Bathymetric mapping in turbid braided mountain streams using SfM-MVS photogrammetry and statistical approaches

EGU2020-5296

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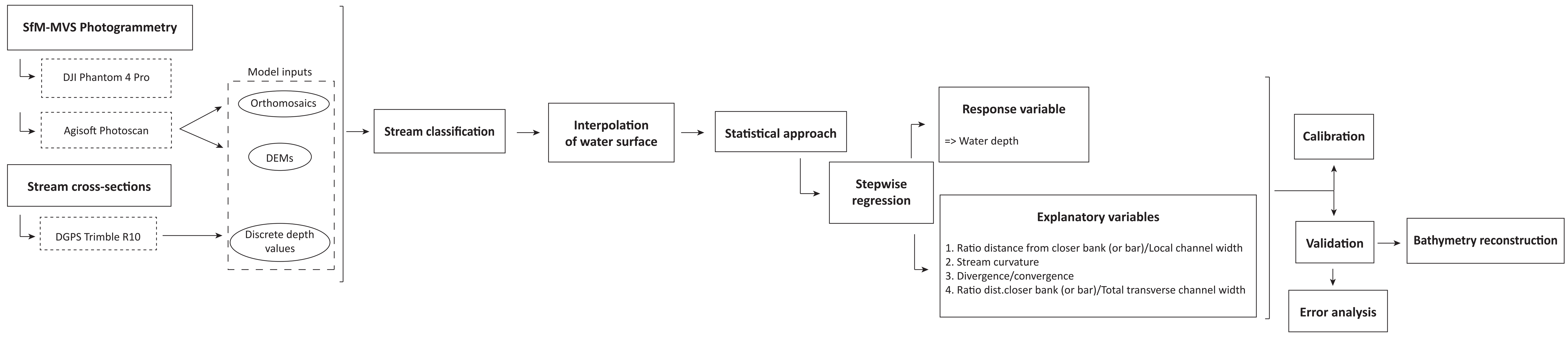
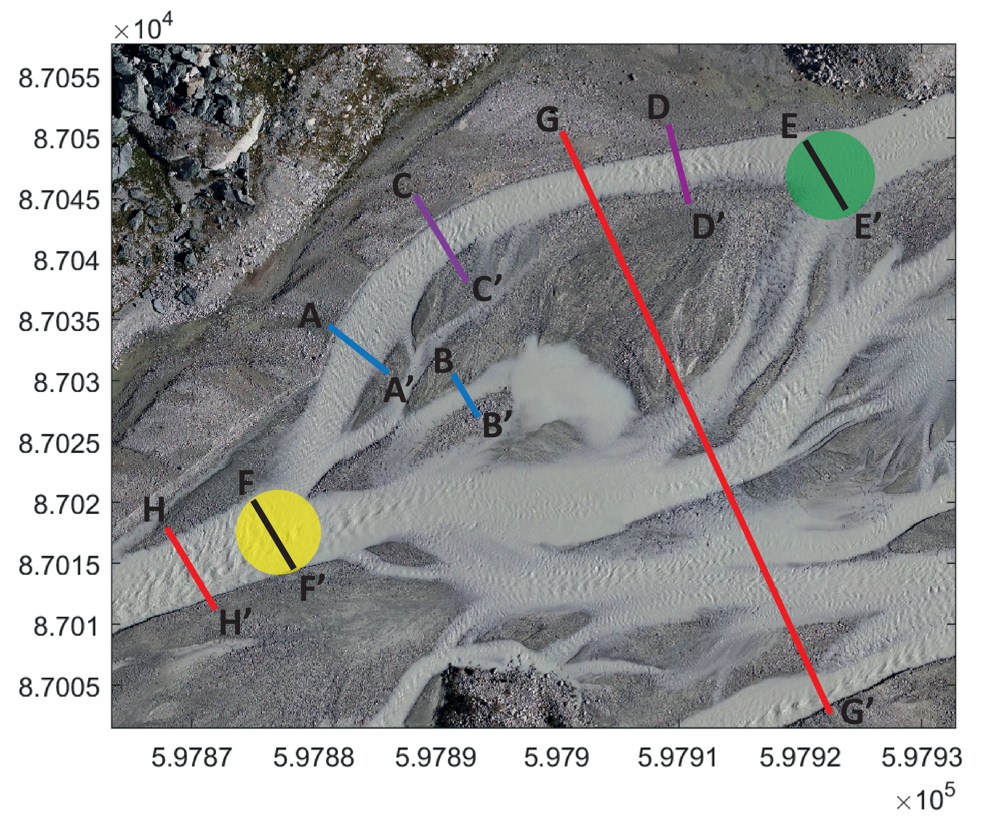
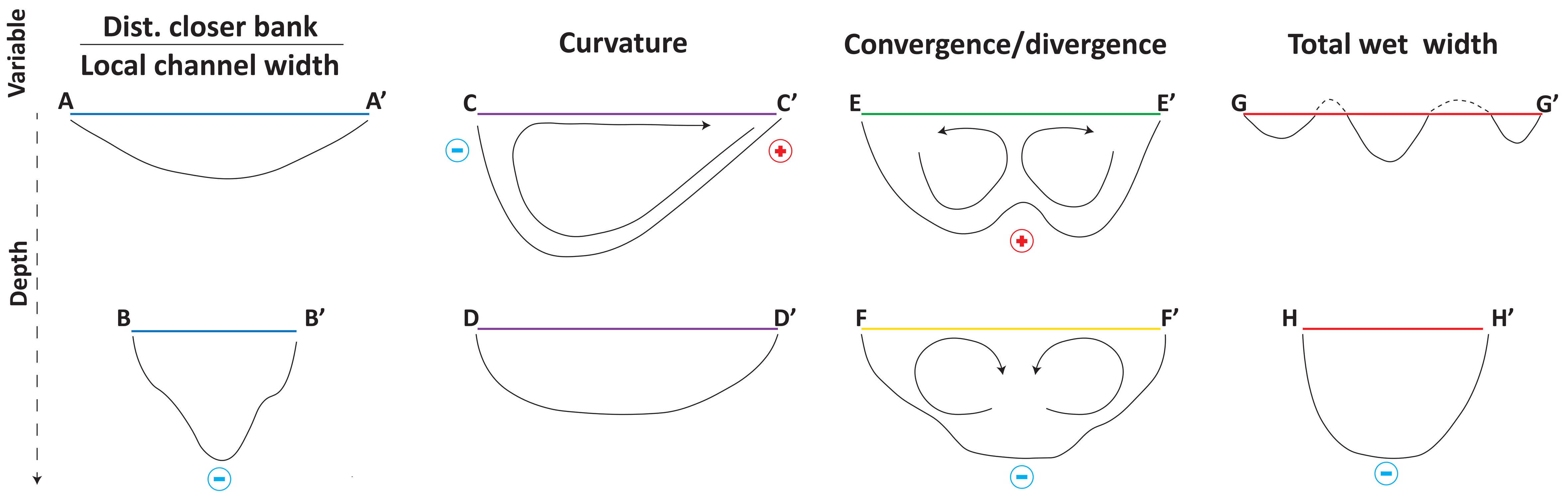
1. Introduction

River bathymetric investigation has a long tradition as river-bed morphology is a crucial geomorphological variable that also has implications for river ecology and sediment management. In one sense, this is becoming more straightforward with the development of UAV platforms and SfM-MVS photogrammetry. Mapping inundated and exposed areas simultaneously has proved possible either by adopting two media refraction correction or by using some form of the Beer-Lambert Law. However, both of these approaches rely upon the bed being visible which becomes restricted to progressively shallower zones as stream turbidity increases. Traditional survey techniques to collect bathymetric data for inundated zones (e.g. total station or differential GPS systems) are time consuming and require a trade-off between point density and the spatial extent of survey. In this study we test a simple hypothesis: it is possible to generalize the likely depth of water in a shallow braided stream from basic planimetric information and use such statistical relationships to reconstruct the bathymetry of inundated zones.

2. Methodology and model development

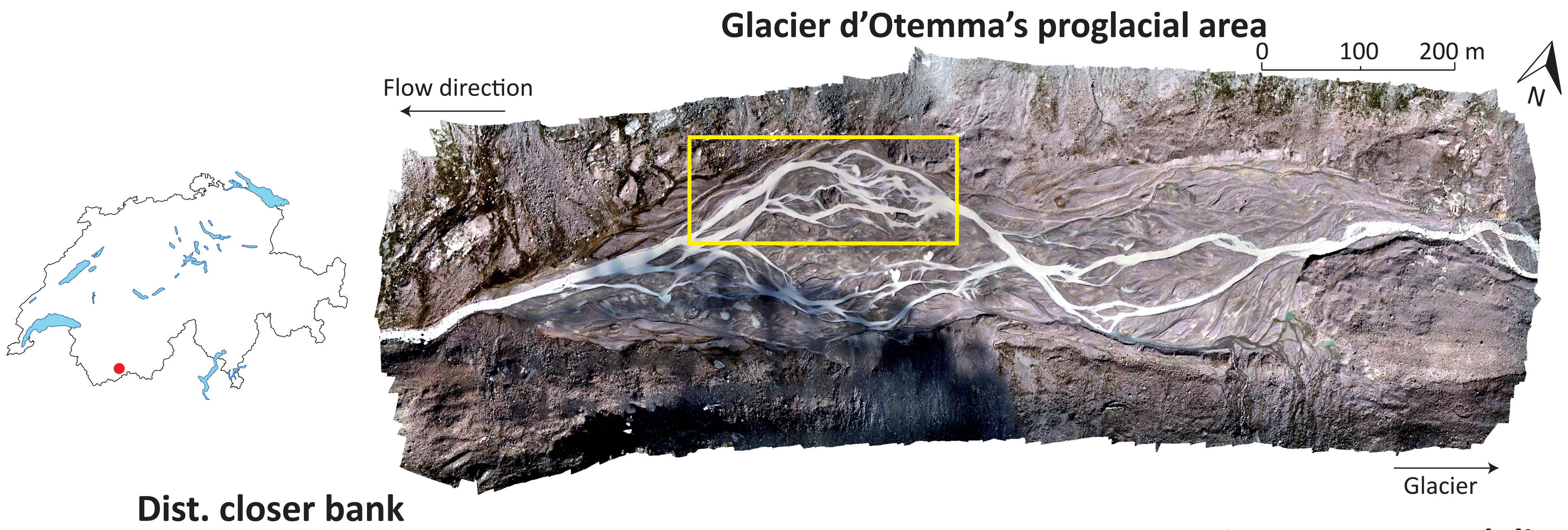


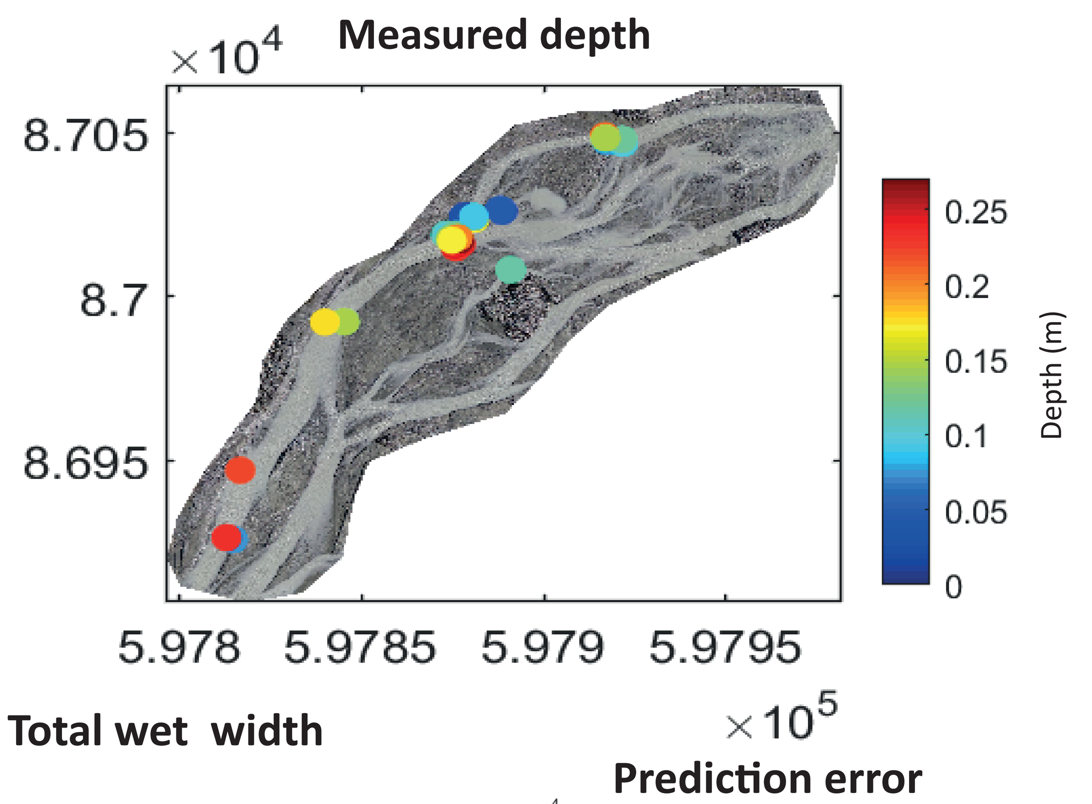


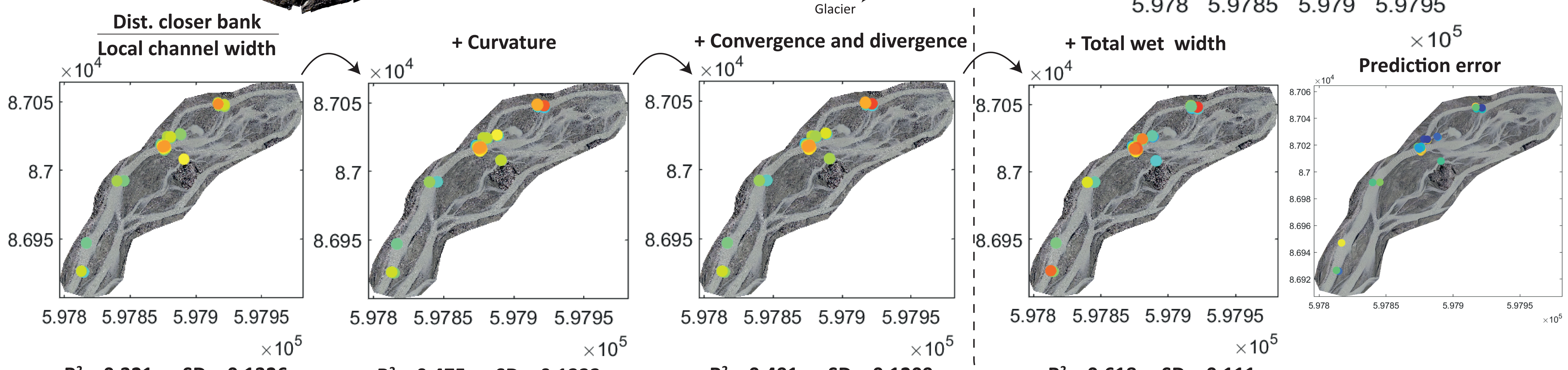


Ashmore (1982,1991); Ferguson (1993); Ashworth (1996); Powell (1998); Nicholas (2013)

3. Preliminary results







4. Conclusions and outlook

At the light of the preliminary model outputs, we can conclude that results are encouraging to predict reliable depth distributions of braided alluvial plains. However, as the model is still in development, further validation tests are needed to evaluate both model performance (comparison between measured and predicted depth) and methodology (variables quantification). At the moment we are evaluating the computation of the streamline curvature.

Given the above, the next steps are: i) to run the model using a dataset representing the whole alluvial plain, ii) to proceed with the validation of the calibrated linear regression and iii) to determine a way to reconstruct the bathymetry.

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