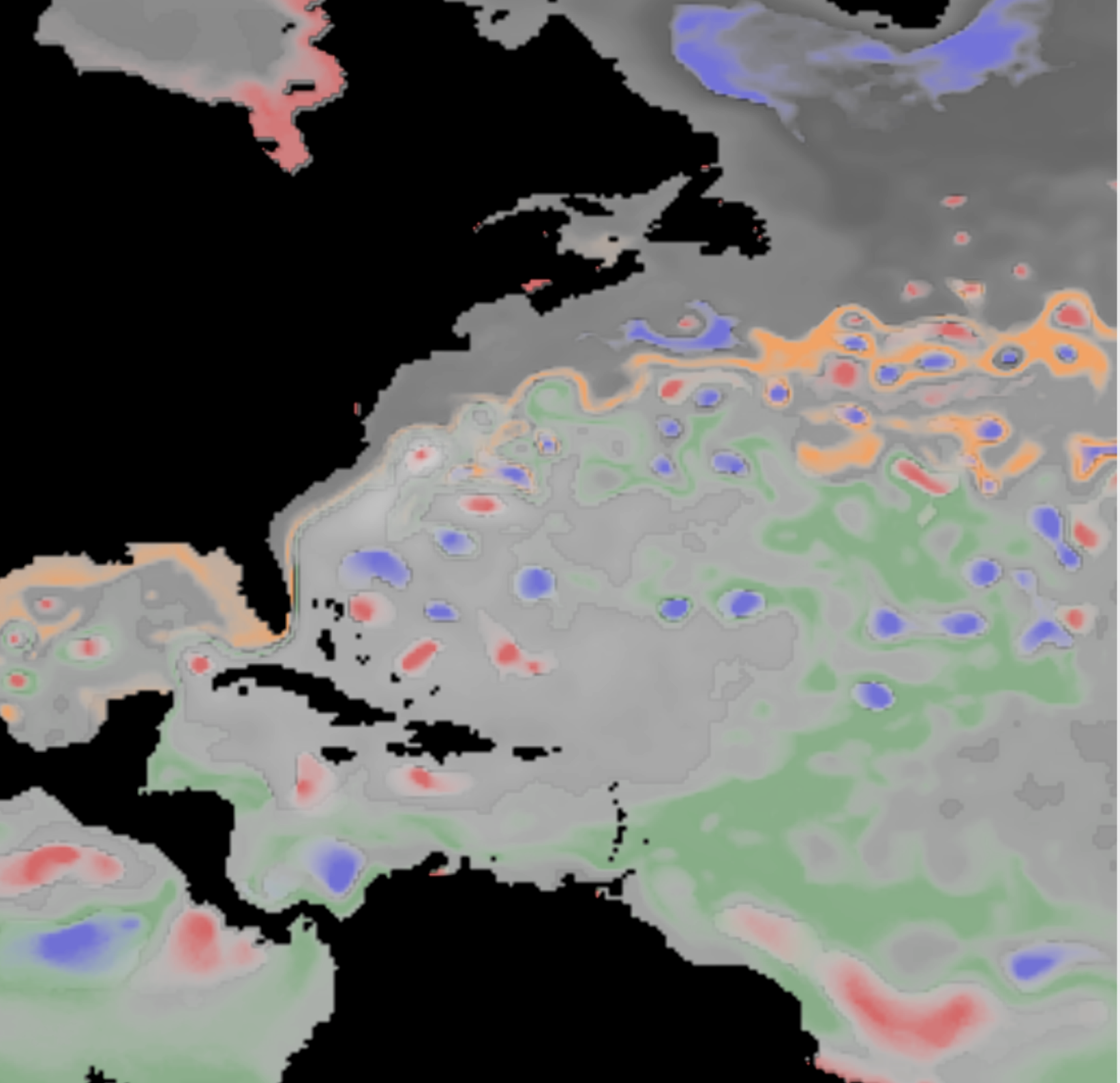

Mandatory Critical Points of 2D Uncertain Scalar Fields

Proc. of EuroVis 2014, Computer Graphics Forum Vol. 33(3)

This paper introduces a novel, non-local characterization of critical points and their global relation in 2D uncertain scalar fields. The characterization is based on the analysis of the support of the probability density functions (PDF) of the input data. Given two scalar fields representing reliable estimations of the bounds of this support, our strategy identifies mandatory critical points: spatial regions and function ranges where critical points have to occur in any realization of the input. The algorithm provides a global pairing scheme for mandatory critical points which is used to construct mandatory join and split trees. These trees enable a visual exploration of the common topological structure of all possible realizations of the uncertain data. To allow multi-scale visualization, we introduce a simplification scheme for mandatory critical point pairs revealing the most dominant features.

Our technique is purely combinatorial and handles parametric distribution models and ensemble data. It does not depend on any computational parameter and does not suffer from numerical inaccuracy or global inconsistency. The algorithm exploits ideas of the established join/split tree computation. It is therefore simple to implement, and its complexity is output-sensitive. We illustrate, evaluate, and verify our method on synthetic and real-world data.

Paper

Video

cnrs