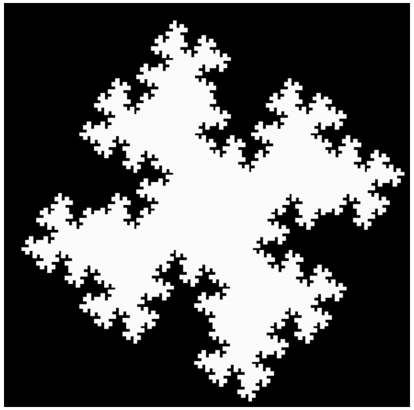
IMAGE PARTITIONING AND SEGMENTATION

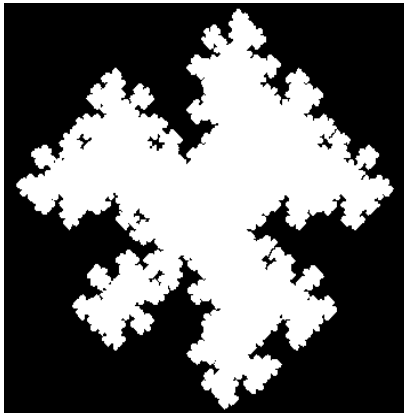
1) Cloud field segmentation via multiscale convexity analysis
2) Generation of geodesic flow fields

Additional (Results) Illustrations

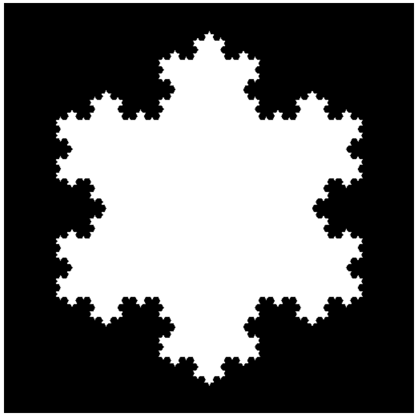
1) Cloud field segmentation via multiscale convexity analysis
2) Generation of geodesic flow fields
3) Visualization of rock porous medium, pore channel, pore throats, and pore bodies



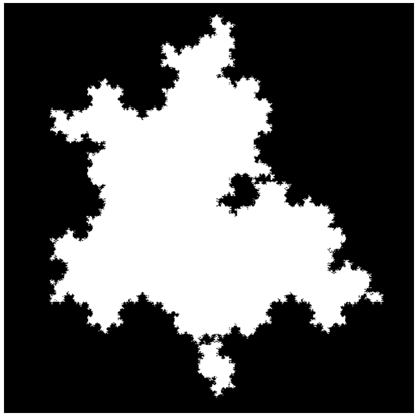
(a)



(b)

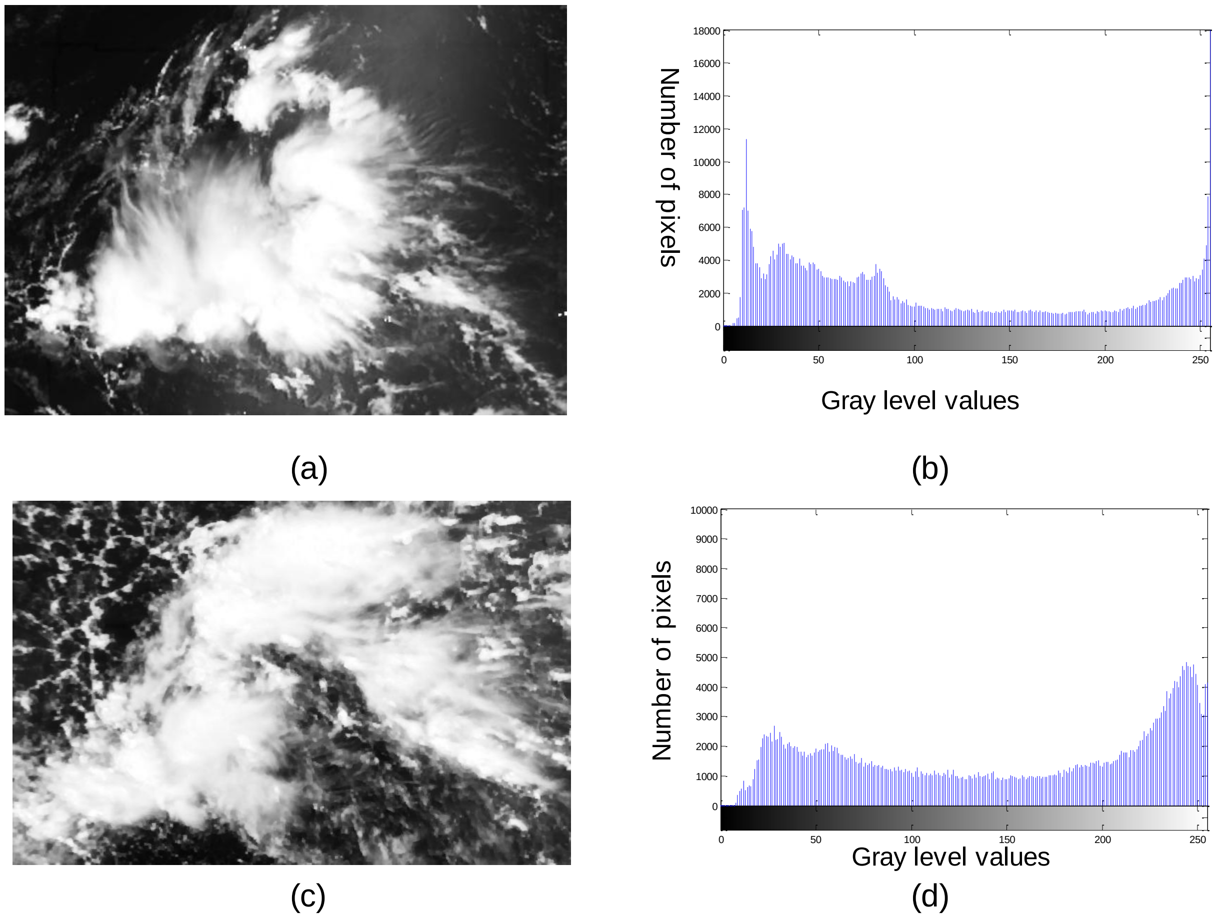


(c)

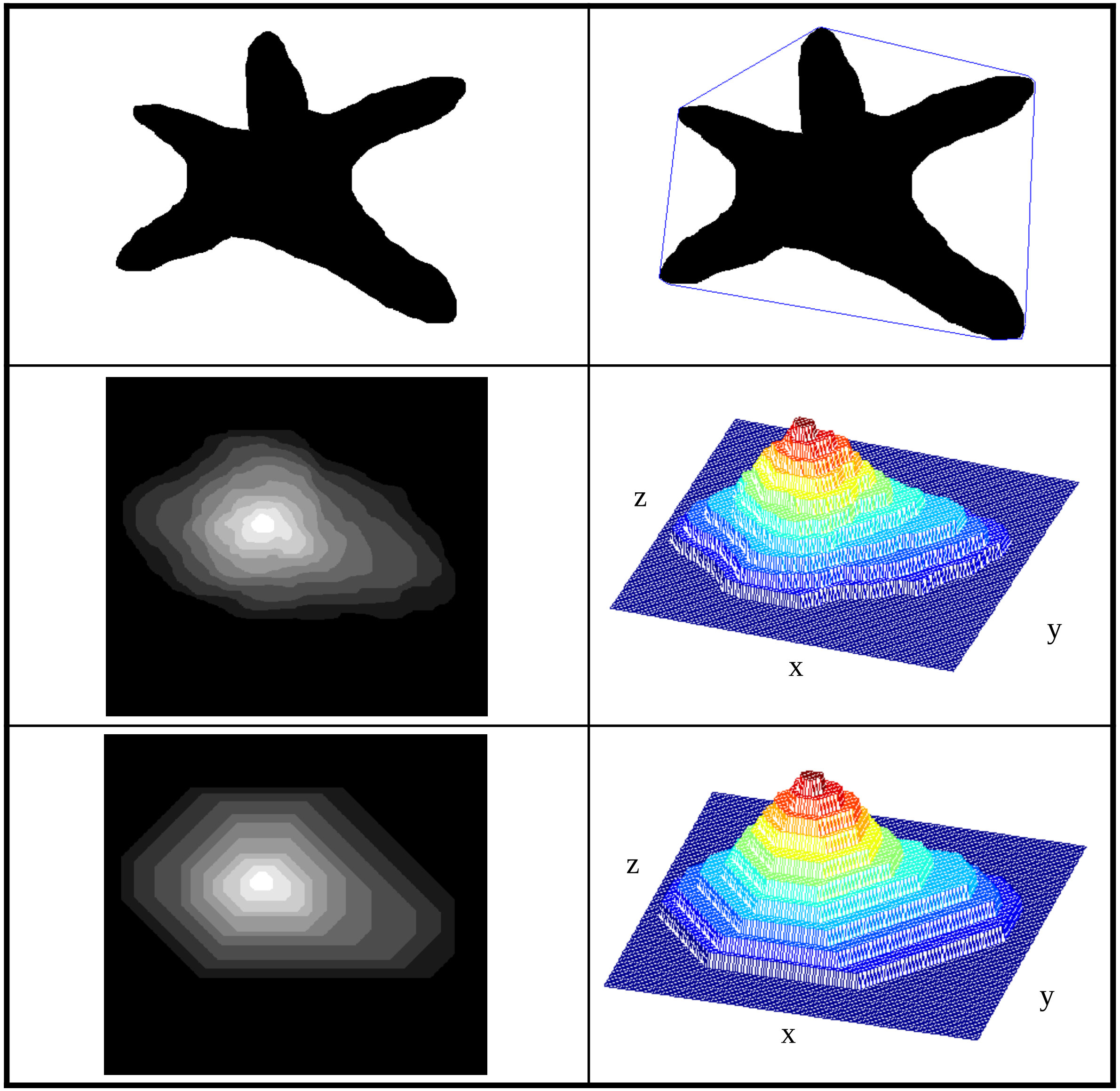


(d)

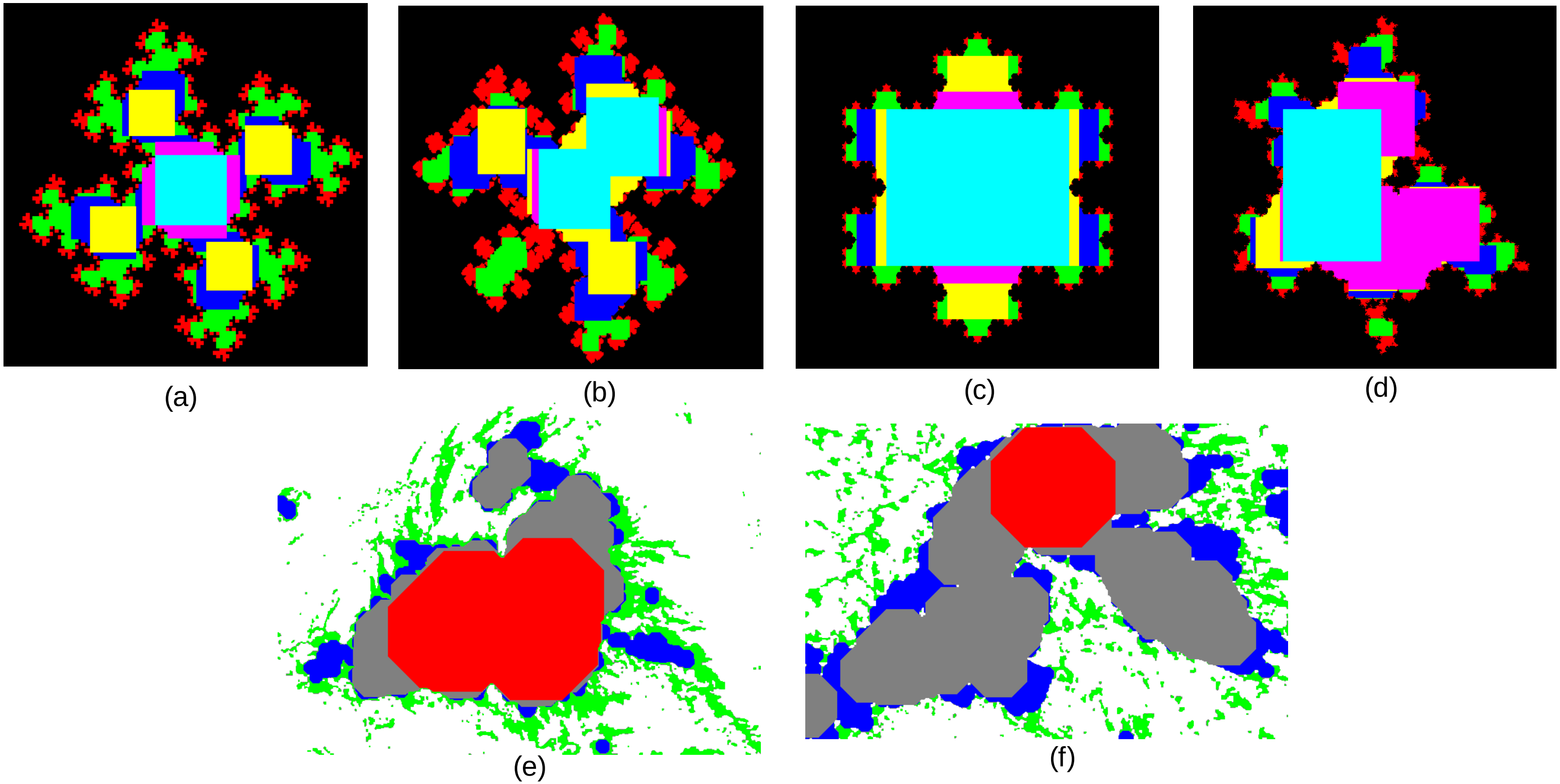
(a) Koch Quadric fractal, (b) random Koch Quadric fractal, (c) Koch Triadic fractal, and (d) random Koch Triadic fractal.



(a) isolated MODIS cloud (cloud-1), (b) histogram of (a), (c) isolated MODIS cloud (cloud-2), and (d) histogram of (c).

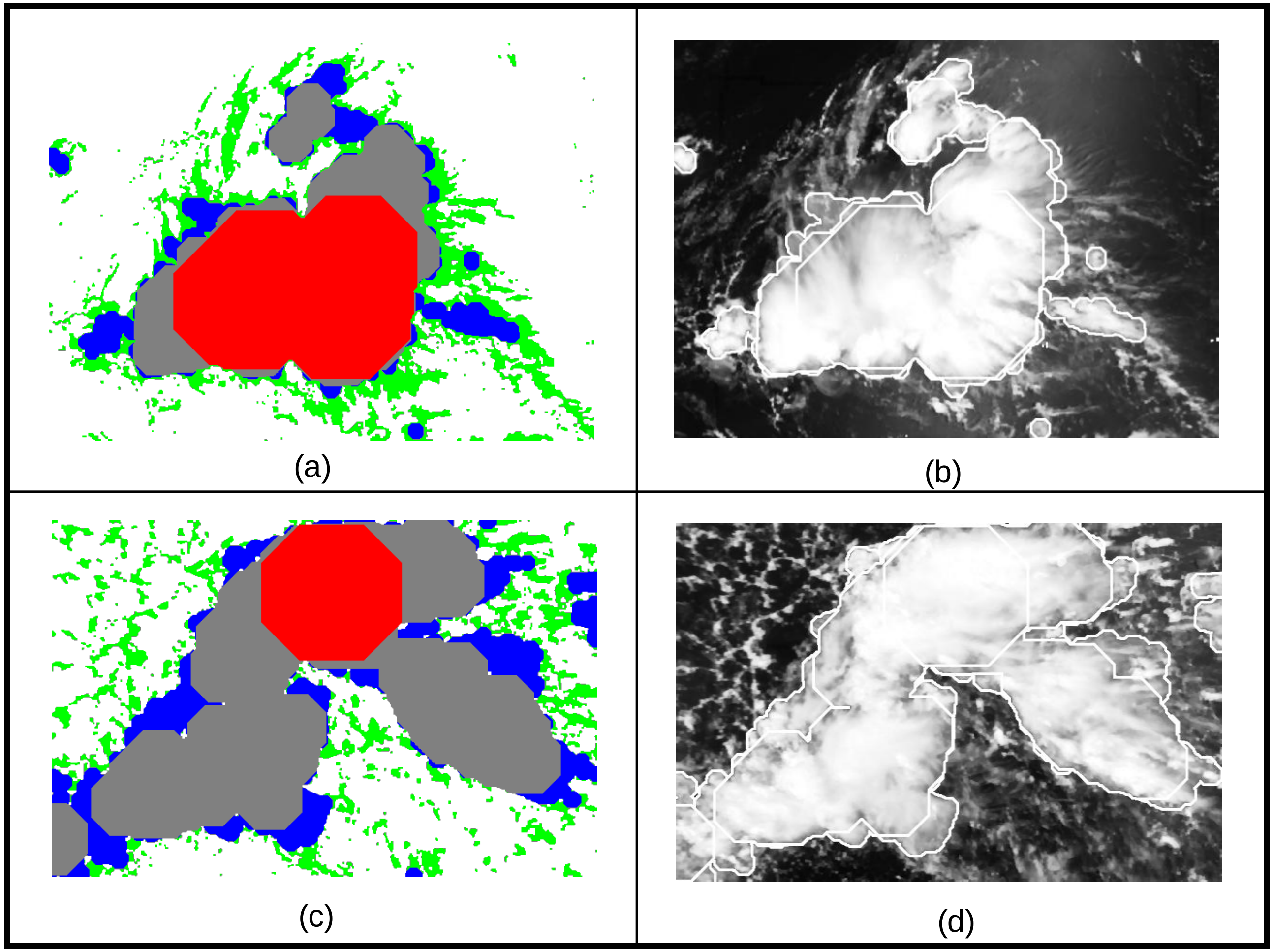


(a) A threshold set decomposed from a synthetic cloud function, (b) convex hull of a threshold set shown in (a), (c) a synthetic cloud function consists of 10 gray levels – which can be decomposed maximally into 10 threshold sets, (d) 3D representation of synthetic cloud function (c), (e) convex hull of (c)



Six zones segmented from deterministic and random Koch Quadric and Koch Triadic fractals, and (e, f) Four zones segmented from realistic MODIS clouds.

- Each of the segmented six zones from fractals, and each of the four zones partitioned from cloud fields evidently possess different degrees of spatial complexity measures. A simple framework is provided here to compute the complexity measure of each segmented zone.



(a) Colour-coded binarized (by choosing threshold gray level value 128) cloud-images at three threshold-opening cycles superimposed on binarized original cloud-1 colour-coded with green, (b) boundaries of 12th, 32nd, and 100th opened cloud-1 images and thresholded original cloud-1 superimposed on the original cloud image, (c) colour-coded binarized (by choosing a threshold gray level value 110) cloud-2 images at threshold-opening cycles superimposed on binarized cloud-2 colour-coded with green, and (d) boundaries of 12th, 49th, and 100th opened cloud-2 images and thresholded original cloud-2

Geodesic Flow Fields and Spectrum of Discrete Functions

- A framework to derive flow fields and spectrum in discrete functions particularly in digital topographic basins and cloud field is presented.
- Hereafter, “basin” refers to inland, tidal, floodplain, coastal, estuary regions, and digital topographies which include DEMs and DBMs, and “topography” refers to both surficial and bottom topographies.
- Through analysis of flow fields that are simulated via geodesic morphology, a new descriptor is generated that characterizes such discrete functions.
- This framework is demonstrated on (i) three synthetic basins, (ii) one realistic DEM, (iii) one realistic DBM, and (iv) two MODIS cloud fields.
- This study provides potentially invaluable insights to further investigate the travel-time flood propagation within basins of both fluvial and tidal systems, as well as the travel-time field and flow perturbations in cloud.

Geodesic Flow Fields and Spectrum of Discrete Functions

- Computation of this new descriptor involves the following five steps:

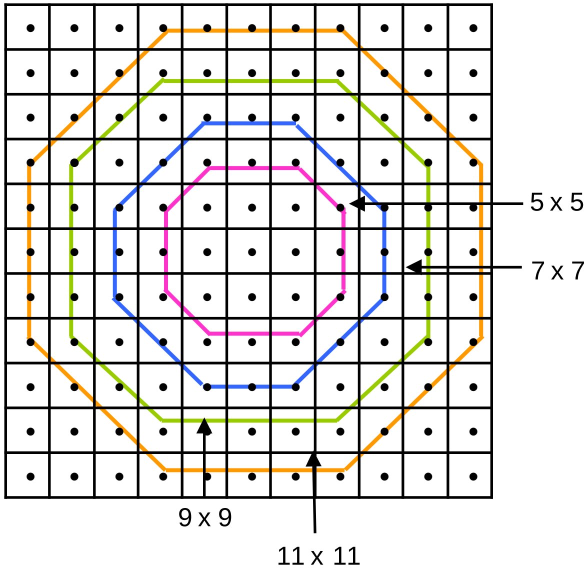
(i) basin or cloud field in digital form representing topographic fluctuations or height

(ii) hierarchical threshold decomposition of

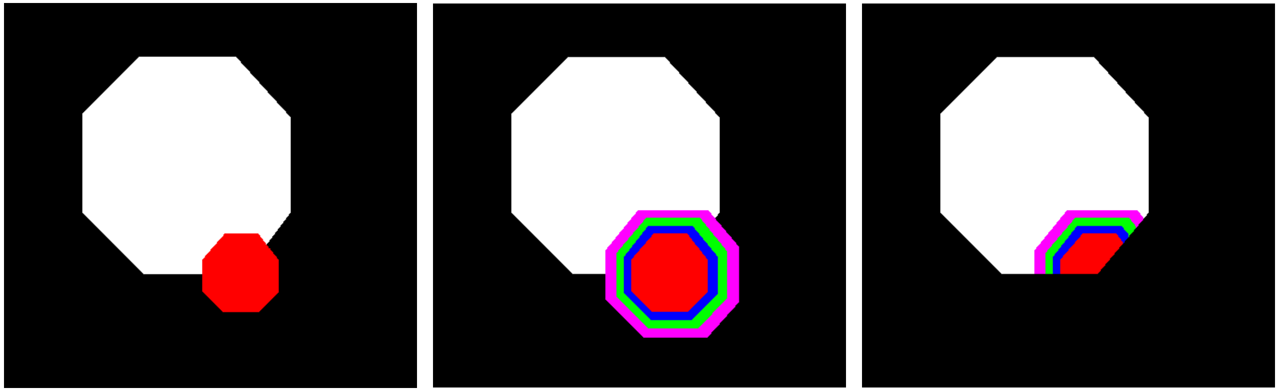
(iii) proper indexing of these sets to determine the marker

(iv) perform geodesic

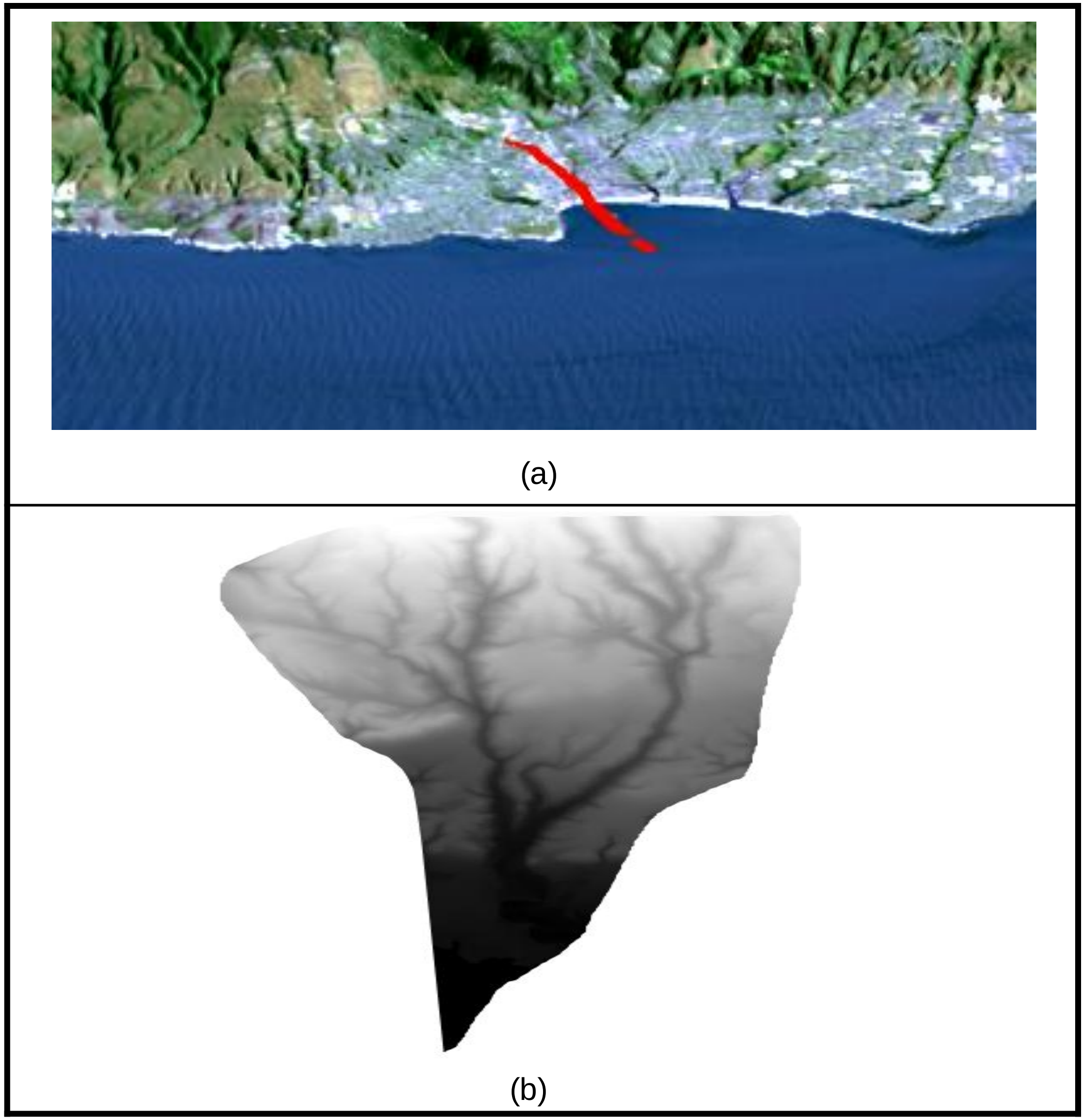
(v) finally to generate a new descriptor—geodesic spectrum to characterize basin or cloud



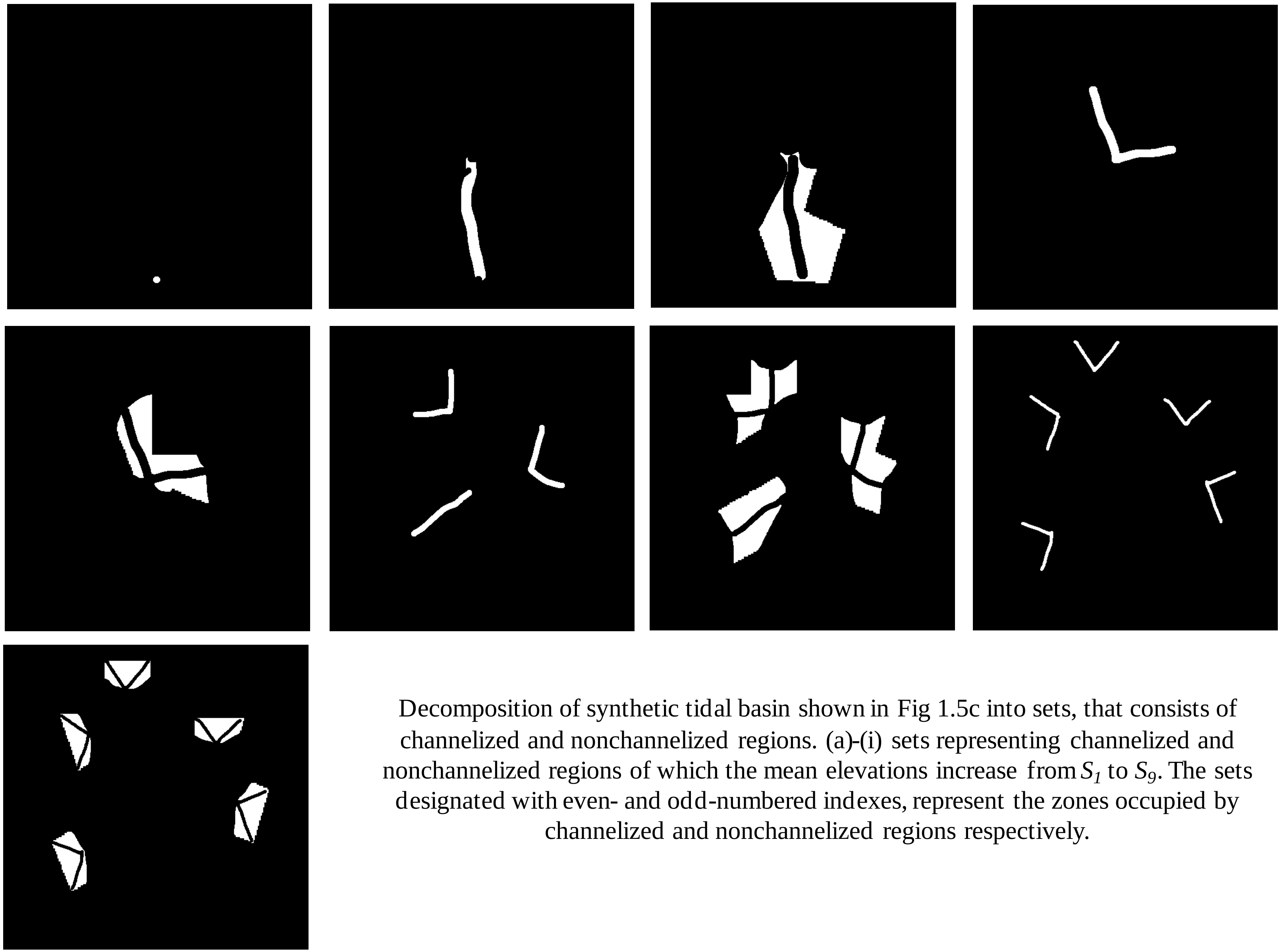
Octagonal symmetric structuring elements of various primitive sizes ranging from 5 × 5 to 11 × 11. These primitive sizes can be considered as B in the employed equations to simulate flow fields with various velocities.



(a) Marker set S_i (in red) and mask set S_{i+1} (in white), (b) after iterative dilations up to fourth level superposed on the mask set S_{i+1}, and (c) the dilated marker set of four iterations intersected with mask set S_{i+1}.



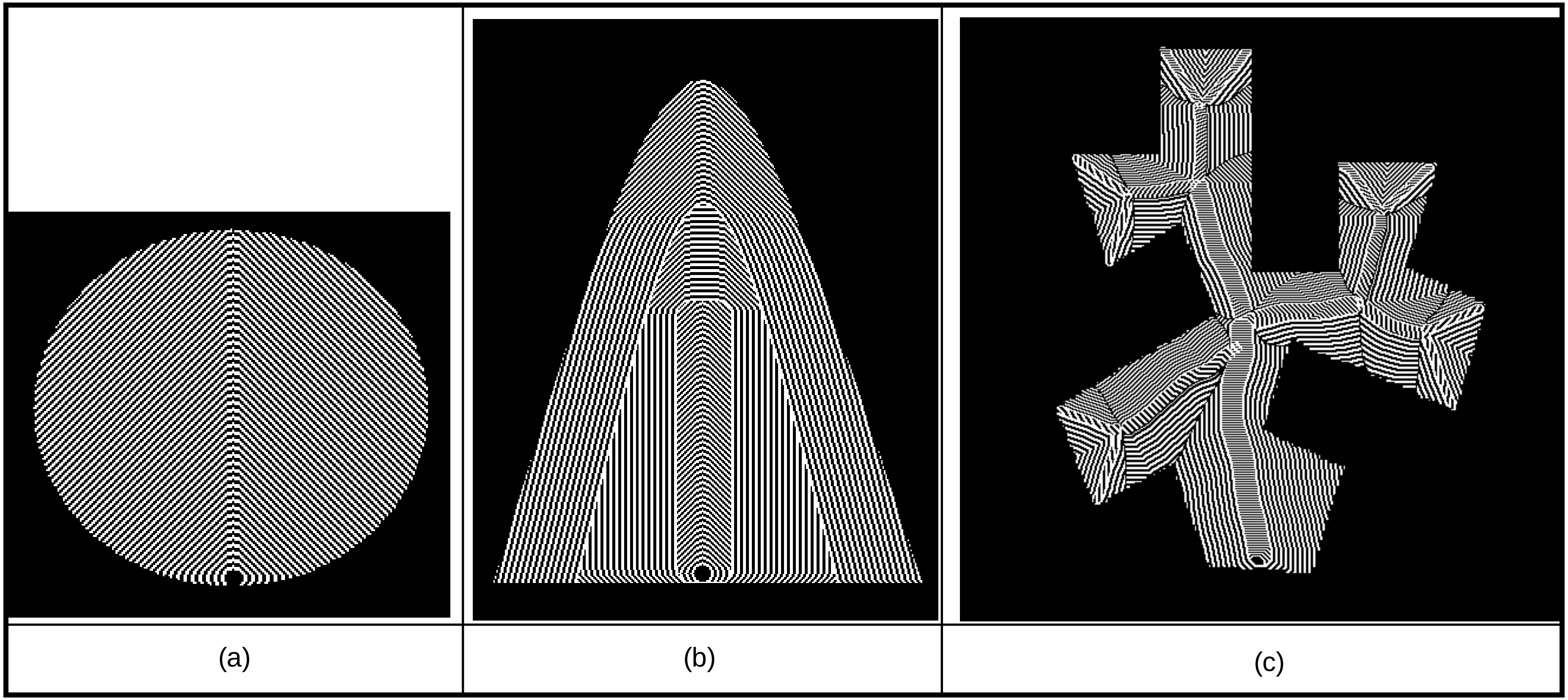
(a) 3D view of Santa Cruz, and (b) Digital elevation map of Santa Cruz.



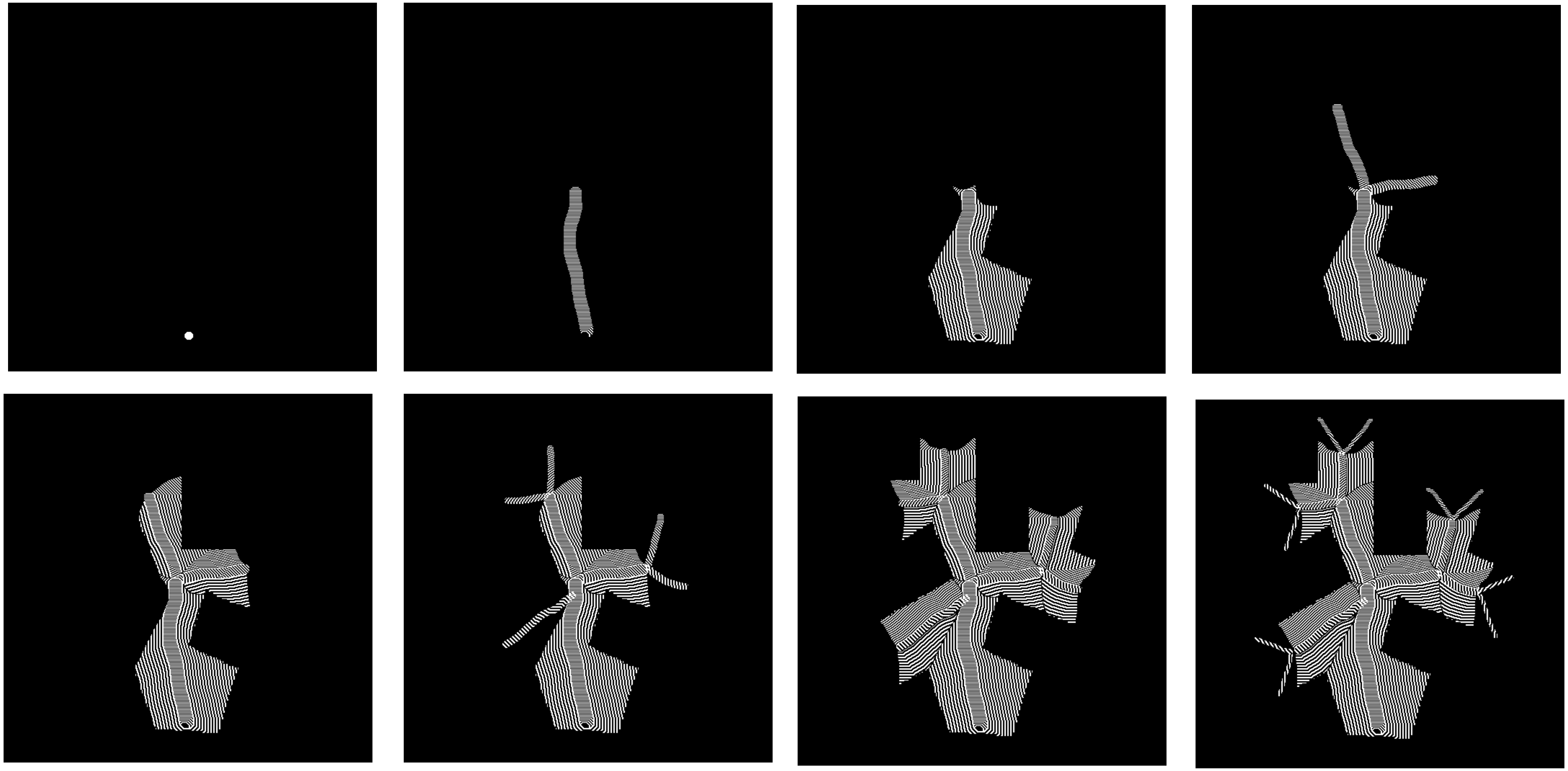
Decomposition of synthetic tidal basin shown in Fig 1.5c into sets, that consists of channelized and nonchannelized regions. (a)-(i) sets representing channelized and nonchannelized regions of which the mean elevations increase from S_1 to S_9. The sets designated with even- and odd-numbered indexes, represent the zones occupied by channelized and nonchannelized regions respectively.

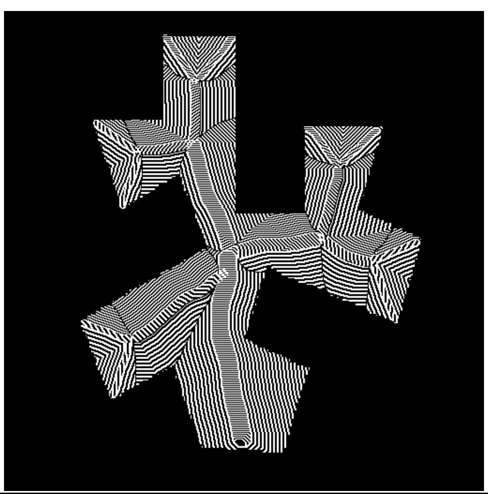
Geodesic Flow Fields and Spectrum of Discrete Functions

- Geodesic morphological transformations (Lantuejoul and Maisonneuve, 1984) are adopted to simulate flow field propagation in discrete functions like basin and cloud field.
- James Sethian's (1999) level set theory and Jean Serra's (1982) random sets and mathematical morphologic concepts offer various transformations to simulate flow fields within basin with physical viability.
- To implement geodesic transformations, the basin is considered as a mask, and the inlet point (through which water flows into the basin during the high flood) is taken as a marker from which the flow propagates into the basin as the flood level increases.

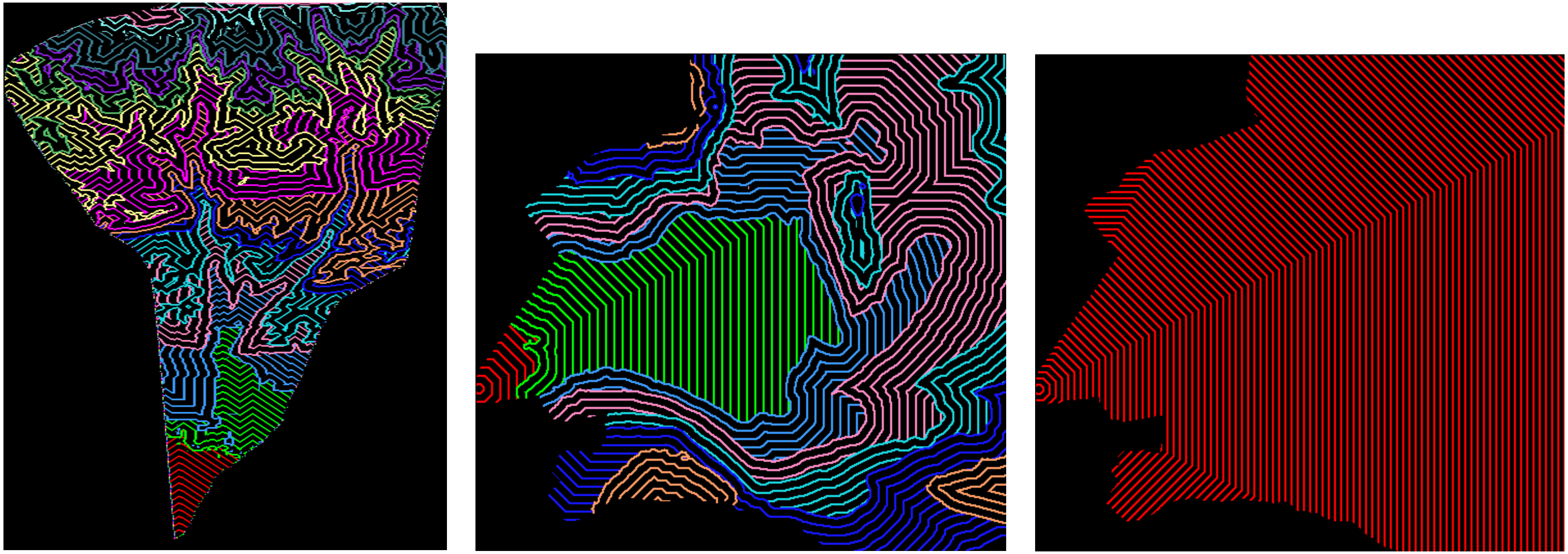


(a) Flow fields with isotropic propagation, (b) isotropic flow fields, and orthogonality between the flow fields of channelized and nonchannelized zones is obvious, and (c) flow fields within the tidal basin.



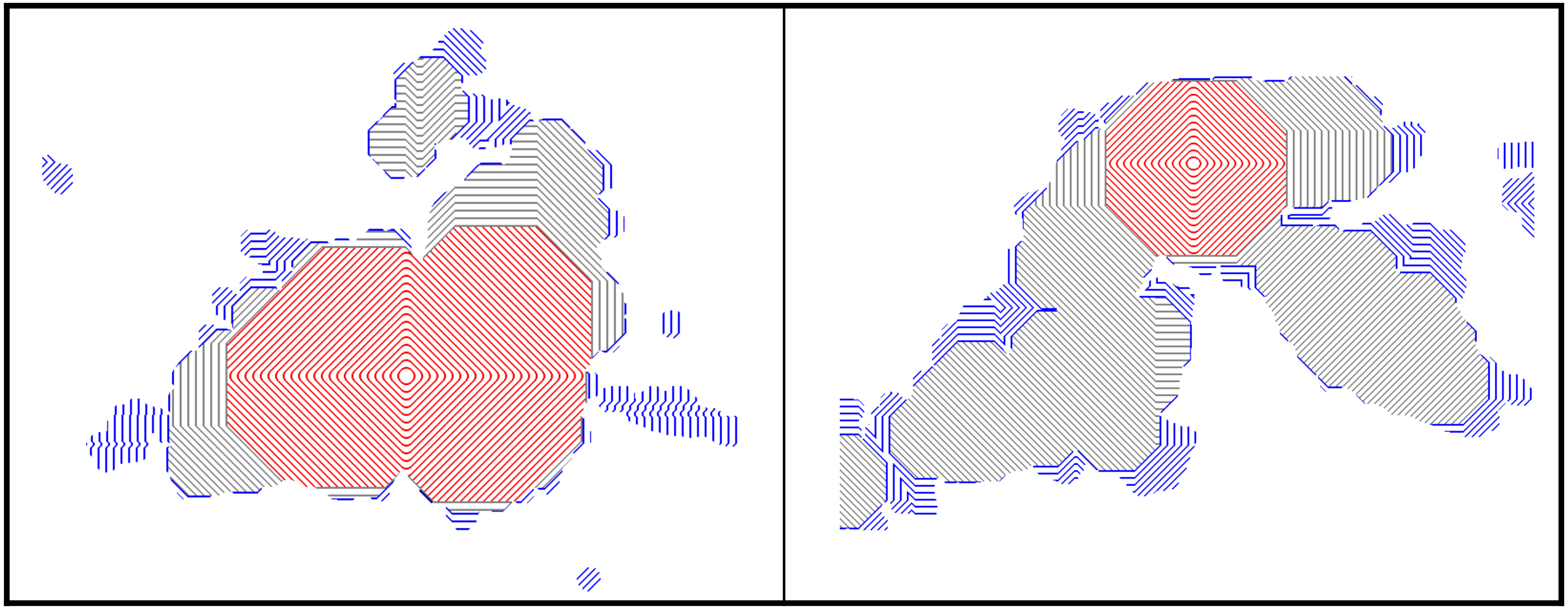


Result of simulation at different time instances for Case 3.



(a) (b) (c)

(a) Flow field simulated on Santa Cruz DEM by using octagon structuring element, (b) flow field simulated on San Francisco Bay bathymetry by using octagon structuring element, and (c) flow field simulated on San Francisco Bay without considering bathymetry.



(a)

(b)

(a) Simulated flow fields of MODIS cloud-1, and (b) simulated flow fields of MODIS cloud-2.

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