

S1 Case study: Persistent fog

This case study was included in the first version of the article but subsequently removed following the reviewer's suggestions, to reduce the number of figures. Therefore, it was decided to leave this content here, in the supplementary material, for future reference.

The persistent fog case study is shown in Fig. S1. This fog case occurred in the fall season, a few days apart from cases 1 and 2 in the article. It is characterized by a very late dissipation time 14:40 UTC, which is eight hours after sunrise. We will focus here on the differences with respect to cases 1 and 2, which can explain the persisting character of this fog layer. During the fog life cycle of this case, the CTH behaves similarly to that of case 1, reaching about 200 m agl and revealing both positive and negative evolutions with a rate of about $\pm 25 \text{ m h}^{-1}$. Meanwhile, the LWP behaves similarly to that of case 2, ranging between 50 and 100 g m^{-2} , which leads to a fog layer with a significant RLWP reaching $+50 \text{ g m}^{-2}$ during the first five hours of its life cycle. Adiabaticity remains always close to 0.6, indicating that the layer is well mixed for the complete fog duration. At 12:00 UTC, nearly six hours after sunrise, the RLWP is still greater than $+30 \text{ g m}^{-2}$, a clear sign that the fog is not about to dissipate, as confirmed by the 200-m near surface visibility. Between sunrise and noon, the rate of change of RLWP switches from positive to negative values (mostly within $\pm 10 \text{ g m}^{-2} \text{ h}^{-1}$). Contributions to RLWP changes from LWP and CTH changes are of opposite signs, with LWP being the dominant contributor, and their values cross the zero line nearly simultaneously eight times during the fog life cycle (Fig. S1 (e)). This is clear evidence of the feedback mechanisms that occur in fog between CTH changes and LWP, that tend to dampen the evolution of RLWP and lead to fog layers that persist for many hours even during daytime. The fog dissipation at 14:40 results primarily from a significant decrease of LWP after 12:00 UTC with a comparatively stable CTH. At the time of dissipation, when RLWP reaches 0 g m^{-2} , there is still about 25 g m^{-2} of LWP in the 200 m thick fog layer, which becomes insufficient to maintain the fog at the ground.

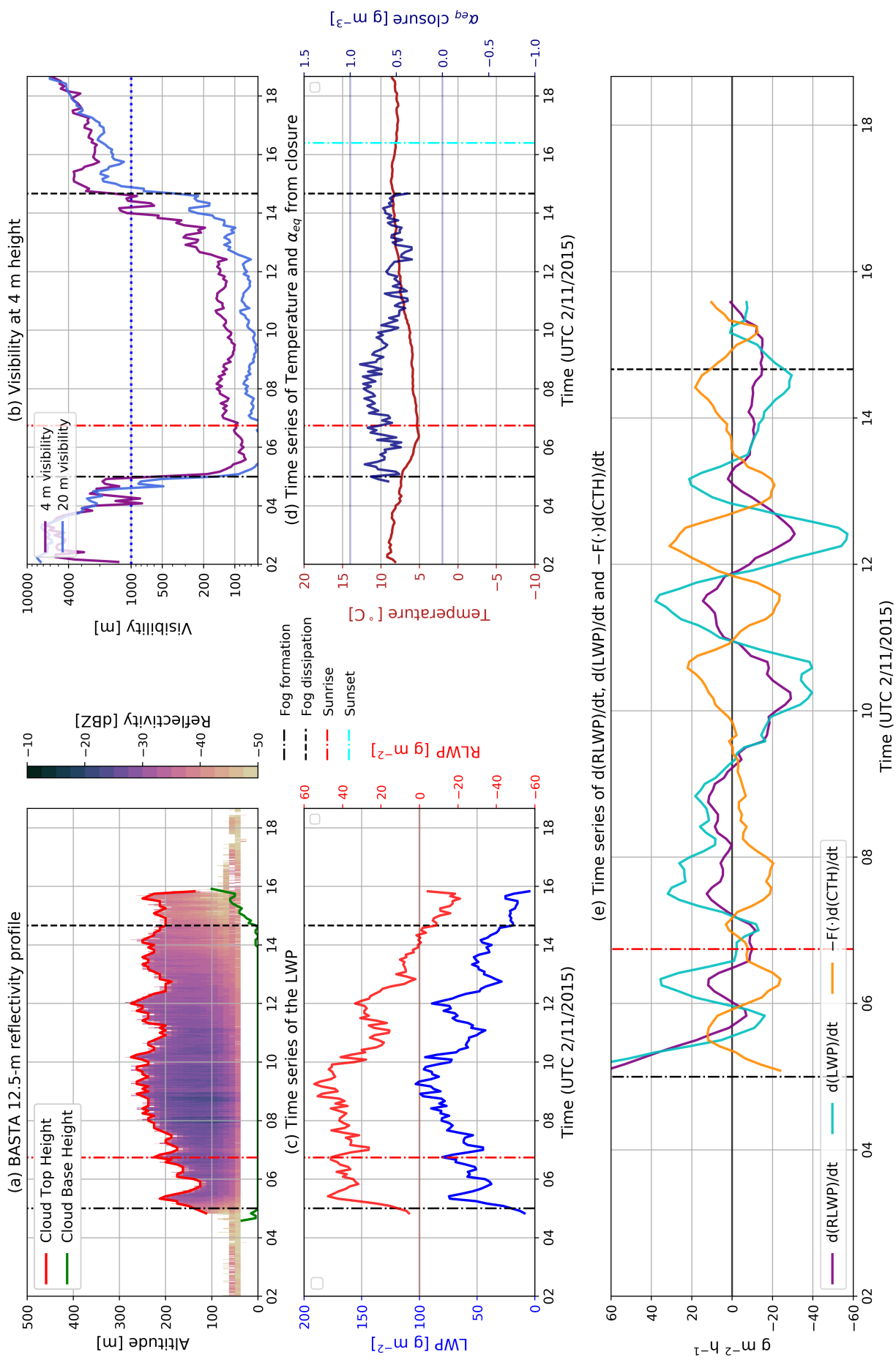


Figure S1: Case study 3. (a) Cloud Base Height (CBH), Cloud Top Height (CTH), and the cloud radar 12.5 m resolution reflectivity profile for the first 1000 m of height. (b) 4-m and 20-m horizontal visibilities. (c) Fog/Stratus layer measured LWP and computed RLWP. (d) Temperature and closure adiabaticity (calculated only when visibility is less than 2000 m). (e) Change rate of RLWP, with the individual contributions from LWP and CTH variations. In each panel, the time of fog formation and fog dissipation are clearly marked as well as the time of sunrise.

S2 Number of samples in fog formation and dissipation statistics

As indicated in the article, all 56 fog events lasting 3 or more hours are considered and superimposed in the life cycle statistics. In Sect. 3.3 of the article, it is explained that to have a valid sample of conceptual model variables in a given 5 min time block, the given block must have valid measurements of fog CTH, LWP, surface visibility, and surface temperature and pressure. Therefore, several fog cases will have time periods of varying duration without samples of conceptual model variables. This causes variations in the number of samples available for each time instant.

Figure S2 presents the number of valid samples considered for each bin of the boxplots in panels (a.1) and (a.2) of Fig. 10 of the article (Sect. 5.2.1 Fog formation). Figure S3 shows the same information for the boxplots in panels (a.1) and (a.2) of Fig. 11 (Sect. 5.2.3 Fog dissipation).

In Fig. S2 it can be observed that before formation, data points come from about 10-20 fog cases out of 56. This happens because radiation fog cases do not contribute a significant amount of samples, because their CTH is too low in this stage to be retrieved with the radar. Hence, the cases that are mostly considered in this stage are stratus lowering fogs. After fog is formed, the amount of cases contributing valid samples rises up to 40 out of 56.

Fig. S3 shows that before dissipation, the number of valid samples contributing to statistics is of 45/56. This number starts to drop after dissipation, as valid samples decrease when fog dissipates in the different superimposed fog cases.

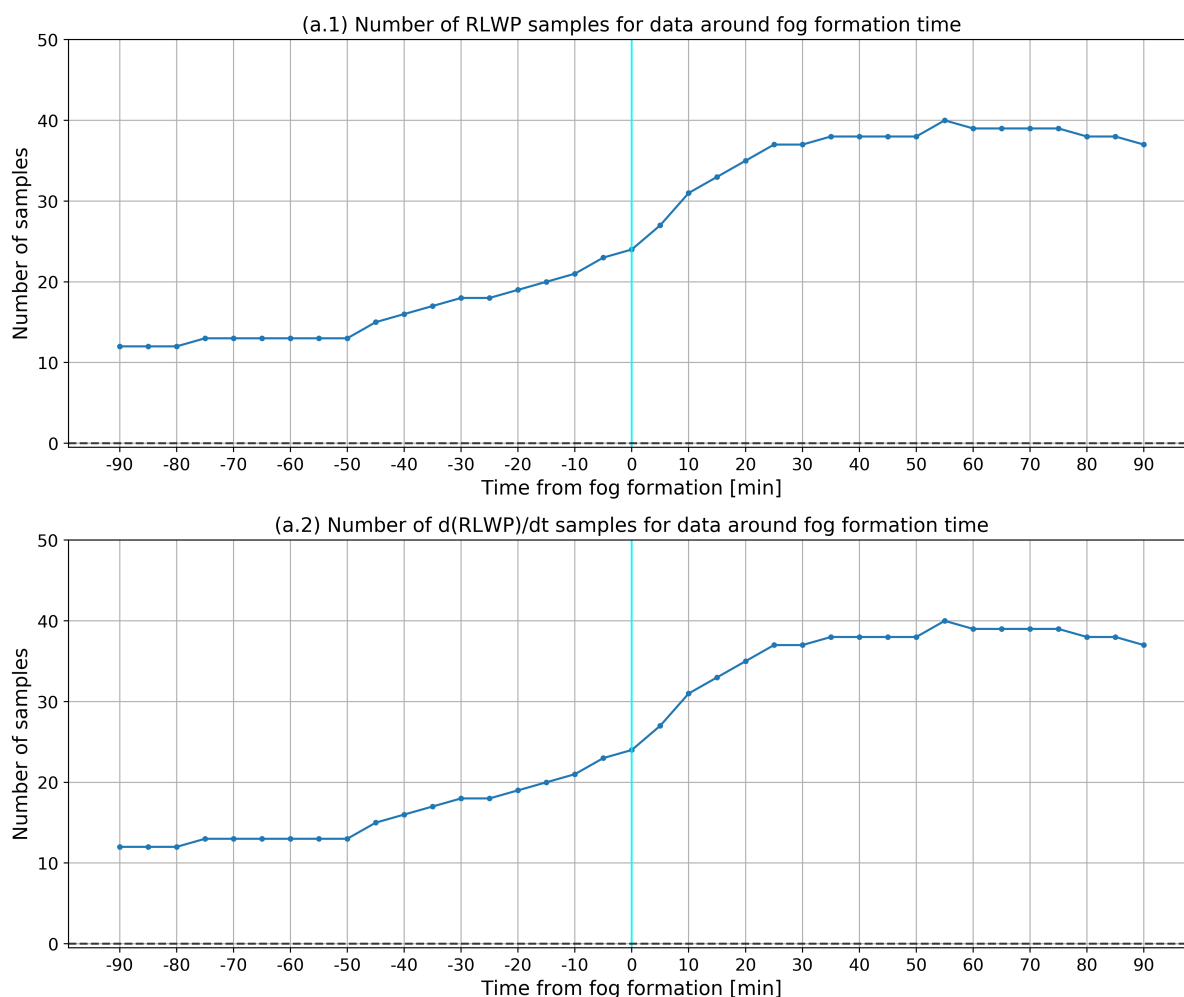


Figure S2: Number of valid samples for each time instant in the boxplots of panels (a.1) and (a.2) of Fig. 10 in the article (Sect. 5.2.1 Fog formation).

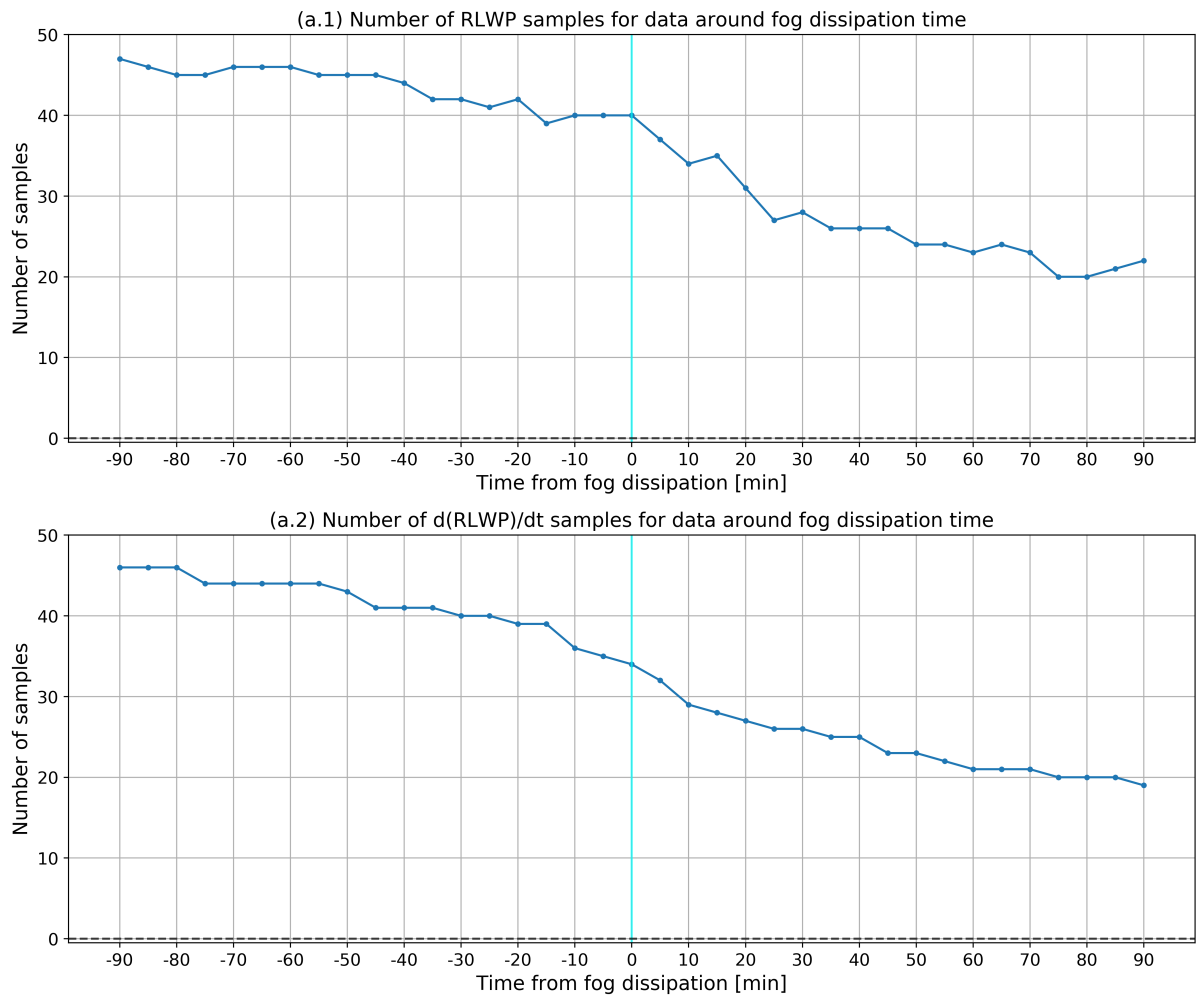


Figure S3: Number of valid samples for each time instant in the boxplots of panels (a.1) and (a.2) of Fig. 11 of the article (Sect. 5.2.3 Fog dissipation)