

NON-RIGID REGISTRATION OF CLOUD MOVEMENT

Bernecker D., Riess C., Hornegger, J. - University of Erlangen-Nuremberg
{bernecker,riess,hornegger}@i5.cs.fau.de

Abstract

Our goal is to optimize the interplay between conventional and solar power plants. We require a short-term and highly accurate prediction of the energy output. On a coarse scale, the weather influencing the power output can be predicted from satellite imagery. To achieve a higher temporal and spatial resolution a ground-based camera is required. In a first step, we focus on determining and predicting the movement of clouds using non-rigid registration techniques.

Data acquisition

Images were acquired with a Canon 550D and a Walimex 8 mm fisheye lens in intervals of 20 seconds. A total of 180 images (i.e. one hour) were used for evaluation.

Used methods

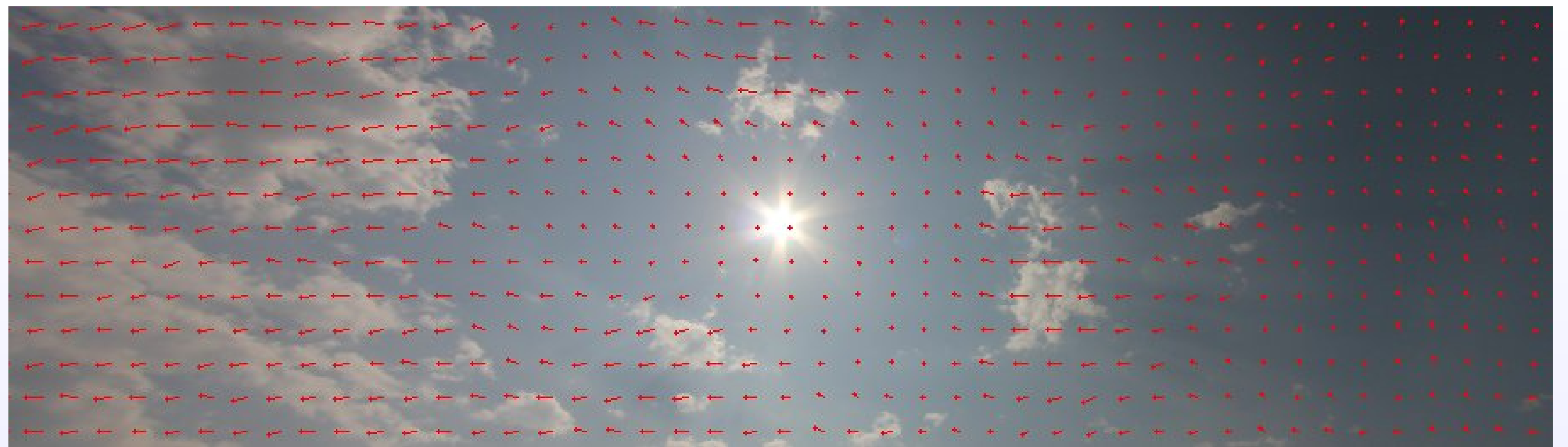
Three methods for motion registration are compared:

Block matching [1]: blocks in the last image are compared to their surroundings in the current one using normalized cross-correlation.

Demons [2]: non-rigid registration with an analogy to a diffusion process. A set of deformation forces derived from the optical flow constraint is calculated iteratively.

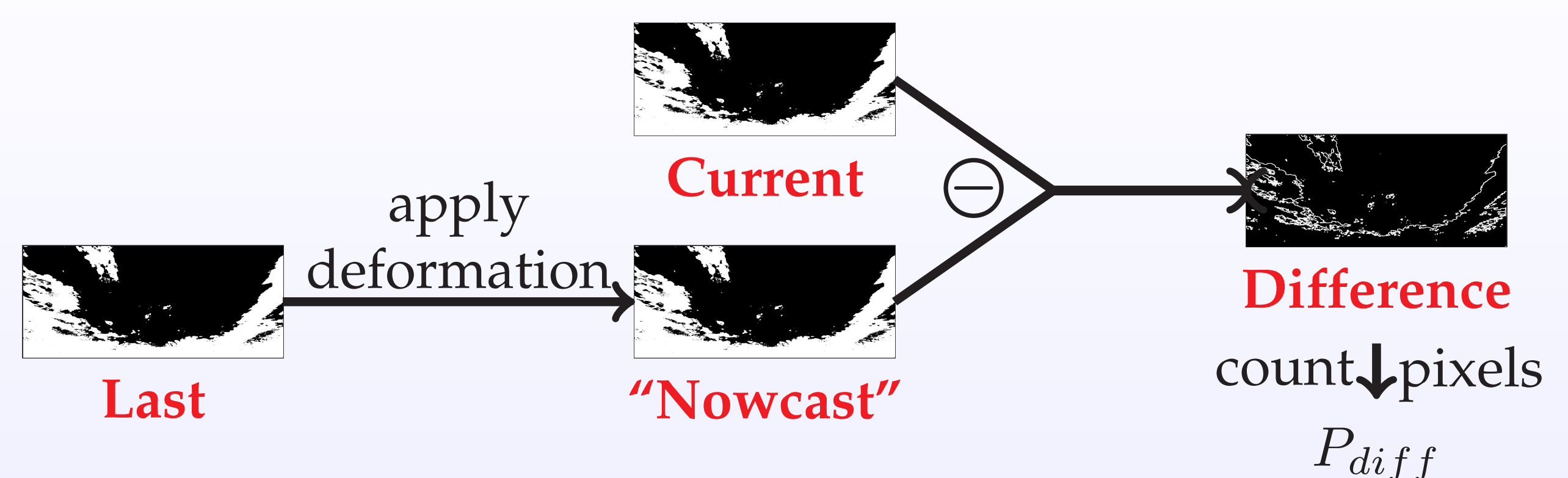
Variational approach [3]: an objective function consisting of a distance and regularization functional is minimized. A sum of squared differences distance functional and curvature based regularization were chosen.

Example Image

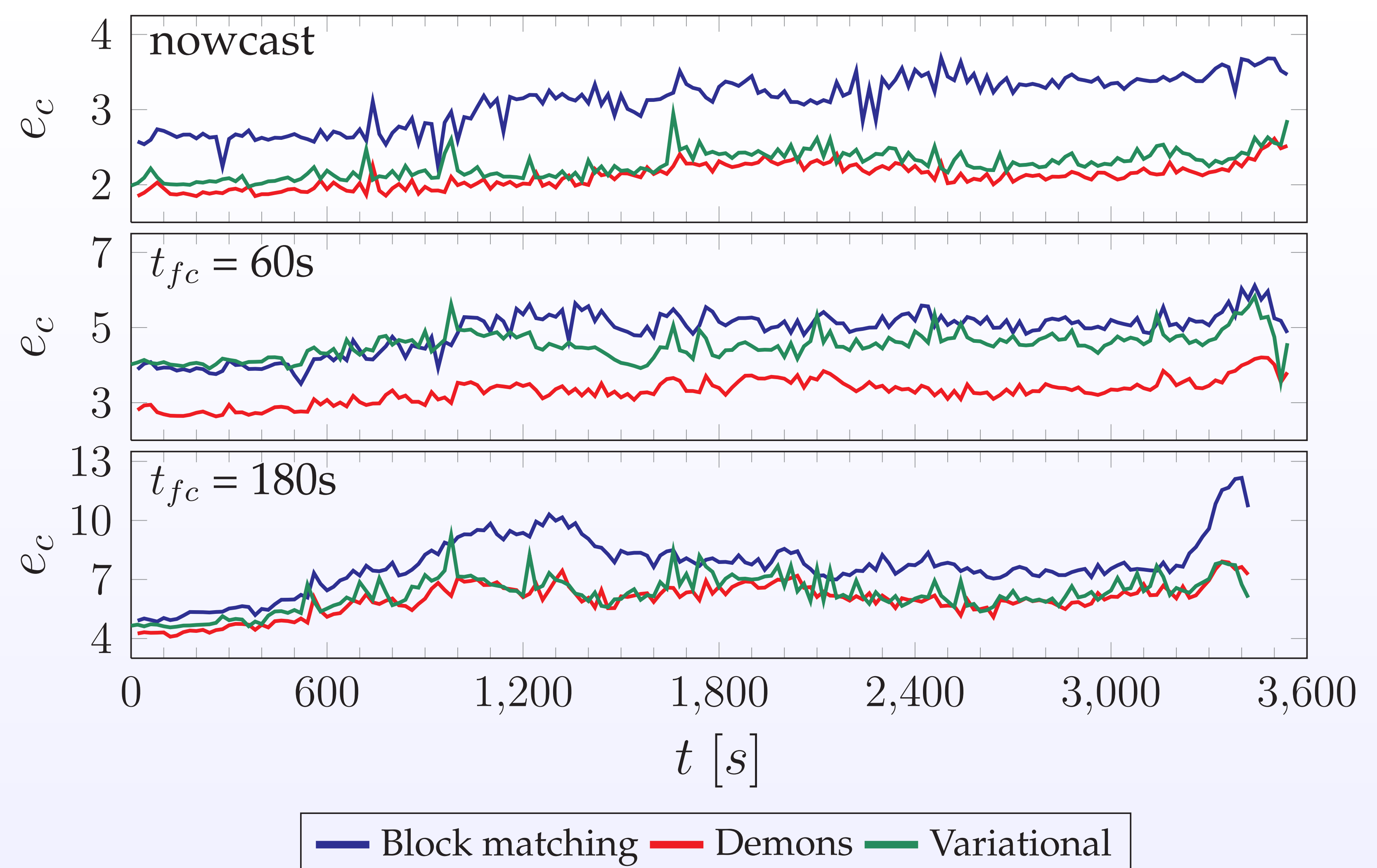


Evaluation

Steps for calculating the error $e_c = \frac{P_{diff}}{P_{contour}}$ after performing the registration:



Results



References

- [1] C. Chow, B. Urquhart, M. Lave, A. Dominguez, J. Kleissl, J. Shields, B. Washom, "Intra-hour Forecasting with a Total Sky Imager at the UC San Diego Solar Energy Testbed", in *Solar Energy*, 2011
- [2] J.-P. Thirion, "Image Matching as a Diffusion Process: An Analogy with Maxwell's Demons", in *Medical Image Analysis*, 1998
- [3] B. Fischer, J. Modersitzki, "Curvature Based Image Registration", in *Journal of Mathematical Imaging and Vision*, 2003