to quantify the quality of this collapse, first, we limited statistics. This illustrates the difficulty of extracting accurate values of the power law exponents with experimental data with a limited statistics.

In order to extract reliable exponents, the right procedure—as described in [2]—is to find the power law exponent \( m^* \) that provides the best collapse of \( Y = P_x(x|x)^{m^*/(2-m)} \) as a function of \( X = x/\langle x \rangle^{1/(2-m)} \). In order to quantify the quality of this collapse, first, we have fitted \( Y_{f\mu} = AX^{-m} \exp(-X/B) \) to the set of our experimental data, varying systematically the exponent \( m \) and leaving \( A \) and \( B \) as free parameters. Then, we have computed the error \( \epsilon = \sum \left| \log(Y_i) - \log(Y_{f\mu}) \right| \) as a function of \( m \). For various velocities (clip level \( C = 0 \)), for the size distribution, the minimum value of \( \epsilon \) (thus, the best collapse) is obtained for \( m = 1.00 \pm 0.15 \), while for the avalanche durations we obtain \( m = 1.25 \pm 0.25 \), as shown in Fig. 1. The insets display the collapse \( P_x(x)^{m^*} \) as a function of \( x/\langle x \rangle^{1/(2-m)} \), showing that the scaling function is very well approximated by a decay exponent.

Finally, Ref. [2] suggests that the problem of forced–flow imbibition might belong to the quenched Edwards–Wilkinson (QEW) or equivalently the C-DP universality class [3], a conjecture based on a possible similarity of the values of the exponents. This should be taken with some caution, however, because forced–flow imbibition is a non-local process [4], while the QEW interfacial equation describes a local interfacial dynamics. Moreover, the various values of the exponents reported here are in very good agreement with the ones obtained from phase–field simulations of a non-local interfacial process [5].

FIG. 1: (Color online) Top: Statistical distributions of avalanche sizes \( S \) for various injection rates (clip level \( C=0 \)). The main plot shows \( P_S(S)/S^{1/(2-\alpha)} \) vs \( S/\langle S \rangle^{1/(2-\alpha)} \), and the inset \( P_S(S)S^\alpha \) vs \( S/\langle S \rangle^{1/(2-\alpha)} \), both computed for the value \( \alpha = 1.00 \) that provides the best collapses. Bottom: Corresponding collapses of the pdf’s of the avalanche durations \( T \), for the value \( \tau = 1.25 \).

FIG. 2: (Color online) Isolines of the joint distributions \( u' \) vs \( w' \), with a fit to the crest giving the value \( \gamma = 1.33 \pm 0.12 \).

Planet, Santucci, and Ortín Reply:

In Ref. [1] we reported that both the size and duration of the global avalanches observed during a forced imbibition process follow power law distributions with cut-offs, \( P_x(x) = a_x x^{-m^*} \mathcal{G}_x(x/x_0) \). While the exponent of the power law appears robust within the quoted error bars, the cut-off of the pdf’s depends on experimental control parameters such as the injection rates \( v \).

When adimensionalising the variables, \( u = x/\langle x \rangle \), we observed a collapse of the various pdf’s \( P_a(u) \). Thus, the exponent \( m_x \) should be found equal to one, as explained in [2]. Indeed, we observed clearly an average power law exponent \( \alpha = 1.00 \pm 0.06 \) for the avalanche size pdf’s. However, for the avalanche duration we reported a slightly larger value within the large dispersion. This can be attributed to the poorer statistics for the avalanche duration, as we explained in [1], affecting the quality of the collapse and/or the fitting procedure. This illustrates the difficulty of extracting accurate values of the power law exponents with experimental data with a limited statistics.

[1] R. Planet et al., Phys. Rev. Lett. 102, 094502 (2009).
[2] G. Pruessner, Comment LPK1047 submitted to Phys.
Rev. Lett., February 2010.

[3] M. Alava and M.A. Muñoz, Phys. Rev. E, 65, 026145, (2002).

[4] M. Alava et al, Adv. Phys. 53, (2), 83-175, (2004).

[5] M. Pradas, Interfaces in disordered media. Scaling growth, avalanche dynamics, and microfluidic fronts. PhD Thesis, University of Barcelona (2009).