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Interactive comment on "Channel flow, tectonic overpressure, and exhumation of high-pressure rocks in the Greater Himalayas" *by* Fernando O. Marques et al.

Anonymous Referee #1

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In the manuscript by Marques et al., numerical models with a critical geometrical configuration, i.e. the upward-tapering channel, have been systematical studied, which show large tectonic overpressure in the confined subduction channel. In addition, series of parameters may regulate the flow kinematics and dynamic pressure inside the channel, including (1) channel viscosity, (2) underthrusting velocity, (3) channel dip, (4) channel mouth's width, and (5) rigid versus deformable channel walls.

The study aims to resolve the geodynamics of the GHS. Based on the numerical experiments, an upward-tapering channel (UTC) model is proposed to account for the combination of well-known geologic features, including simultaneous reverse and nor-

mal faulting, inversion of the metamorphic grade in the GHS, and exhumation of HP rocks along a narrow conduit close to the STD. In particular, this study focuses on the evaluation of dynamic overpressure to explain the formation and exhumation of high-pressure rocks in the GHS.

The paper is generally interesting with careful numerical investigations of the dynamic pressure evolution in such a model with 'special' geometry, which has not been studied before (as I know). In these aspects, I think it is worth publishing.

For this manuscript, my main concern is about the extremely high overpressure (even larger than ten times of the lithostatic pressure). I think such high values should be strongly related to the specific model geometry (upward taper), which is the most favorable condition for the overpressure. This geometry is constructed by comparing with the GHS geometry (cf. Figure 1b, c). In this model setup, the Tethys Himalaya (TSS shown in Figure 1b) is considered as a strong wall (rigid or rheologically strong); however, if TSS is weak, i.e. comparable to the GHS, then the channel geometry will be downward taper or parallel walls, similar to the general subduction channels. In the latter case, I do not think such high overpressure could be obtained.

Secondly, there are many previous numerical studies for the tectonic overpressure. I think a general discussion and comparison is required. In this manuscript, the authors just comment that 'previous models have used two of the three main possible configurations of a subduction channel: parallel-sided and downward tapering, which have been shown to produce relatively small overpressure (TOP < 3) (e.g. Li et al., 2010).' In my opinion, for the overpressure TOP = dynamic pressure / lithostatic pressure, the value 3 is quite large, which indicate the dynamic pressure is three times of the lithostatic. In this case, the rocks at 30km depth can obtain the pressure of up to 90 km. So it is better not to consider it as 'small overpressure'.

In order to avoid the possible misleading for the UHP community, I suggest adding a separate section at the end of the paper to discuss the specific conditions and/or model limitations of the current more theoretical studies. Actually, many explanations have already been included in the main text (located in different sections).

The paper is generally well-written, without clear typos, etc.

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