Instability Effect on the Performance of Thermal Energy Storage (CSP-5)

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Scientific Achievement:

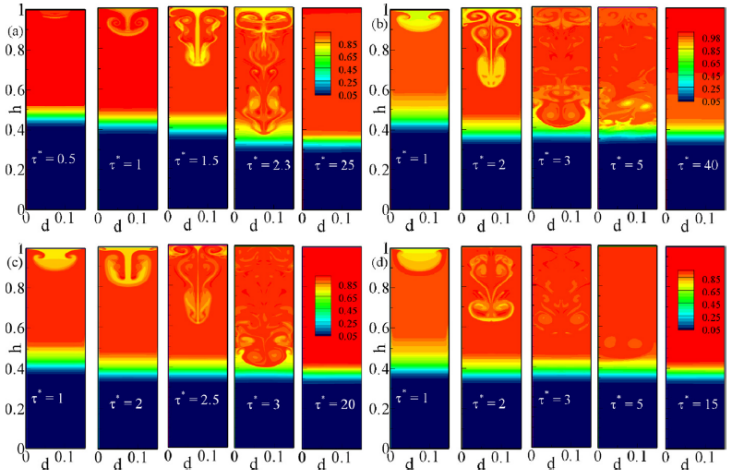
We studied the interaction of coherent structures with the thermocline and analyzed the coherent structures associated with R-T instability.

Significance and Impact:

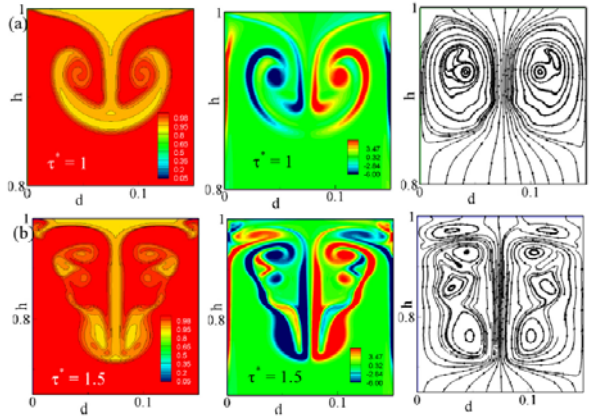
This work provides some insight into the nature of the instability process, which can help to predict and control instability. The present study also shows how inlet temperature variation can affect thermal energy storage (TES) performance.

Research Details:

- We investigated the transient dynamics of disturbances inside thermocline-based molten-salt TES.
- We conducted numerical simulations with four inlet flow configurations.
- Measurements included the disturbance growth rate, penetration length, and vortex Reynolds number.
- We studied the impingement of vortex on thermocline.



Evolution of disturbance inside the TES; temperature contour (a) Case 1, (b) Case 2, (c) Case 3, and (d) Case 4.



Mushroom and spike-like structures formed temperature, vorticity contours and stream lines; (a) t* = 1; (b) t* = 1.5.

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