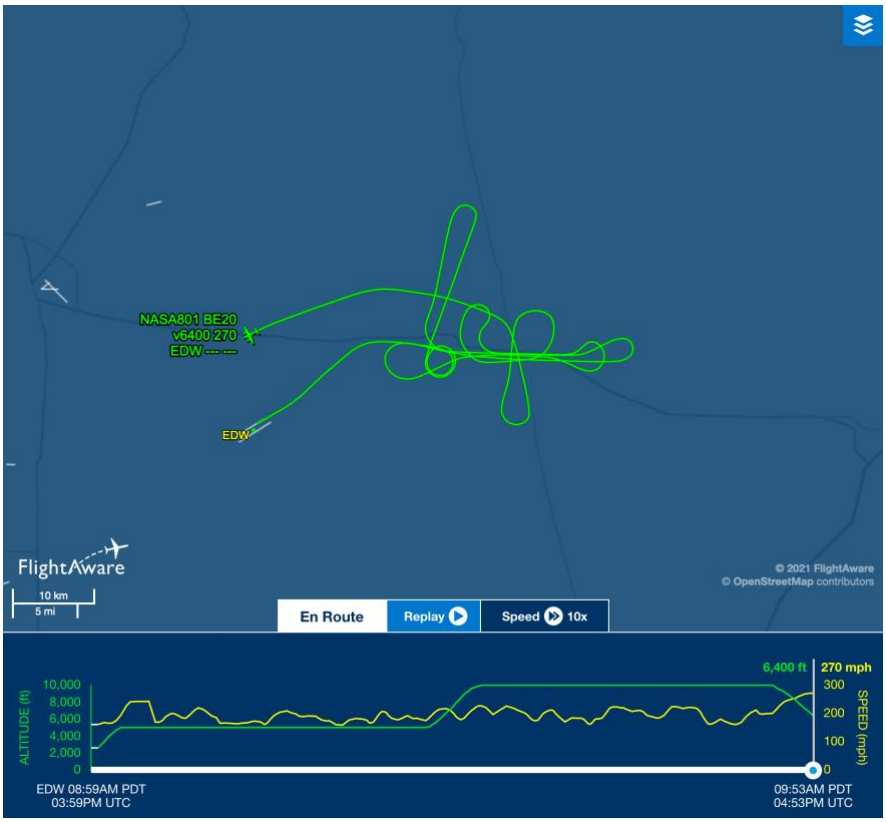
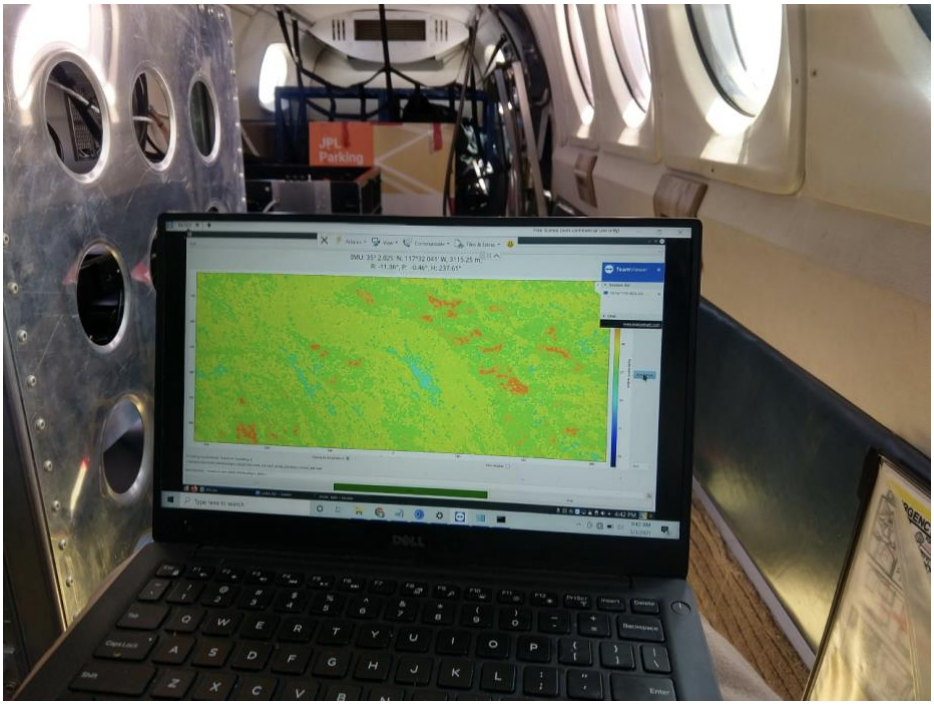
S-MODE Field Experiment Report 2021-05-03

Summary: After being delayed by COVID-19 for a year, the S-MODE EVS-3 team had their first successful set of flights on May 3rd aboard AFRC's NASA 801 B200 aircraft. The day's activities were centered on demonstrating the joint operations between JPL's DopplerScatt (wind and current measurements), UCLA's MOSES (sea surface temperature (SST) measurements), and WHOI's ocean wave glider (currents at depth and environmental conditions). A long (7am to 7pm) day included the georeferencing calibration of MOSES, and fast (<½ hour) sampling of a 100 km x 25 km patch of quickly varying ocean currents by the three instruments for close to 5 hours. This combination of instruments, which will be joined by UCSD Scripps' MASS instrument in a few days, represent some of the key measurements that will be made during the forthcoming S-MODE campaigns.

MOSES Georeferencing Calibration: MOSES is a new near-infrared camera to measure SST. In order to figure out where the camera is pointing, the instrument needs to be flown in orthogonal directions over a known landmark: in this case a road crossing. MOSES PI, Jeroen Molemaker (UCLA) flew early in the morning to obtain these calibration data.

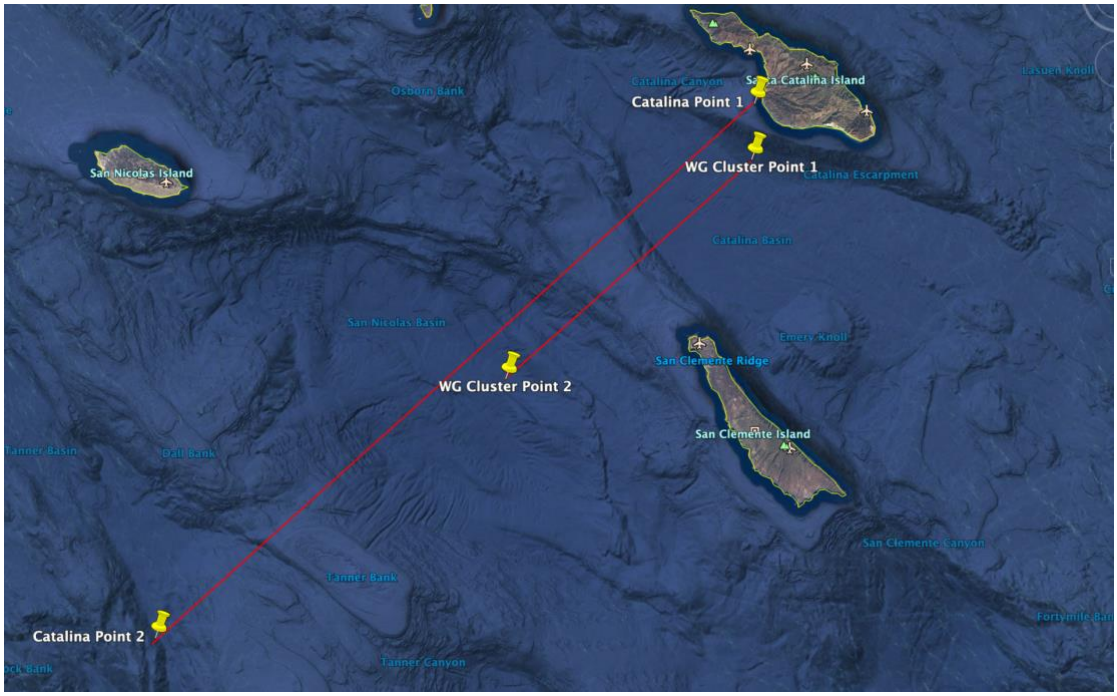


MOSES calibration flights



MOSES real time display of the calibration site: not as exciting as the ocean!

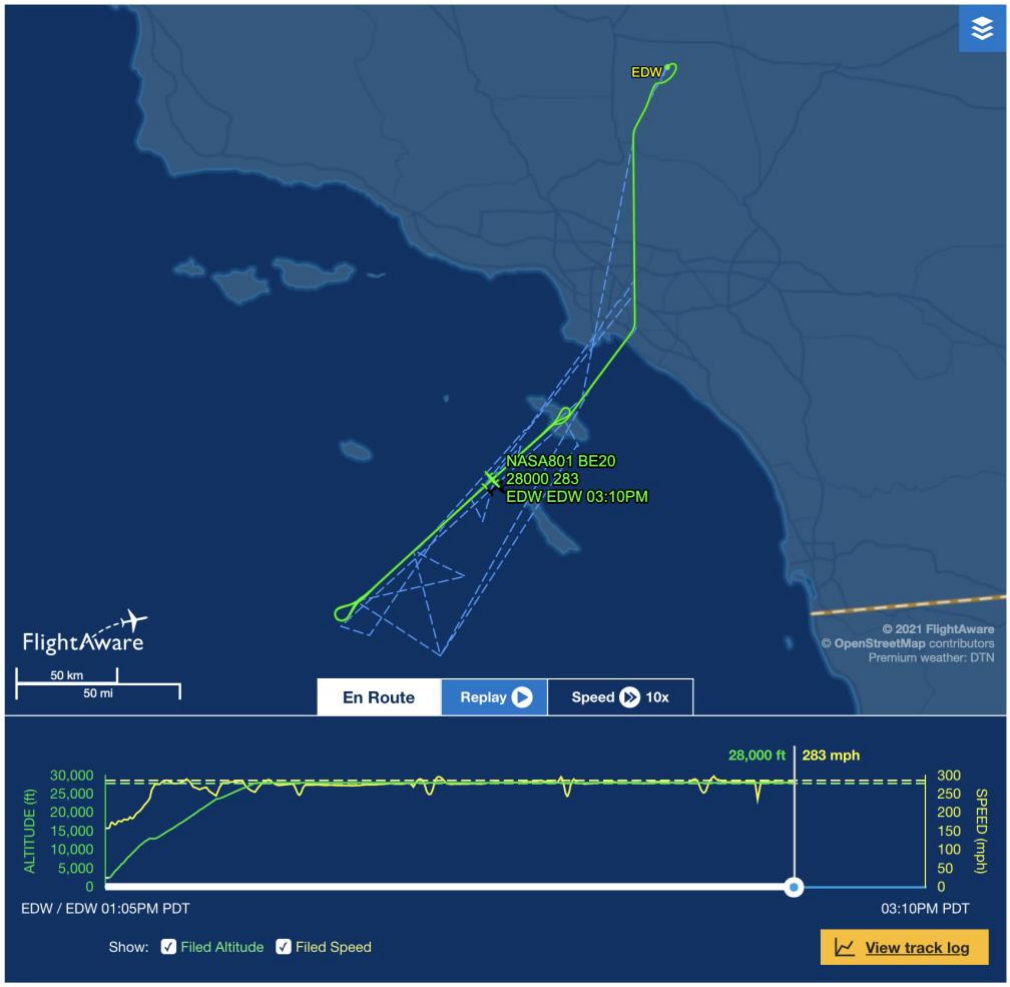
Afternoon Data Collection: Today's experiment concentrated on mapping quickly varying currents between Santa Catalina and San Clemente Islands, using the airplane and wave glider tracks shown below:



NASA 801 tracks (northern track) imaging the wave glider track, displaced by 6km to the SE. DopplerScatt and MOSES provide a two-dimensional x-y

surface image that complements the wave glider's two-dimensional (along-track & depth) information.

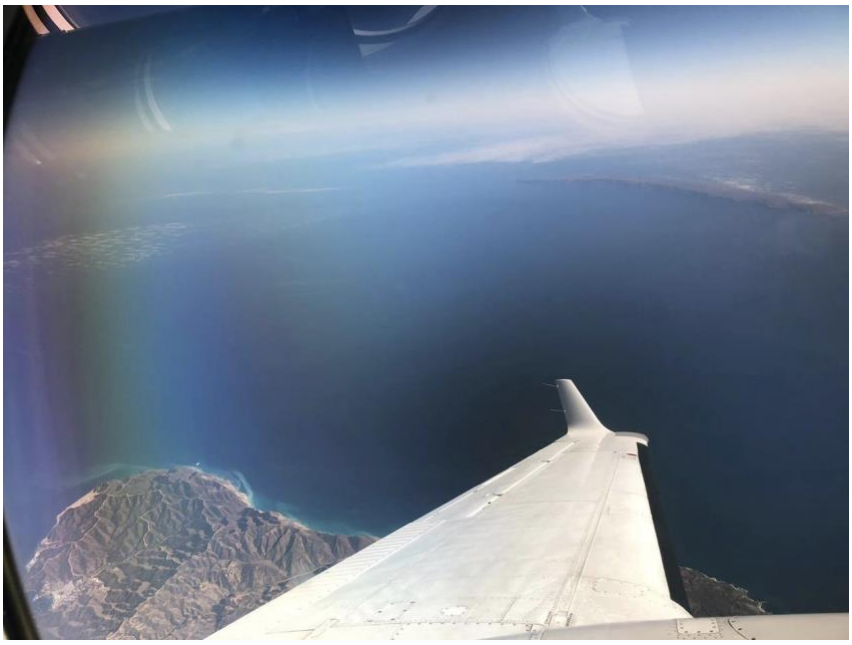
These were the 12 lines flown in the afternoon. To achieve fast temporal sampling and calibration of DopplerScatt, the same line was flown 12 times in alternating opposite directions:



Racetrack line collected 12 times over 4.5 hours during the first day deployment.

Collecting data with MOSES, an optical instrument, poses challenges in May due to the common occurrence of fog and low clouds this time of year: the well known Southern California "May Gray" phenomenon. Although the day started quite foggy, the fog lifted in the afternoon, leaving a few scattered clouds at the end of the track. The following figures show conditions seen from the plane during the flight.
The NASA 801 B200 was flown by pilots Hernan Posada and Scott "Jelly" Howe, who put in a very long flight day. The instrument operators (and also S-MODE investigators)

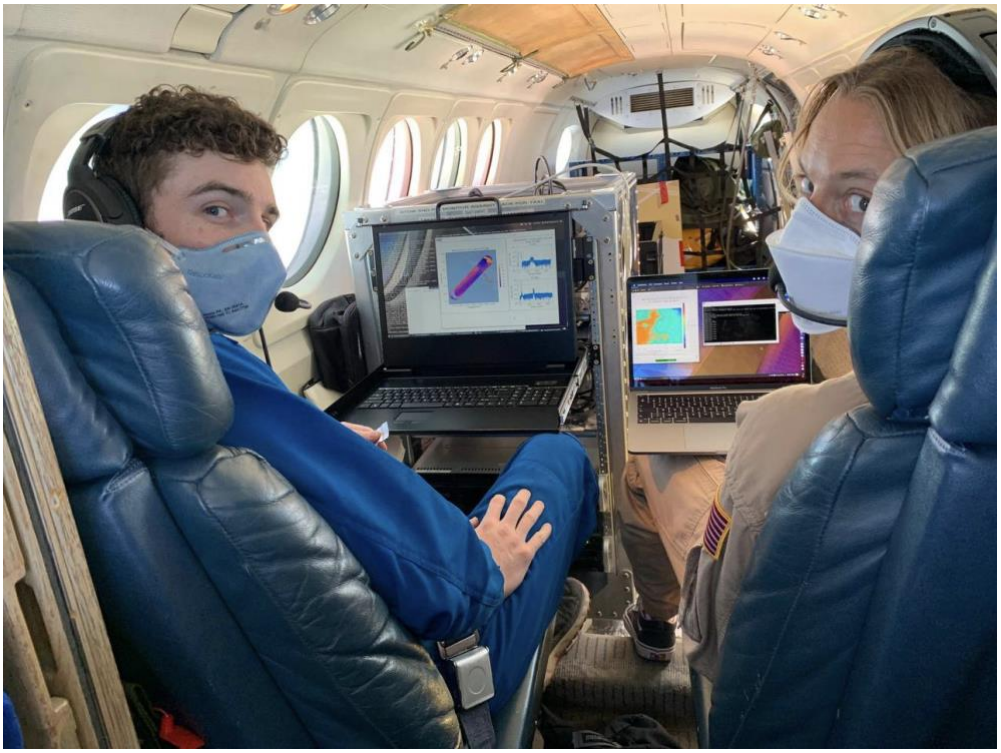
were Delphine Hypolite (MOSES/UCLA) and Alexander Wineteer (DopplerScatt/JPL). They were captured following NASA COVID-19 protocols by Jelly Howe in the 4th image below. Notice that their instruments are showing radar brightness (related to wind speed) and SST in real time. The final image shows a closeup of the DopplerScatt real-time display, that features Santa Catalina island and the changing winds (reflected in changing radar cross section) over an entire track of DopplerScatt data.



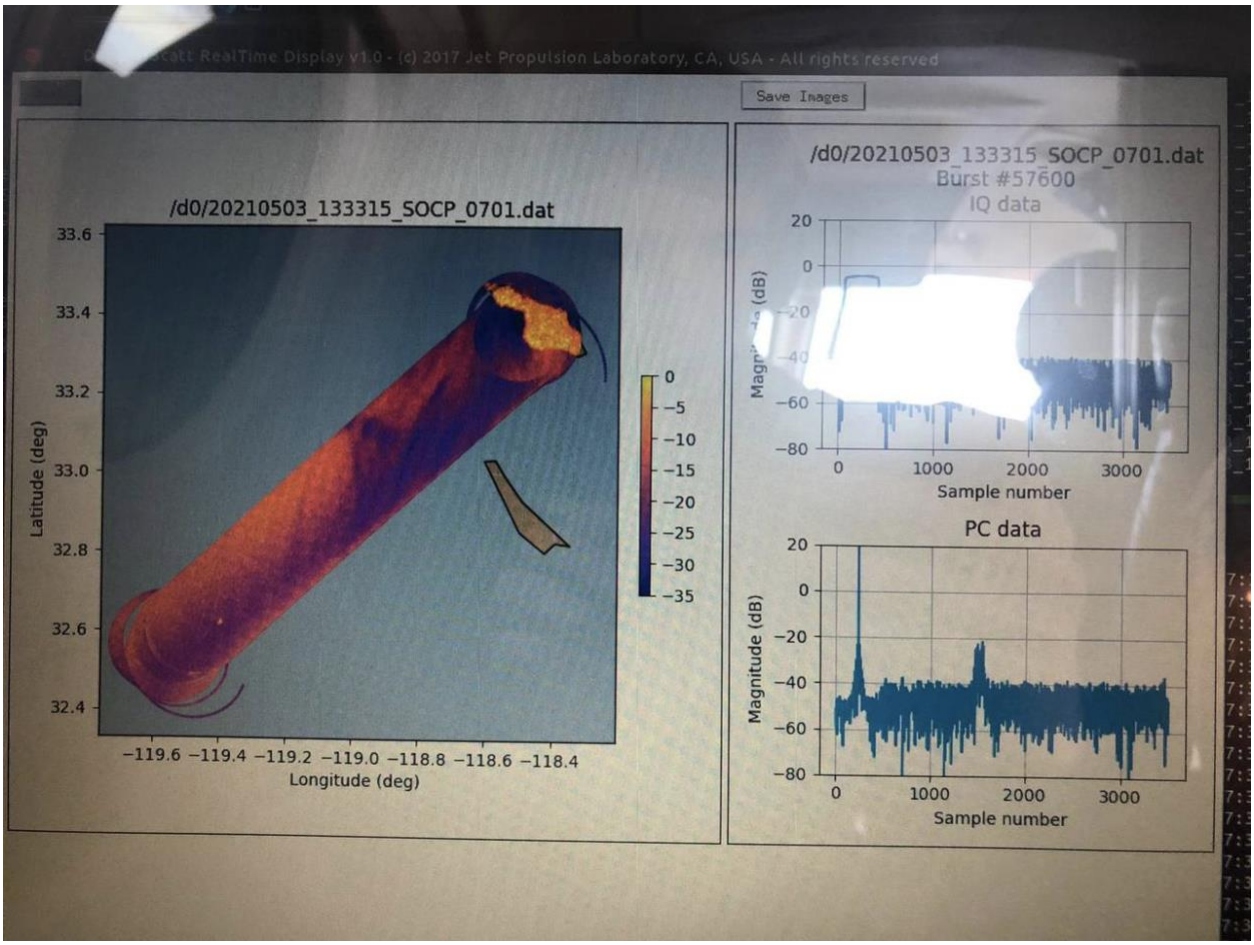
Santa Catalina Island is below, San Clemente in the distance. Beautiful (mostly) cloud free conditions.

A strong wind from the north was blowing, resulting in strong swell, captured by the sun glitter.

There were scattered clouds at the southern end of the data collection lines.



MOSES instrument operator, Delphine Hypolite (UCLA), on the right, and DopplerScatt instrument operator, Alex Wineteer (JPL), show off their real-time data and COVID-19 awareness to AFRC pilot “Jelly” Howe.



DopplerScatt real-time display, captured by JPL's Alex Wineteer, shows Santa Catalina Island (in bright yellow) together with radar brightness (in dB), indicative of wind speed. The wind flow in the south is indicative of strong southerly winds, while wind modulation is apparent near the islands (San Clemente is shown by a polygon on the right). The panels on the right allow for real-time monitoring of radar health.