

CVO EVENTS FOR 990824 – TUESDAY.

After yesterday's hot temperatures at CVO and strong winds on the coast, expected stratus to develop. Northerly winds and cooling air temperatures.

Fog in the high valley below Mary's peak showed promise at daylight. First VIS images indeed showed band of clouds extending from the south up to Washington. The planned 9 am launch was advanced by half an hour, in order to accommodate the idea of making a second flight in the afternoon.

Satellite images throughout the morning showed a wide band of uniform cloud off the coast, much structure at its W boundary and many interesting lines and swirls. Band narrowed with time, remaining adjacent to the coast.

FLIGHT 1 – 15:32Z T/O; 19:04 L/D

Flight notes 990824 Coastal Stratus

Crew: Hoshor, Kelly, Haimov

1521 Start engines

Corvallis weather: clear skies, though can see tops of coastal st coming through low spots in the coastal range. Plan: missed approach at North Bend, then into W93 area for detailed studies.

1532 takeoff

Enroute to North Bend at 10 kft. Can see haze layer above the st, so can't see the horizontal westward extent very well. Clear above the st in all directions. On approach to North Bend, note cloud tops at 1900 ft with winds 016/9 and cloud bases at 1100 ft with winds at 020/9.5. There is a lot of near-ground "scud" along the shoreline.

1616 climbout from missed approach, through ragged cloud bases at about 1100 ft. Cloud tops about 2000 ft, capped by a strong inversion.

For the period roughly 1620 through 1645 we tried to skim the cloud tops, interrupted by ascents and descents through the cloud and at least 500 ft above cloud. We tried to keep the "skimming" runs just low enough to be intercepting the top-most cloud elements, so the cloud presence would be recorded by the fssp, etc. The entire run was on a 252 deg magnetic heading (270 true). Notes from "skimming:"

Time	Cloud Tops(ft)	Cloud Bases(ft)	Other notes
1623	2100	1300	fssp 120-150/cm3
1626	2000	1300	
1629	1700	1000	
1632	1450	1000	
1636	1500	1100	
1642	1600	900	
1643	1400		

Move back to about 125.5 longitude, to have a bit more maneuvering room in the W93 area. We then tried a series

of large-radius spiral ascents and descents, with slow rates of ascent or descent, going at least 500 ft above cloud top and at least 100 ft below cloud base on each excursion.

1656 First spiral down then up in a no-roll (flat, rudder-only) right turn, with the radar side-looking. Here we passed cloud base at 1000 ft and cloud top at 1700 to 1900 ft.

1705 Second spiral down then up with small bank angle and radar up-looking, finding cloud top at 1800 ft and cloud base at 1000 ft.

1721 Spiral descent from 5000 ft (I think) to 300 ft. At 5000 ft and below we recorded dew-point depressions of about 5 C. Then, just 100-200 ft above cloud top, the dew-point depression was even greater (7-8 C), before collapsing to the temperature at cloud top. The temperature inversion was strong (roughly 5 C).

1727 level run at 300 ft on 160 mag heading. Will use 160 and 340 mag for wind-parallel passes, these being parallel to the "average" cloud-layer wind. The cloud appearance from below was distinctly different from prior days, being very flat and uniform in all directions and with no sub-cloud "scud" elements visible. Also no signs of sub-cloud drizzle.

1734 level run on 340 mag heading at 1500 ft.

1741 Right, 45-degree banked turn to start second pass on the 160 mag heading at 1500 ft.

174830 spiral up to 2500 ft then back down to 300 ft. Cloud tops still 1700 ft.

1753 level run at 300 ft on 070 mag (crosswind) heading.

1800 level run at 1500 ft on 250 mag heading.

1807 second run at 1500 ft (on 070 mag heading) after right turn at 45 deg bank.

1813 spiral up to 4000 ft then back down to 300 ft. From above cloud, can now see open area to west, with the sharp and distinct cloud edge extending southward from about North Bend and passing offshore from Cape Blanco. To the west the cloud cover appears broken.

1821-1833 porpoising between 2500 and 900 ft, on 000 mag heading.

1833 start last climb from 300 ft, sounding to

10 kft before leveling out to start Rodi maneuvers. At about 1839 took series of photos to document cloud edge to east and broken clouds to west.

1842 start Rodi maneuvers

1914 land

Distinctive features from this case:

- cloud uniformity in the horizontal. It was more uniform than I remember seeing in any of the 1995 cases, and definitely more uniform than anything we have seen thus far in 1995. The radar cross-sections also didn't show the vertical striations of other cases.
- higher droplet concentrations than we have seen on other flights (some max values to 150/cm³).
- little if any drizzle-sized drops, and no signs of drizzle below cloud base.
- no evidence of inversion height ascending with distance from shore. A small zone of near-shore clouds had higher tops than those further out (up to 2100 ft near shore vs. average 1700 in study area). The top and base heights in the study area were apparently quite uniform.
- The layer above cloud top was dry, with a curious shallow layer of even drier air in the first 100 or more feet just above cloud present on one of the soundings. I don't know yet if the data show a similar drier layer in the other soundings and porpoisings. The temperature inversion was strong, at least compared to other cases so far this year.

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The second flight was planned for 3:30 pm but Center would not clear us to W93 until 5:45 pm. Images indicated a continuation of the wide band along the coast.

FLIGHT 2 – 00:14Z T/O; 03:02 L/D. Crew: Hoshor, Vali, Haimov

Coast was clear by NPT but cloud invaded over land to the N and S. Practically no Ci over W 93; there are few patches to the N, their shadows are clearly visible.

From 3 km alt. some dark patches are clearly visible in the layer. Most uniform deck seems to run along a line to the S. After entering W93 at the NE corner (point T) headed S along what was seen as the most uniform cloud zone.

Cloud top at 1100', 150 cm⁻³, horizontal visibility recovered at 400', but there is no definable cloud base. Patches extend to the surface.

After this, a number of porpoising maneuvers and several long legs at constant altitude confirmed that there was a great deal of variability in cloud density. Many clear areas to S and W of the NE corner of W93. Densest cloud region in the NE corner.

Cloud is really a **fog**, with tops varying between 500' and 800'. Even in visually clear areas, rainbows confirm what the probes show: large droplets. FSSP concentrations only a few to tens of cm^{-3} . Both 1D and 2 probes indicate droplets to probably up to 100 μm .

Cloud remained most solid in NE corner. However, echoes were detectable in essentially all clouds. Some areas had large patches. Reflectivities reached to +5 dBZ.

Flight pattern included porpoising, spirals (with level wings) and constant altitude ovals.

Cockpit display went blank once; 'tigger' was rebooted to solve the problem, although inadvertent switching off the power to the front display was part of the problem.

All sensors seemed to have been working. The high rate recording of the PVM data was also successful.

Post facto: Flight was in an area just E of more substantial band of clouds.

Thin fog with large droplets is an extreme situation for examining patchiness which is evident in the radar echoes.

Comparisons with sat. retrieval will test limit of applicability for thin clouds.

Fog is also an unusual case for droplet spectra, variability, fluxes, ...