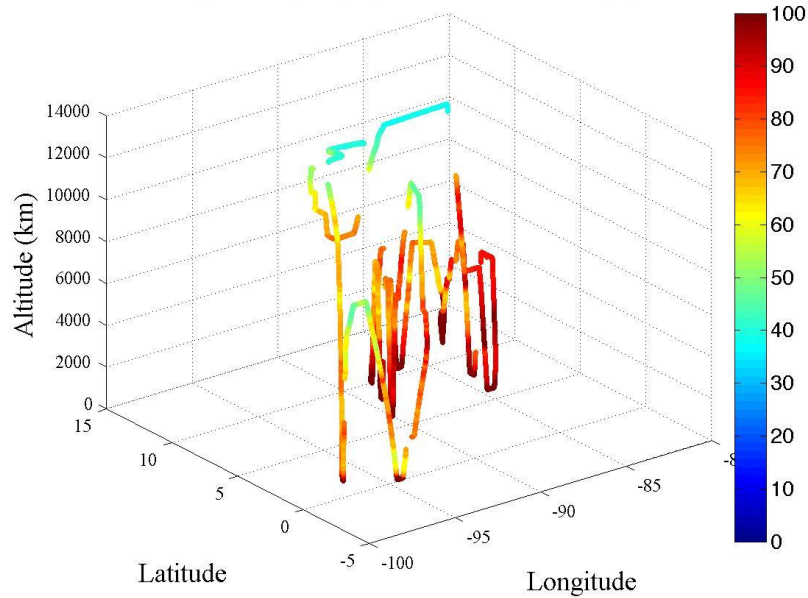
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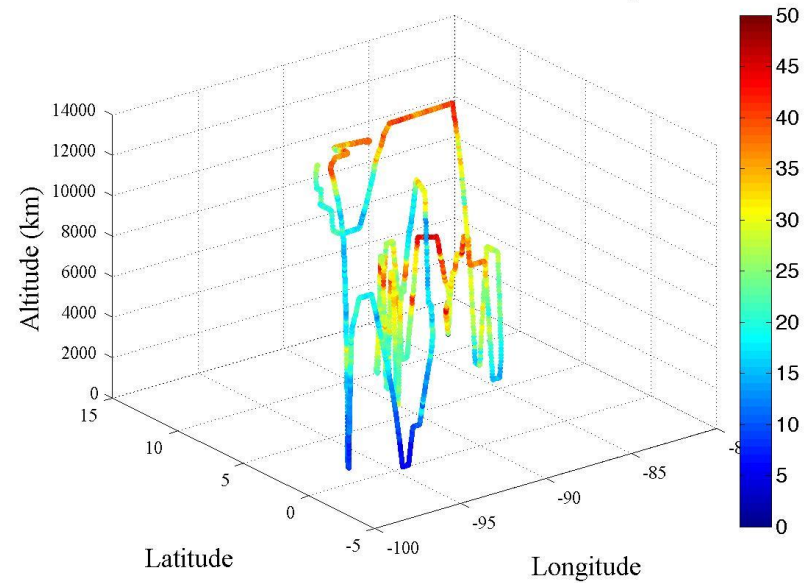
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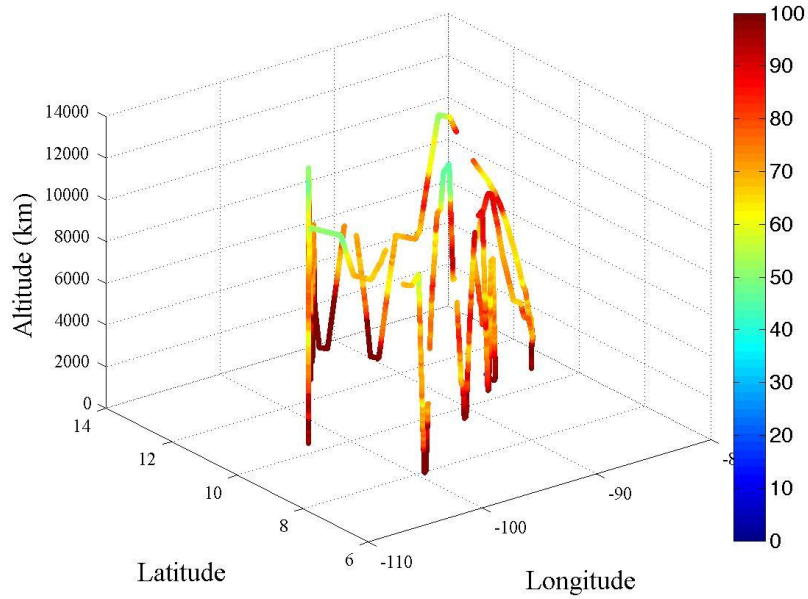
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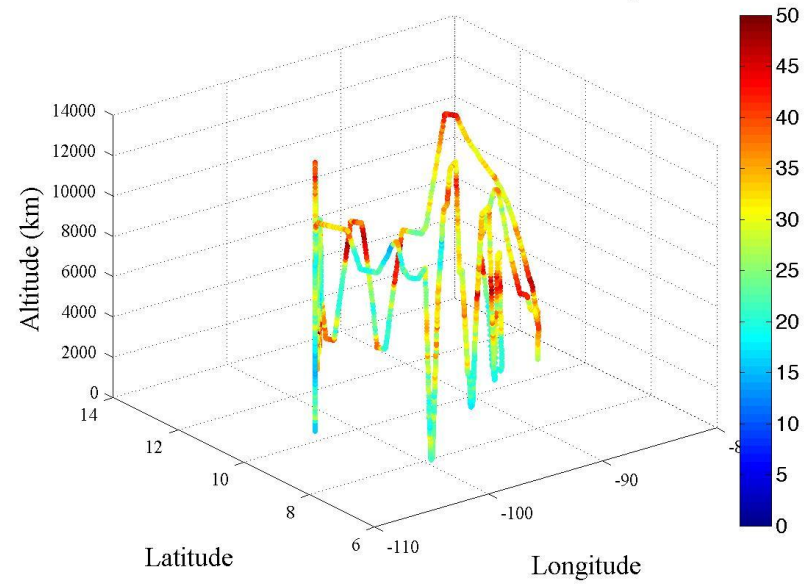
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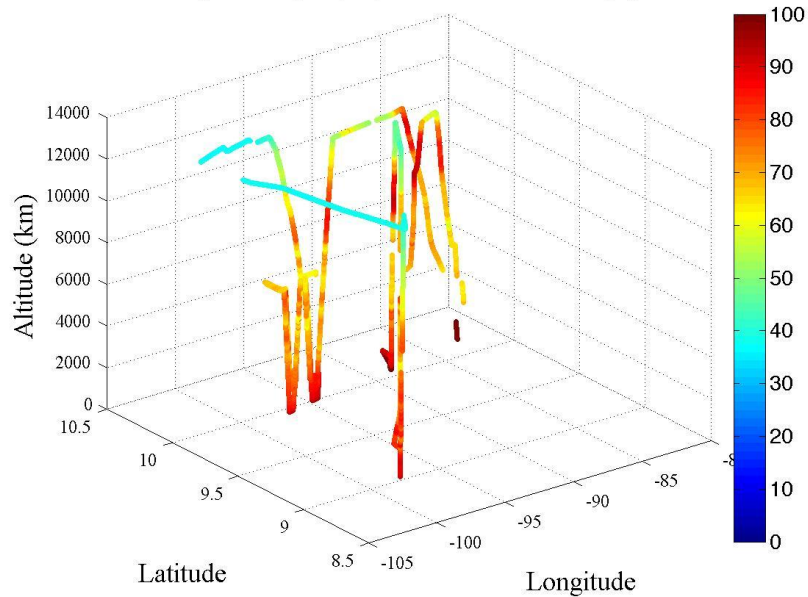
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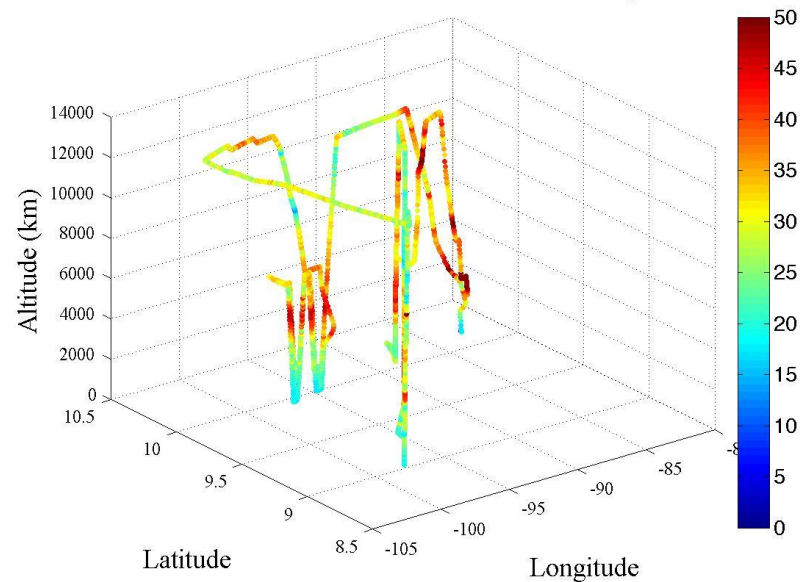
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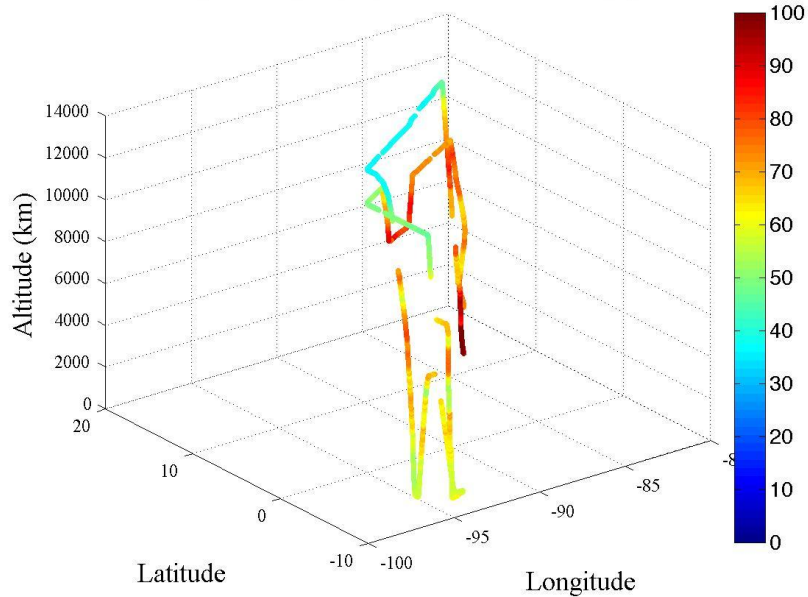
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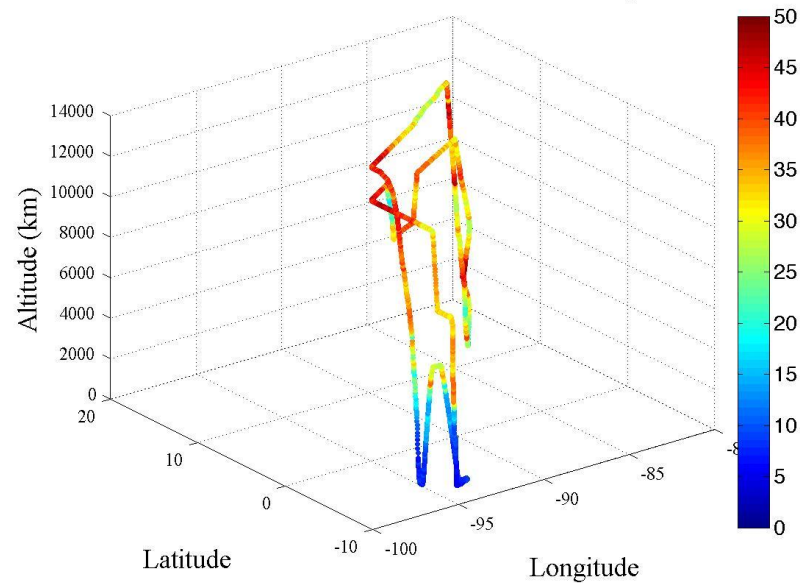
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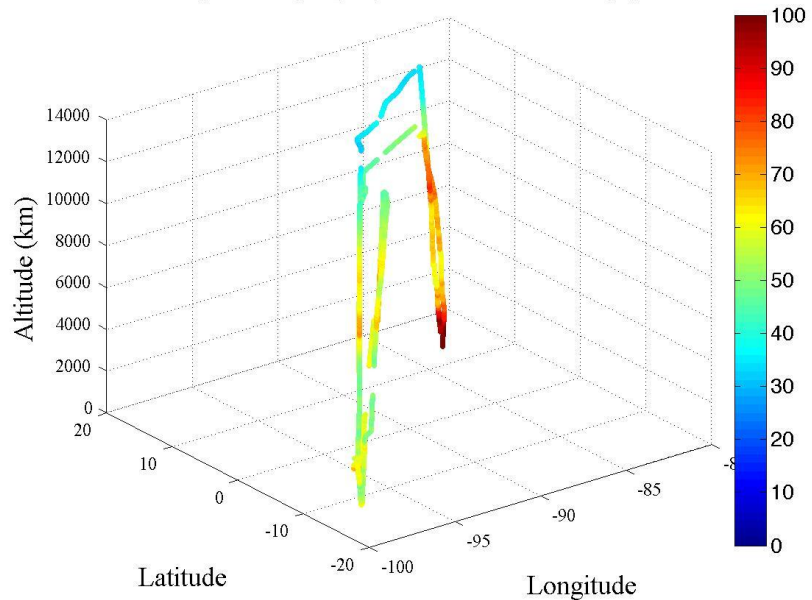
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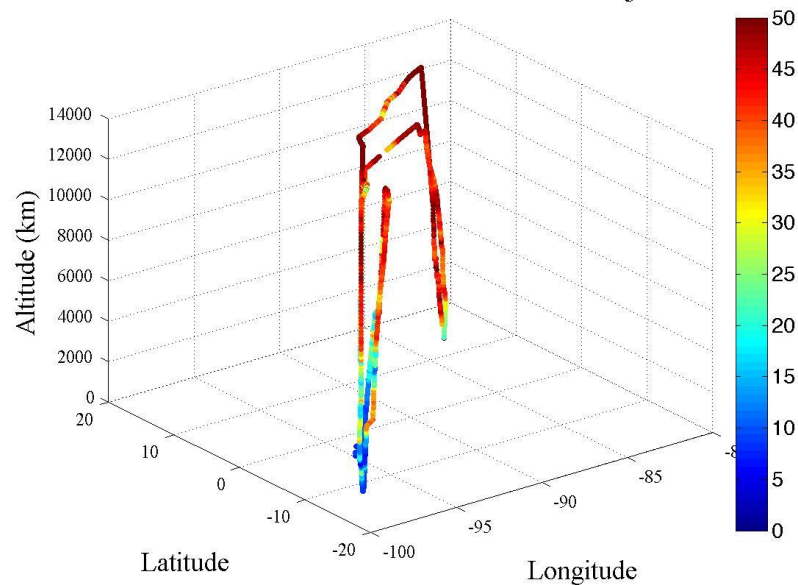
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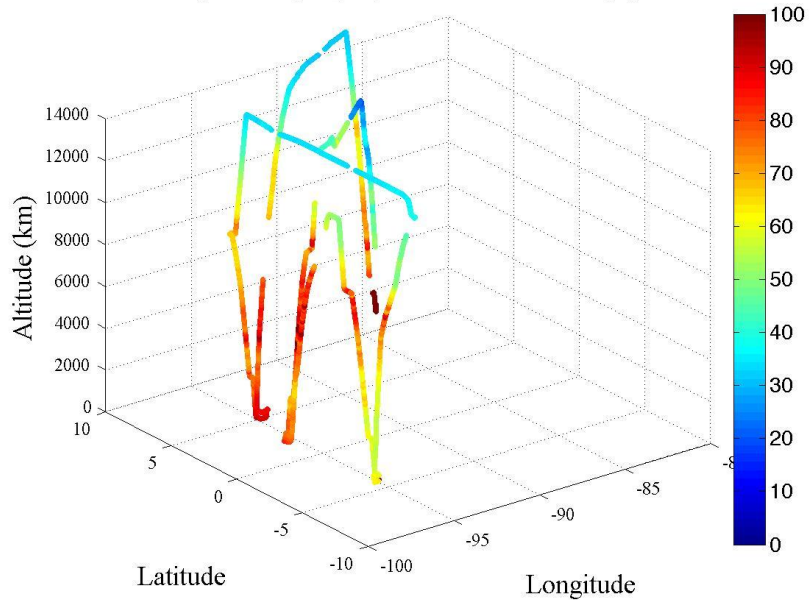
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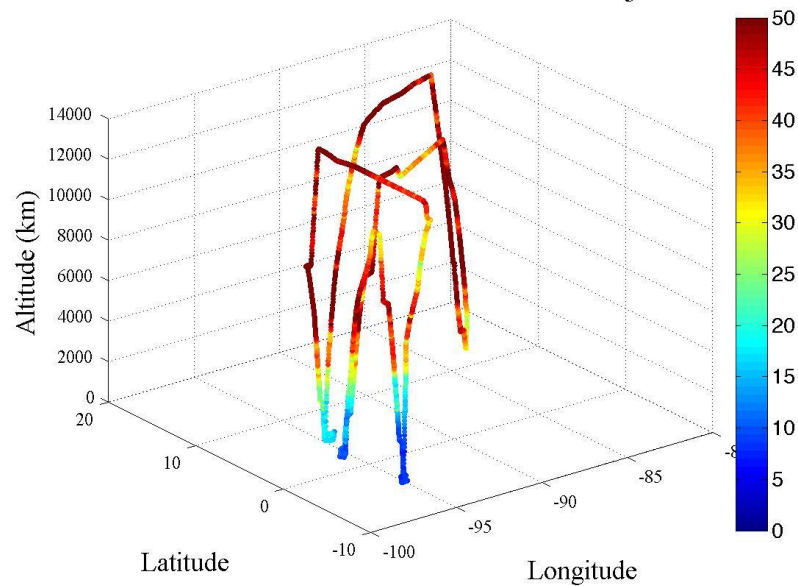
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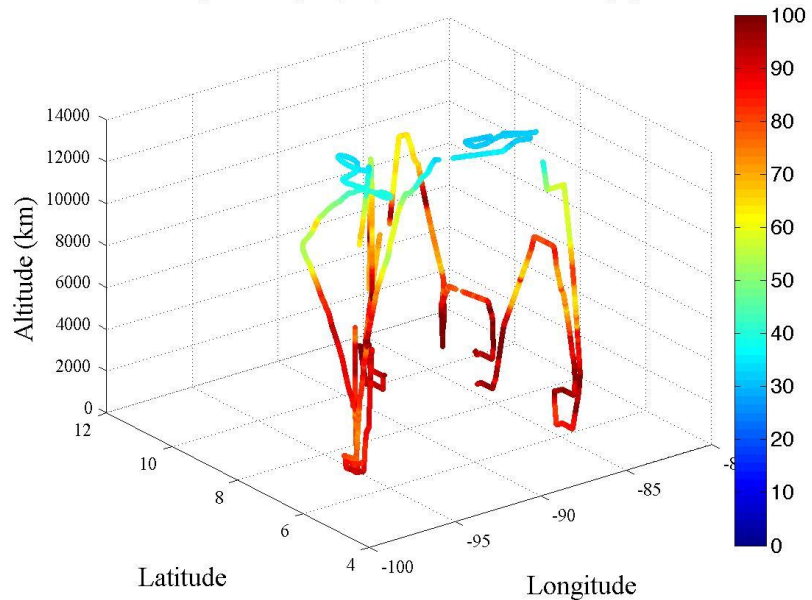
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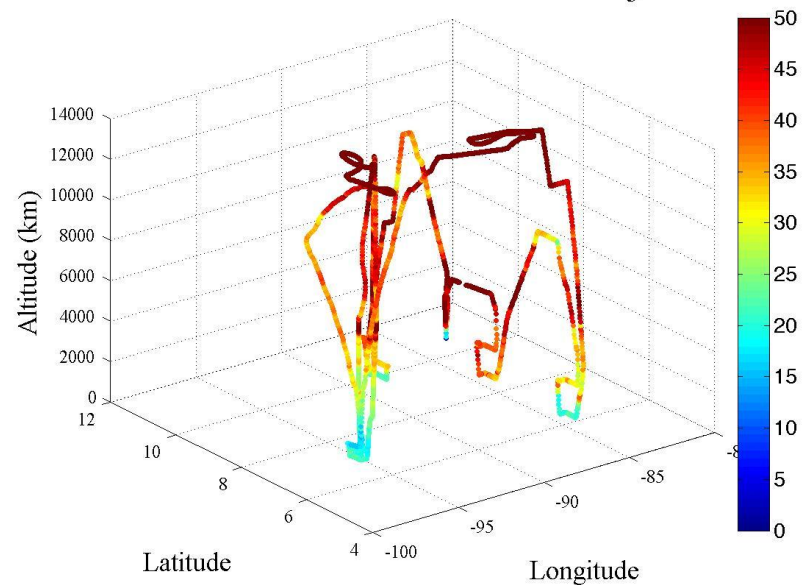
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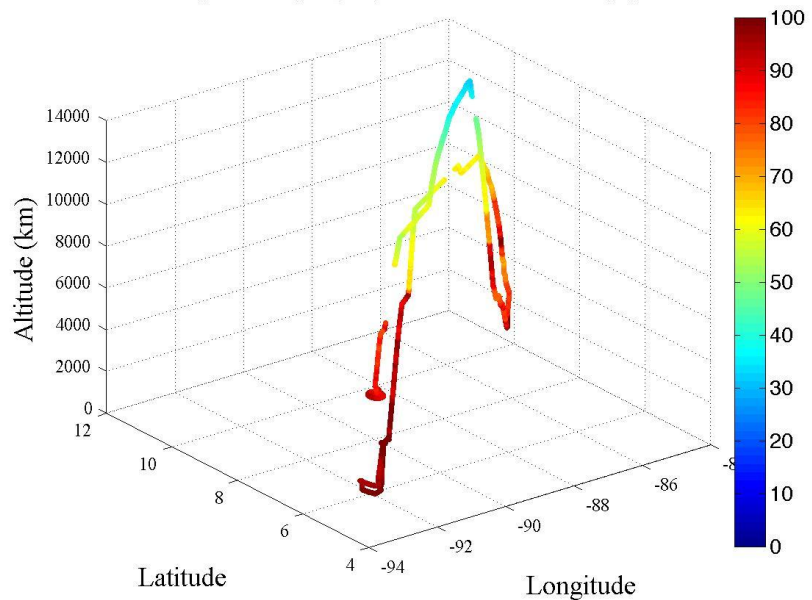
TORERO G-V 120224RF16 CO



TORERO G-V 120224RF16 O₃



TORERO G-V 120226RF17 CO



TORERO G-V 120226RF17 O₃

