

Fults et al.: Wintertime Aerosol Measurements during the Chilean Coastal Orographic Precipitation Experiment, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-185>, in review, 2019.

Review

General

The paper presents results from a measurement campaign (CCOPE) on the Chilean Pacific Coast. The data consist of particle number concentrations measured with a condensation particle counter (CPC) and size distributions measured with a high-resolution optical particle counter (UHSAS) at a measurement station near the town of Arauco. The data are used for parameterizations of aerosol properties relevant to cloud and precipitation processes: number-to-volume ratios, concentrations of cloud condensation nuclei and sea-salt aerosol. The goal is to use these parameterizations for interpreting other data collected during the campaign on the Nahuelbuta Mountains about 30 – 100 km south of Arauco. The paper is basically well written and I can recommend its publication in ACP after some corrections and more detailed explanations.

It is in a way pleasant to see that it is still possible to make relevant observations even with such very simple traditional aerosol instrumentation when the setup in most similar campaigns today consists of several instruments measuring both physical properties and chemical composition. On the other hand, the lack of knowledge of size distributions at sizes smaller than those measured with the UHSAS, chemical composition and hygroscopicity increase the uncertainty of the interpretations. Discuss this.

The trajectories were calculated with HYSPLIT by using the GDAS wind data with a 0.5° spatial resolution. This is so coarse that the effects of local topography are not properly taken into account. The measurement site is very close to the town of Arauco and the sea, Gulf of Arauco is to the north of it and to the west of Arauco there are some hills higher than 300 m. As a result, even when the HYSPLIT trajectories show that wind blows from the west local wind in Arauco may have blown from other directions bringing anthropogenic aerosol from the town. The main goal of the paper is to use the parameterizations in the CCOPE data interpretations and modeling. During westerly winds the Nahuelbuta mountains are definitely not affected by the anthropogenic sources around the Gulf of Arauco whereas your measurement station obviously is – the average total particle number concentration in air that you classified as "clean" was $2759 \pm 1827 \text{ cm}^{-3}$. This is high compared with marine aerosol essentially everywhere, possibly also on the coast directly to the west of the Nahuelbuta mountains. In light of this, discuss the validity of the results for CCOPE.

Detailed comments

Section 2.1. Add information on the distance of the Arauco measurement site from the sea, from the town of Arauco, the paper mill, the Curanilahue measurement station and the rest of the CCOPE campaign area.

L145-146 " ... **CPC concentrations were recorded once per second and once every 10 seconds (Table 1).**"

The expression "CPC concentrations" would mean there are many Condensation Particle Counters flying in the air. That is not quite correct. Use "... CPC data were recorded..." Another thing I don't understand, is the logic of saving data once per s and once per 10 s. The 1-s data has it all, from it 10-s data can be picked up if needed. What is the logic?

The expressions "**CPC concentration**" and "**UHSAS concentration**" have been used in some sentences also later. As I wrote above, these should be rewritten. For example title of section 4.1 should rather be "Comparison of particle number concentrations..."

L256-258 " ... **194 classify as clean sector. For both sites we required a clean sector wind speed > 1.5 m s⁻¹ in addition to the clean sector directional criteria (Fig. 2).**"

You started wind measurements at Arauco on 19 June. Did you use only the aerosol data after that in this comparison?

L286-289 " **During this two-hour data segment, centered on 00 UTC June 9 (9 pm local time), winds were light at Arauco and Curanilahue (< 2 m s⁻¹) and the wind direction was variable at Curanilahue (Arauco Site wind direction measurements are only available after 19 June 2015; Sect. 2.1).**"

You wrote that wind measurements at Arauco started on 19 June. How can you then write that the wind at Arauco was < 2m/s on 9 June? The distance between Arauco and Curanilahue is approximately 25 km, the measurement site of Curanilahue is at > 100 m ASL and there are quite a few valleys and hills higher than 100 m ASL between the two sites. So the local winds at these sites may have been completely different. How justifiable is it to use Curanilahue in interpreting Arauco data?

Section 4.3

In calculating the N/V ratio, justify using N_{UHSAS} and not N_{CPC} for N? What did HK98 and VD00 use?

Section 4.4

L377-385 This is an important part of the paper and it should be understood properly in order to understand the parameterization FAC(SS) presented later. Now it is not quite clear to me. You have earlier presented some of the simplest possible aerosol equations, Eqs. (1) – (4), which is fine, they are good to be shown. But now when it comes to a clearly more complicated issue, equations are missing which is not logical. And on line 379 it is written " ... ***kappa-Köhler formula of Petters and Kreidenweis (2007, their Eq. (11))***" but their Eq. (11) shows the relationship of growth factor, dry particle diameter, kappa, and relative humidity. How is this used to " ***...interpret a FAC's lower-limit diameter as an upper-limit SS***" as was stated on line 377? Is the referred equation right? Write the proper equation and explain the steps of the calculation in more detail so that readers can repeat the calculation for their own data.

Section 4.5

Refer also to O'Dowd, C. D. and de Leeuw, G. (2007) and consider comparing your results also with the parameterization they presented

O'Dowd, C. D. and de Leeuw, G.: Marine Aerosol Production: a review of the current knowledge, Phil. Trans. R. Soc. A., 365,1753–1774, doi:10.1098/rsta.2007.2043, 2007

Fig 1. Add a distance scale.

Fig. 3b. Why is the y axis reverse? Why is the lowest pressure 920 hPa? A sensible scale would be 990-1020 hPa.

Fig. B1. What is the vertical dashed line at ~11:33 UTC?