This study concerns the modeling, through interpretation of laboratory experiments, of the dynamics of the very large features of the Earth system on climate time-scales. The manuscript (presumably) covers the Lecture for the Lewis Fry Richardson (EGU) medal of Berengère Dubrulle, with several of her co-authors. It is entitled *How many modes are needed to predict climate bifurcations? Lessons from an experiment.* The paper is placed in the broad framework of the question of whether a scientifically acceptable answer can be given to society concerning the evolution of climate, and what effort (theoretical, modeling, experimental and numerical) is needed in order to be able to do so reliably. Two examples are specifically examined: the switching in the atmosphere between convection and blocking, and the Niño–Niña transition, a prediction of which would be extremely useful to society (and to modelers of course). The principal tool is the experimental facility used by this group in Saclay (France), together with sophisticated mathematical tools. Specifically, the study is focusing on spontaneous transitions of the von Kàrman flow between two counter-rotating cylinders under different types of forcing. Reynolds numbers are of the order of 10^{13} (or less, when using glycerol instead of water), basically too small compared with geophysical flows, but still very enlightening. In the last sentence of the abstract and in the conclusion, the authors *stress the importance of describing very small scales to capture fluctuations of correct intensity and scale*. Of course, one thinks of the 50-year old Donnella Meadows *et al.* project at MIT that predicted a collapse of the world climate and economic system in or around 2020 with a model having a small number of relevant variables and different complex (feedback) interactions. Are these models enough? With such drastic truncations, how are the all-essential small-scales treated or incorporated?

One could argue that the equivalence between Earth systems and the von Kàrmàn (VK) flow is not quite as much as stated in the paper; in particular, what of the role of stratification, which is strong at large scale? What is the effect of shear? Can it be quantified? Do they play any role in these transitions? What about chemistry, moisture and the like?

Also, concerning the computational nightmare, sometimes called the curse of dimensionality, there are several papers claiming that neural networks can lead to avoiding that curse. Do the authors have a comment on that?

This paper is very pleasant to read. It describes the thinking going-on at the intersection of several fields of physics and the creativity in the development of new data and in interpreting it. I recommend publication.

Details:

1. In the very first sentence, it is a bit odd to see the first author (BD) talk of herself in the third person, ...

2. In the title, *fry* and *?:* might have to be changed

3. I have several problems with Figure 1 (l. 55+). What is a Dansgaard-Oeschger event? What is *ka*? What are M12345? What do the 8 12 14 18 etc refer to? Also, the insets are way too small, I suggest making the figure substantially larger. A reference (to Didier Paillard or other) would be necessary as well.

4. line 92+, perhaps one could cite and discuss a bit the drastic reduction of modes (down to 3) done by Ed Lorenz and which led to many investigations of lack of predictability of atmospheric flows. For example, why is 3 enough (when, as pointed out by the authors, we need a priori 10^{24} modes)? Why not 5 or 13? And what do larger systems bring compared to the small (and successful) system? When do we know that we have *enough* small scales? What criteria can be applied?
5. Figure 2: give the unit of sizes (0.925, 1, ...)
6. l. 164, ITCZ is not defined
7. Figure 3: is there a significance in the fact that the amplitudes in flow (a) are smaller than for (b) and (c)?
8. Figure 5: Spring and Summer states are undefined here. One could at least refer to Figure 3, or perhaps add a line in Table 1 defining the 3 (or more) states (Spring or autumn, Austral and Boreal Summers, and Transitional) since they are key ingredients of the analysis and the paper refers to them often.
9. Figure 11: Multifractal spectrum of what?
10. l. 345: Are there not strong velocity gradients in the Planetary Boundary Layer as well as the extreme events mentioned here? Do they not translate into large-scale extremes?
11. l. 351 and beyond:
12. l. 365: By *few modes*, do you mean 3 as in the Lorenz model, or 10^4 as in the glycerol experiment described in the paper? Again, how little can it be? How does one determine this threshold? Is not the *computational nightmare* mentioned in Section 5.4, *also* an experimental nightmare?