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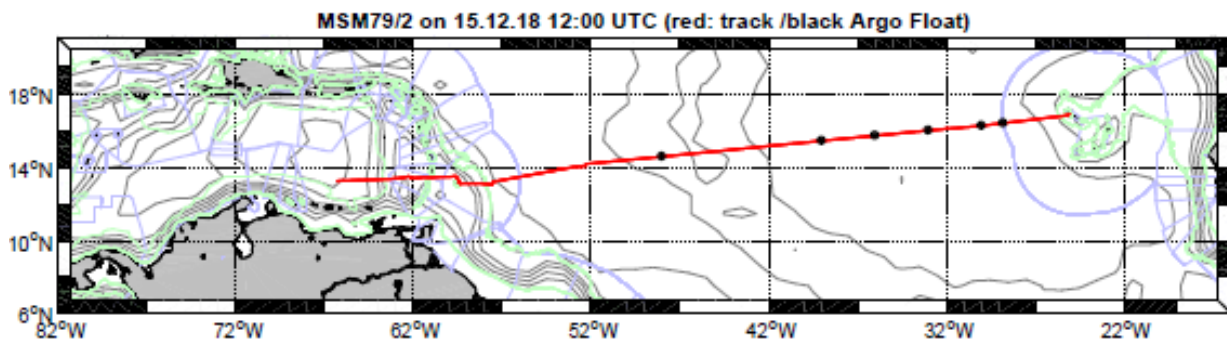
Short Cruise Report Schiff und Fahrt - Nr. MSM 79-2

Mindelo (Kapverden) - Bahia de las Minas (Panama)

6. Dez 2018 - 18. Dez 2018

Chief Scientist: Stefan Kinne

Captain: Björn Maaß



The MSM 79-2 route until December 15 (red line) on the research cruise from Mindelo (Capo Verde) to Panama. Also indicated are the deployment locations of the six ARGO floats (black dots).

Objectives

As the title “MOOR” (**M**asuring **O**ver **O**cean **R**eferences of aerosol, clouds and trace-gases for evaluations of satellite retrievals and model simulations) indicates, the major focus of the MSM 79-2 research cruise was the sampling of atmospheric reference data. Three sun-photometers (for aerosol) and two MAX-DOAS instruments (for trace-gases) were brought along in personal luggage and quasi permanent installed ceilometer and cameras (for clouds) were already installed or onboard. In addition, the cruise opportunity was used (1) to deploy 6 ARGO floats and (2) to analyze the underway sampling of ocean surface properties (temperature and sea-salt content with a thermosalinograph), ocean currents (in two different altitude regimes with two vessel-mounted VM-ADCPs Ocean Surveyors) and bathymetric sampling of the oceans floor (depth and composition with the Kongsberg EM122 multi-beam echo sounder data).

Narrative

The MSM 79-2 cruise started on December 6 with a slight delay as part of the crew and some luggage were stuck in Lissabon. Late in the afternoon of December 6 the Merian departed from Mindelo. Due to electrical issues only one pot could be used to propel the ship. This limited the speed to about 9 knots, as speed far too slow to reach Panama in time. We had, however, a technician onboard and were hopeful that the problem could be fixed. We had received a science permit for Cape Verde so we could start sampling soon after leaving Mindelo. All atmospheric instruments (sun-photometers, cloud cameras, ceilometer and MAX-DOAS instruments) worked as planned and even an old cloud camera, stored in the basement of the ship was brought onto the piledeck and activated. As soon as we left the Capo Verde EEZ the first of the six ARGO floats was deployed. As the forward speed remained slow the planned CTD profile at the deployment location had to be scratched out of time-concerns. Although after about three days we went back to full speed (at 13kn) the captain still signaled concerns about future propulsion problems so all CTD profiles needed to be scratched (In hindsight this was unfortunate as the propulsion system turned out to be OK and there was plenty of help from ocean currents and easterly winds so in the end we were even slightly ahead of schedule). With relatively few clouds present we could sample many reference data for aerosol and clouds, but for trace-gases we were limited to a few good samples early on, when wind speeds were still low. When the easterly (trade) winds at the surface picked up (for the rest of the cruise $>10\text{m/s}$) after a few days, the winds were faster than the ship's forward movement even at full speed. As a result the motor exhaust was pushed over both MAX-DOAS instruments (in the front of the ship) and their oceanic background data were frequently contaminated. Thus, on two days (December 12 and 13) the ship was turned for ca 20 minutes into a southern (then perpendicular to the wind) direction to allow for at least a few good background data at the TROPOMI satellite overpass near 13.30 local time. Shortly before we reached the Barbados EEZ, we finally received clearance to sample in Barbados waters. Thus, we performed a desired manoeuvre at the east coast of Barbados, where the MPI-M maintains a cloud observing station since 2010 (the BCO site). With identical cloud instruments (ceilometer and thermal camera) as on the ship we approached that site in direction of cloud base (ca 940hPa) movement from 50 miles out to as close as 1 mile (almost at midnight). After another half hour forth and back in and out the wind-direction we passed Barbados Island to the north. Once we left the Barbados EEZ, we had to stop our scientific work, as we did not have permits for countries like Venezuela or Columbia, which are difficult to obtain, also as time between cruise approval (in August) and cruise (in December) was too short. Some figures below summarize initial results for the Atlantic cross-section between -60W and -25W near 15N in December:

Figure A: Sea surface salinity gained by the thermosalinograph on cruise MSM79-2. (UNI-HH)

Figure B: Sea surface temperature gained by the thermosalinograph on cruise MSM 79-2. (UNI-HH)

Figure C Atlantic cross-sections for December at 15N between -60W and -25W for temperature, relative humidity and wind-speed at the surface and for broadband solar and infrared radiation. (MPI-M)

Figure D Atlantic cross-sections for December at 15N between -60W and -25W for sun-photometer derived data for AOD at 550nm , Angstrom parameter, aerosol index and water vapor. (MPI-M)

Figure E NO_2 column data sampled along the Atlantic cross section. The occasional higher values on the western side are caused by sampling ship exhaust (due to unfavorable winds). (MPI-C)

Figure F mid-visible sunphotometer optical depth measurement summary (left) and NO_2 loads at different elevations ($15, 30\text{ deg}$) above the horizon (right) with larger pollution early on after leaving Mindelo. (KNMI)

Figure G ocean floor details for the Atlantic Ridge and near Capo Verde. (HCU)

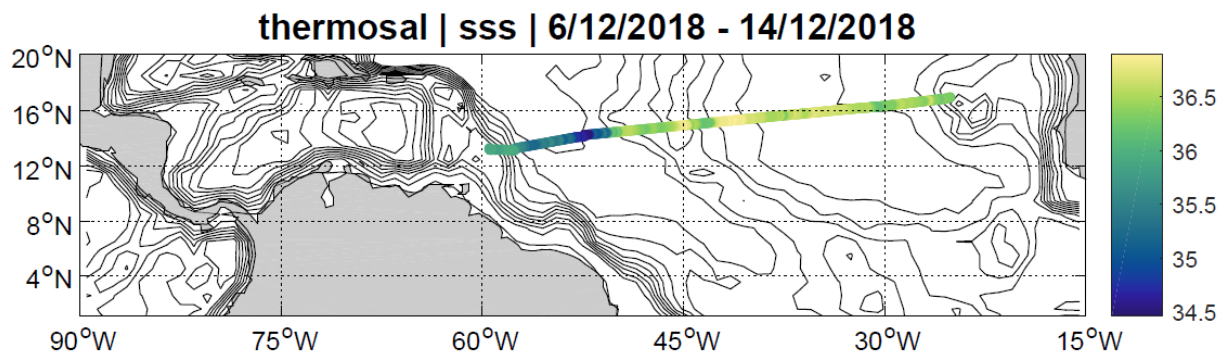


Figure A: Sea surface salinity gained by the thermosalinograph on cruise MSM79-2. (UNI-HH)

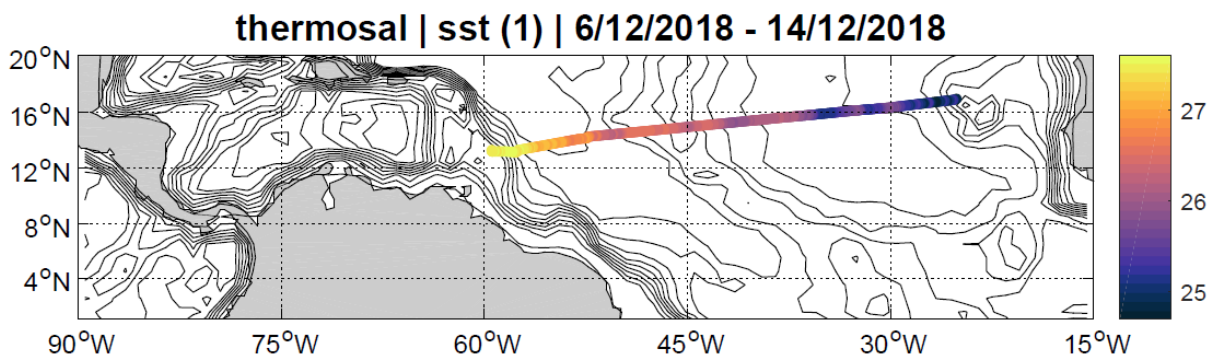


Figure B: Sea surface temperature gained by the thermosalinograph on cruise MSM 79-2. (UNI-HH)

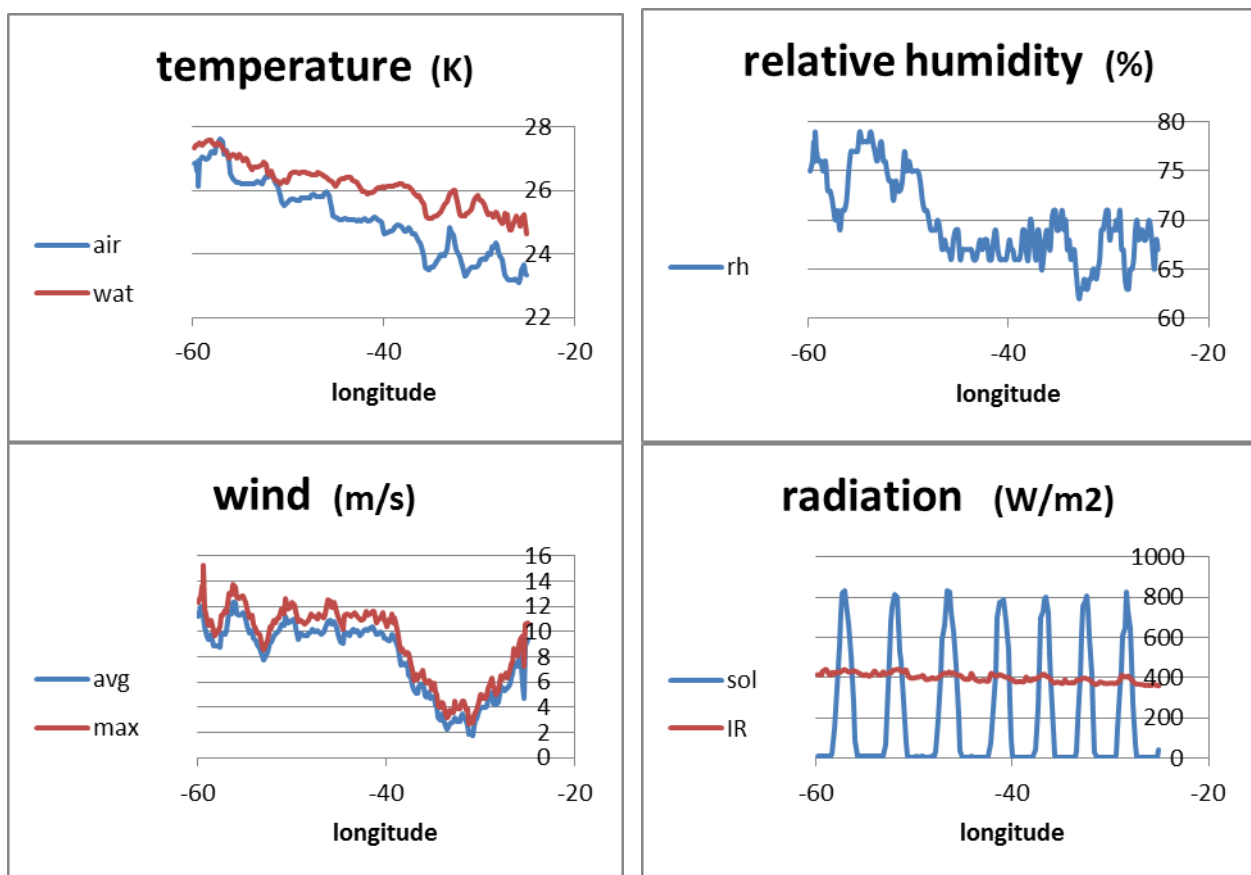


Figure C Atlantic cross-sections for December at 15N between -60W and -25 W for temperature, relative humidity and wind-speed at the surface and for broadband solar and infrared radiation. (MPI-M)

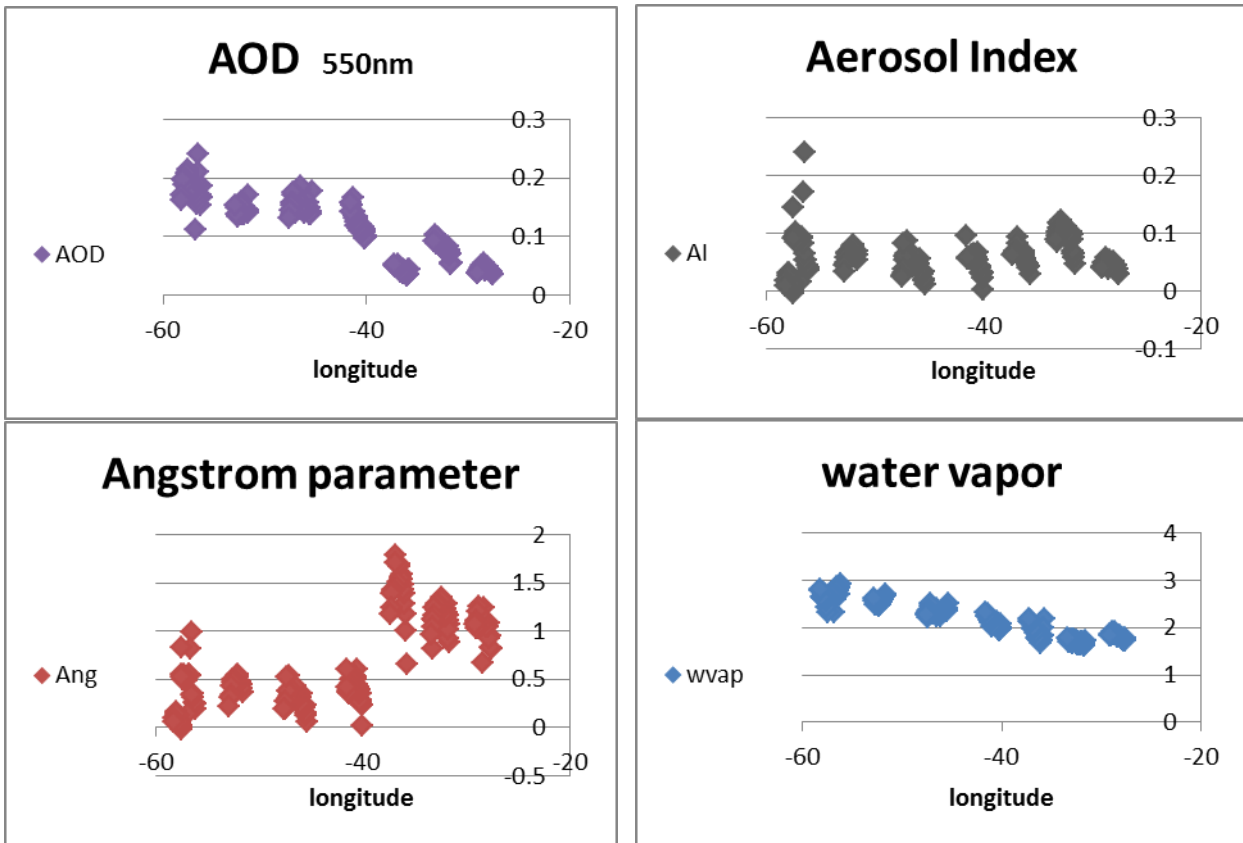


Figure D Atlantic cross-sections for December at 15N between -60W and -25 W for sun-photometer derived data for AOD at 550nm, Angstrom parameter, aerosol index and water vapor. (MPI-M)

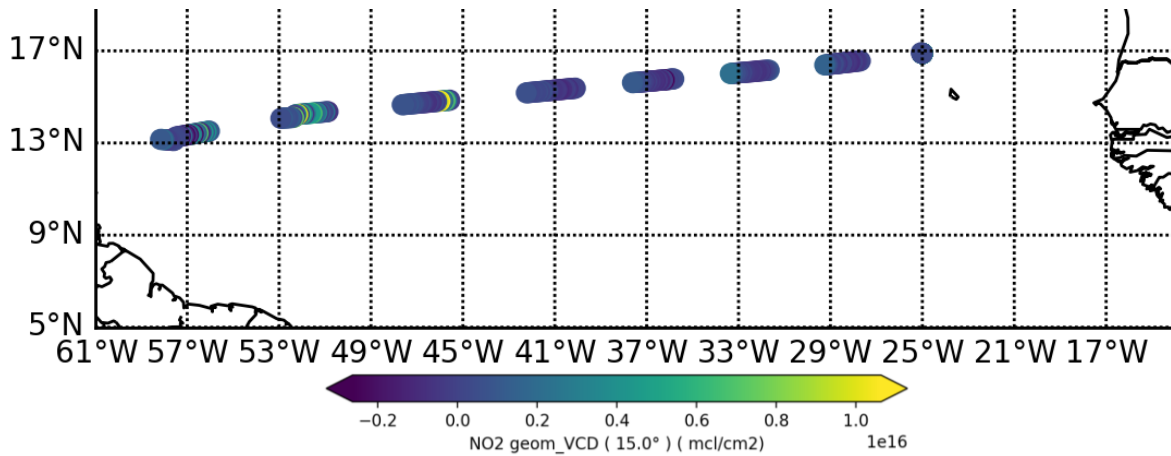


Figure E NO₂ column data sampled along the Atlantic cross section. The occasional higher values on the western side are caused by sampling ship exhaust (due to unfavorable winds). (MPI-C)

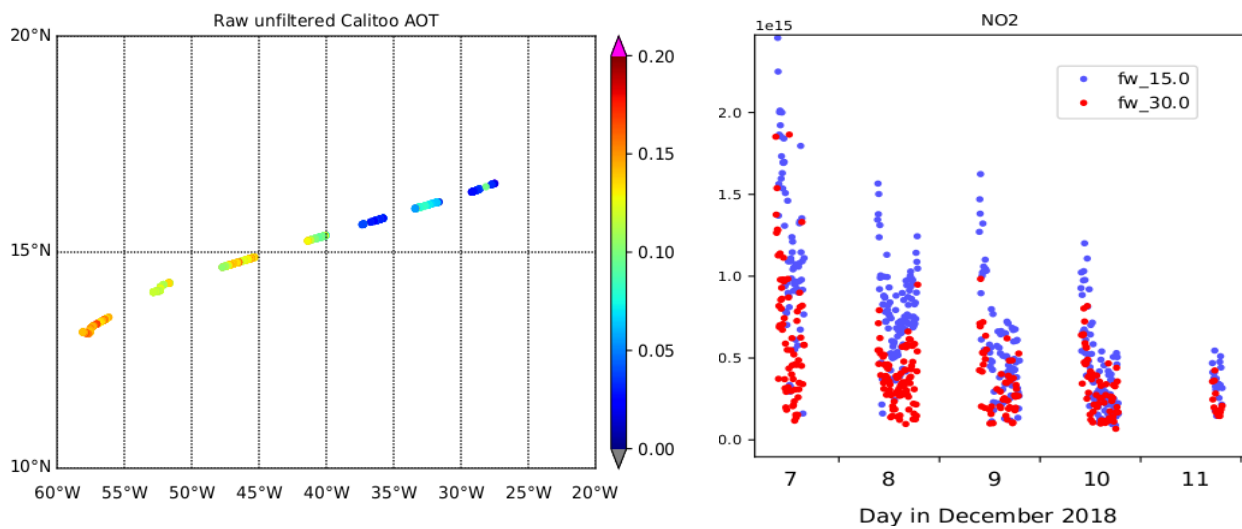


Figure F mid-visible sunphotometer optical depth measurement summary (left) and NO₂ loads at different elevations (15,30 deg) above the horizon (right) with larger pollution early on after leaving Mindelo. (KNMI)

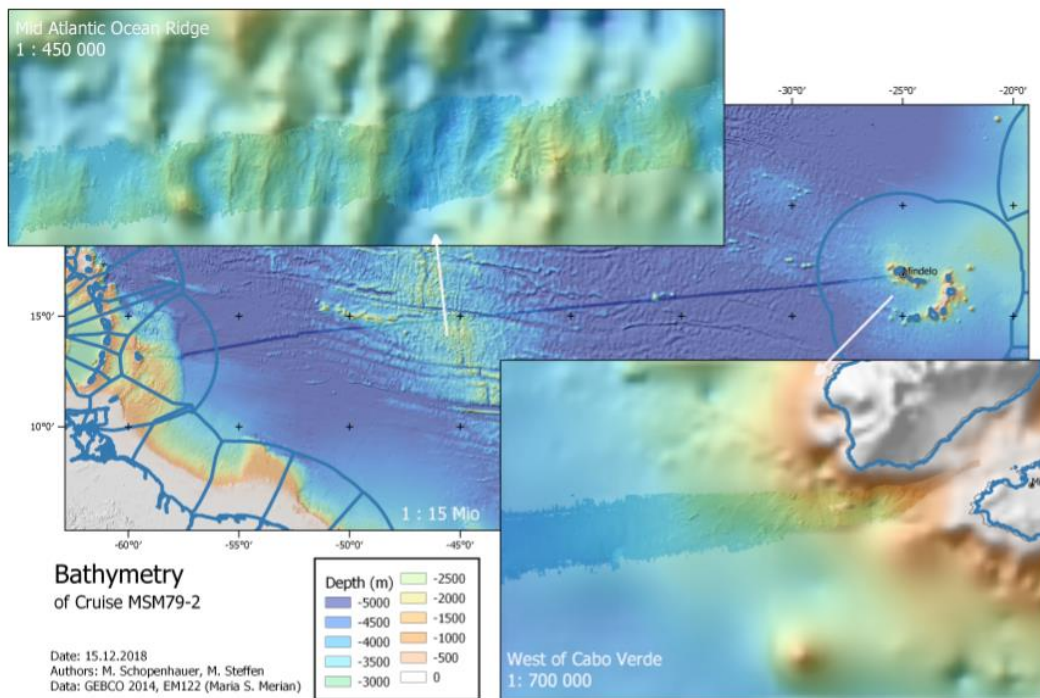


Figure G ocean floor details for the Atlantic Ridge and near Capo Verde. (HCU)

Acknowledgements

We thank the crew for the relaxed home away from home atmosphere, the captain for helping in achieving our science goals, with route changes even on short notice, the kitchen for the excellent food, and the Leitstelle Deutsche Forschungsschiffe in Hamburg for their assist in getting the permission for sampling in Barbados EEZ in ‘the last minute’.

Teilnehmerliste

1. Stefan Kinne	Fahrtleiter / <i>Chief Scientist</i>	MPI-M
2. Ulrike Kirchner	Sonnenphotometer (Aerosole)	MPI-M
3. Stephanie Fiedler	Kameras (Wolken)	MPI-M
4. Olaf Tuinder	MAX-DOAS (Spurengase)	KNMI
5. Vinod Kumar	MAX-DOAS (Spurengase)	MPI-C
6. Dagmar Hainbucher	Thermosalinograph, CTD	UNI-HH
7. Anja Schneeorst	ARGO floats	BSH
8. Melanie Steffen	bathymetry	HCU
9. Mila Schopenhauer	bathymetry	HCU

MPI-M	Max-Planck Institute für Meteorologie	Hamburg
KNMI	Koninklijk Nederlands Meteorologisch Instituut	De Bilt
MPI-C	Max-Planck Institute für Chemie	Mainz
BSH	Bundesamt für Seeschifffahrt und Hydrographie	Hamburg
UNI-HH	Universität Hamburg, Meereskunde	Hamburg
HCU	Hafen City Universität	Hamburg

list of stations

- no stations
- 6 ARGO floats deployed

Table Details to the ARGO float deployments

Float S/N	WMO	Lat	Lon	DeplDate [UTC]
8593	3901677	14° 37,570' N	047° 59,812' W	2018-12-11 21:36:28
8594	3901676	15° 29,154' N	039° 00,122' W	2018-12-10 03:00:58
8595	3901684	15° 45,825' N	035° 59,923' W	2018-12-09 10:24:37
8596	3901683	16° 02,796' N	032° 59,857' W	2018-12-08 16:52:32
8597	3901682	16° 17,992' N	030° 00,014' W	2018-12-07 23:10:05
8598	3901681	16° 26,289' N	028° 47,514' W	2018-12-07 16:00:55