Pattern Recognition Enhancements to ACSPO Clear-Sky Mask.

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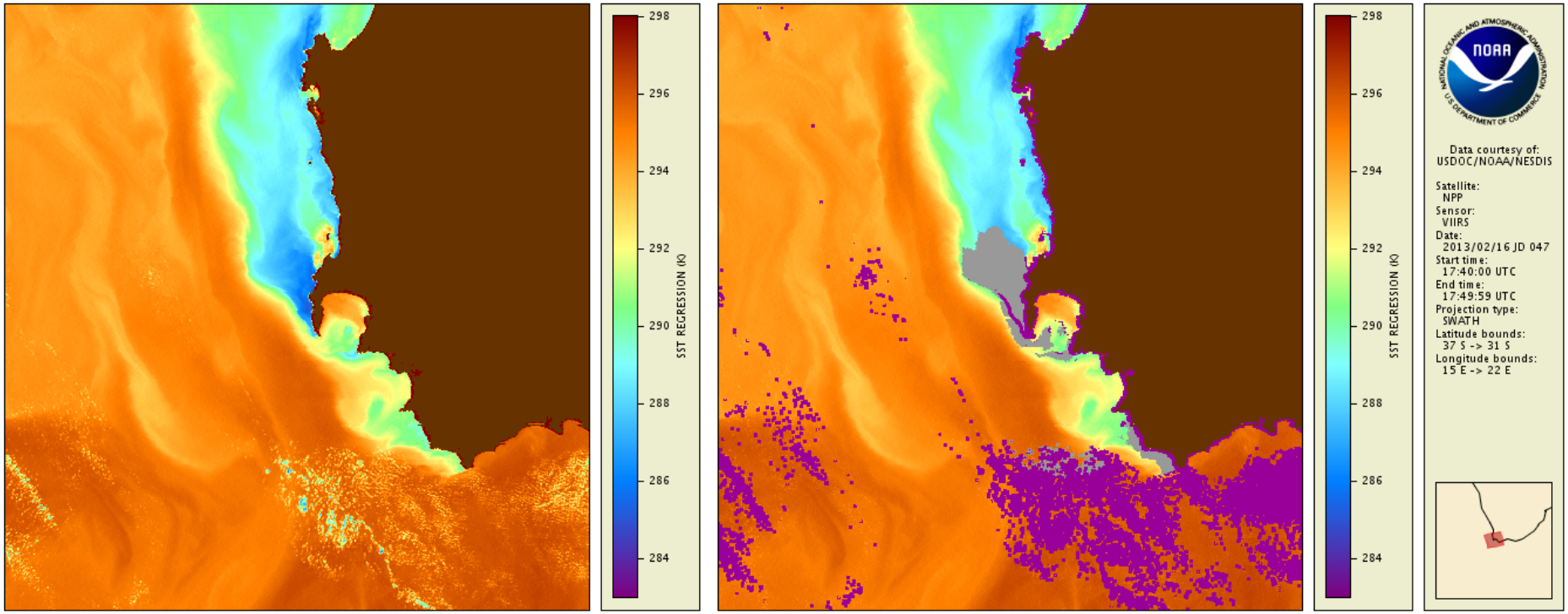
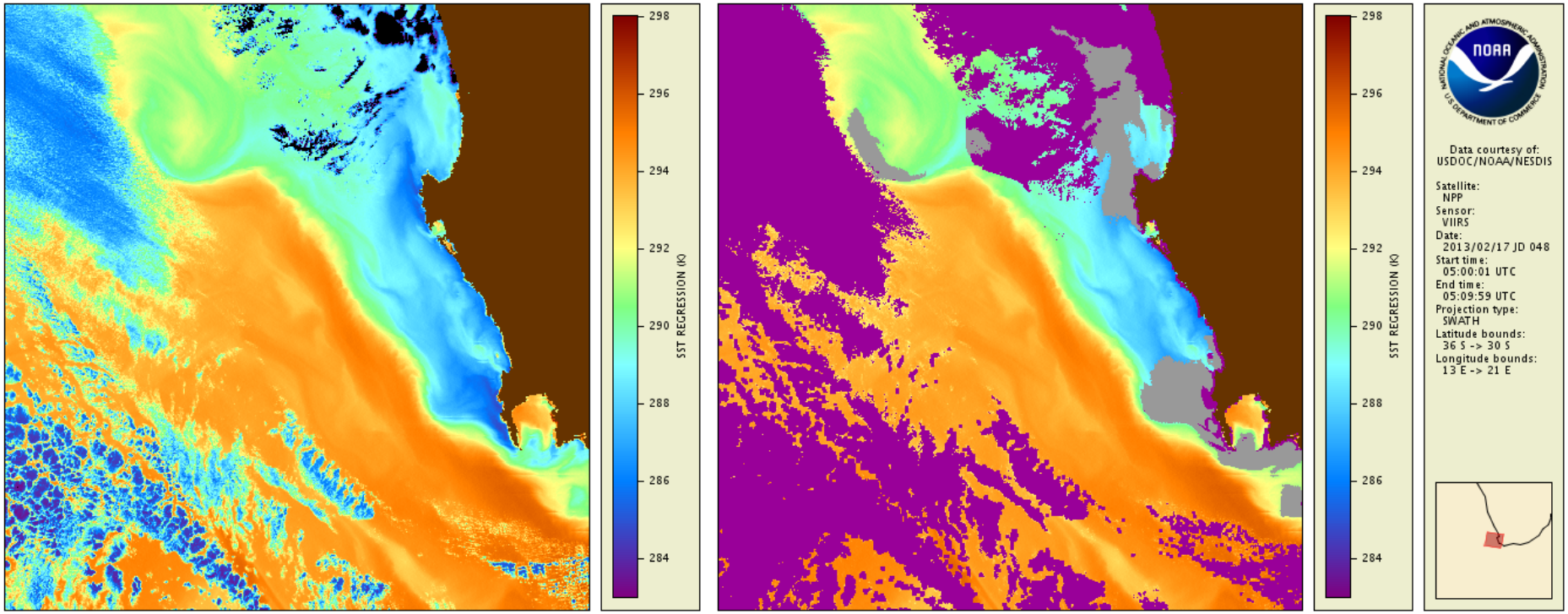
Motivation

- ACSPO Clear-Sky Mask (ACMS) employs comparisons of retrieved SST with L4 analyses, reflectance threshold tests and spatial uniformity tests.
- ACSM performs well on a global scale but tends to over-screen some highly dynamic areas (e.g., with strong currents, cold upwellings, eddies) as well as the coastal zones.
- These deficiencies cannot be completely eliminated by simple thresholds adjustment within ACSM without triggering massive cloud leakages.
- Visual analysis of SST field easily discriminates cloud leakages from cold SST anomalies

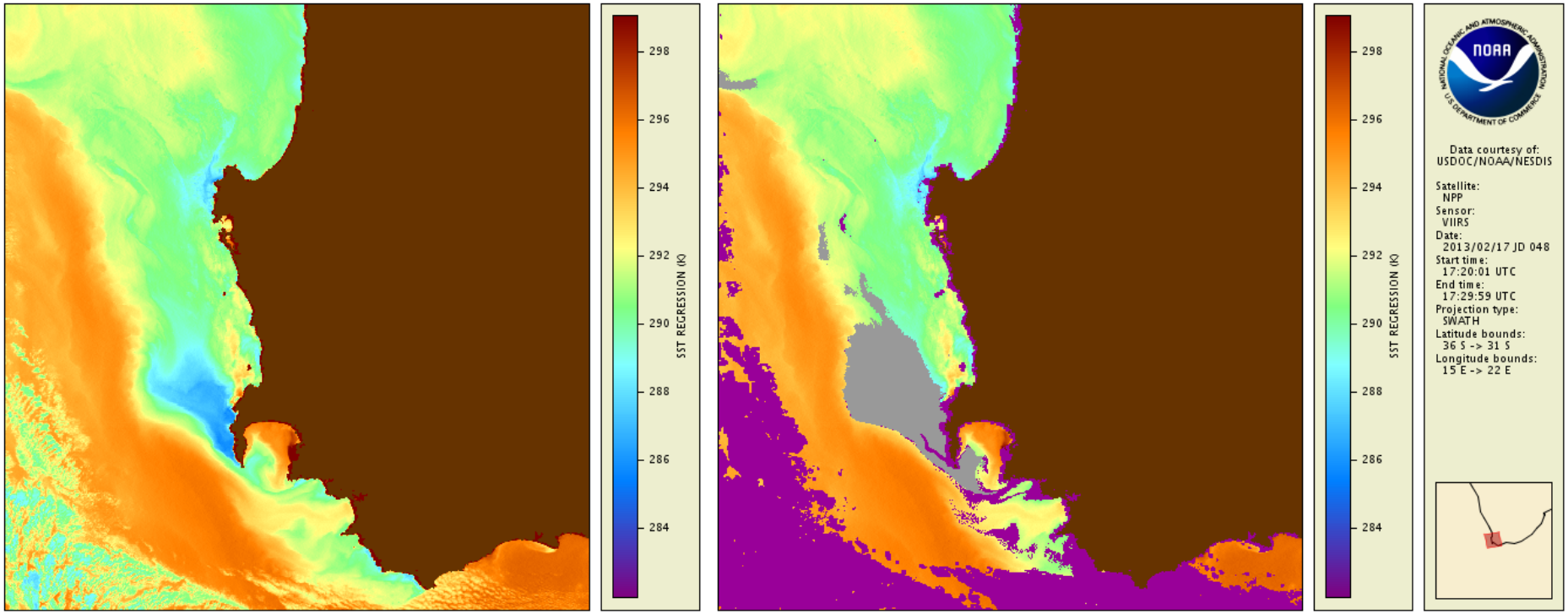
South Africa, 02/16/13



South Africa, 02/17/13



South Africa, 02/17/13



Types of misclassifications

Typical clear sky ocean regions misclassified by the ACSM :

- o contiguous,
- o with well-defined boundaries,
- o typically located in the vicinity of ocean thermal fronts.

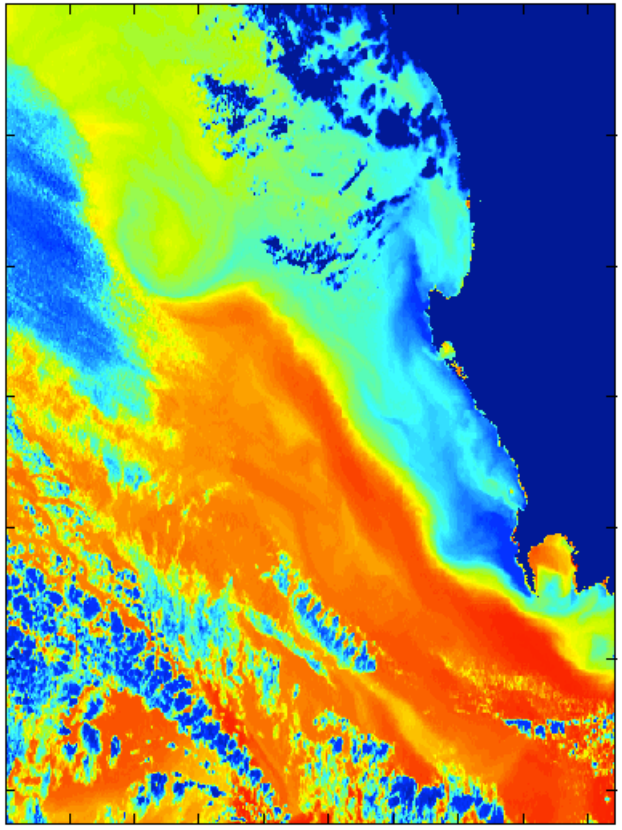
Existing image processing techniques:

- Segmentation;
- Morphological Procedures: erosion and dilation;
- Thermal Front Detection.

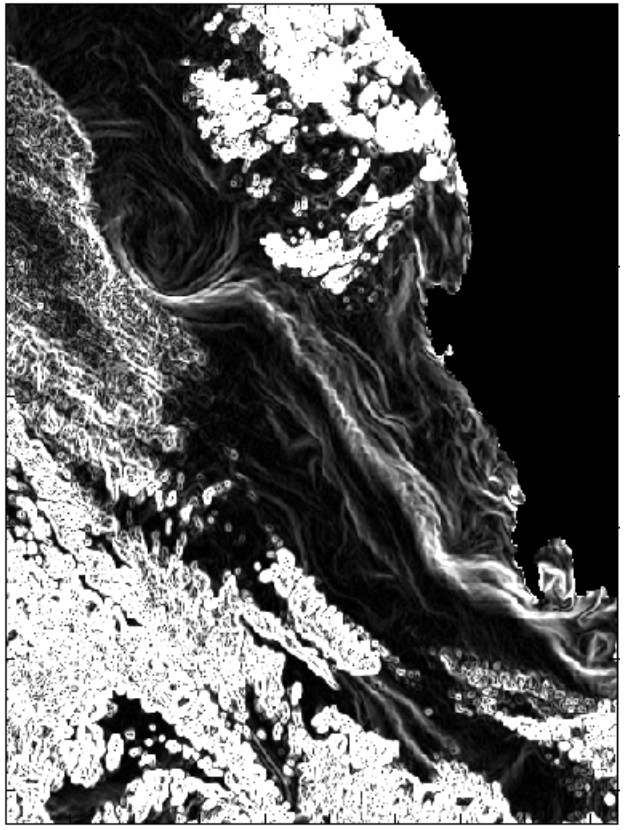
Human Perspective

- Human eye does not perceive absolute pixel values (i.e., SST values)
- It relies instead on local contrasts and ratios, which more directly correlate with gradients in an image.
- Difference between ocean and cloud patterns should be more pronounced in the SST gradient magnitude domain.

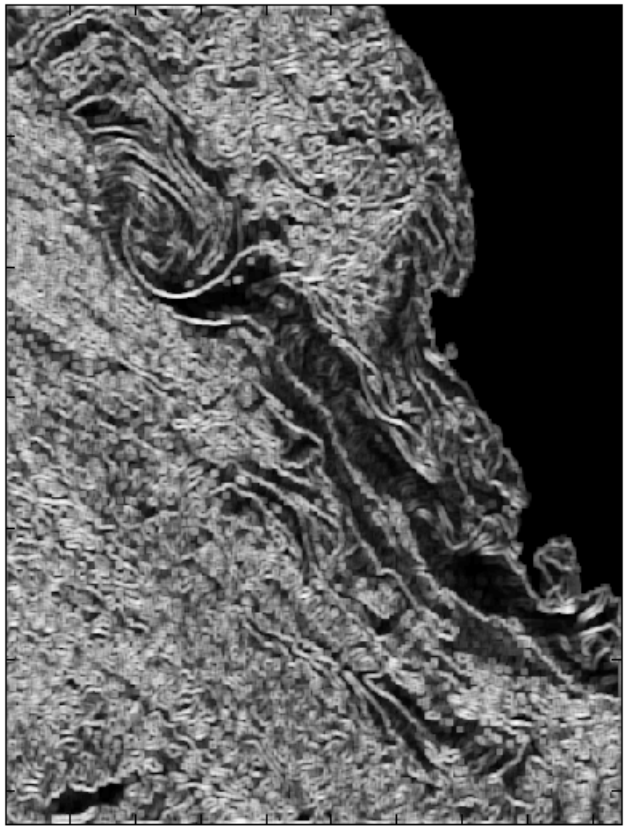
Gradient magnitude and angle



SST



Gradient magnitude



Gradient angle

Algorithm

Step 1: Identify Search Domain

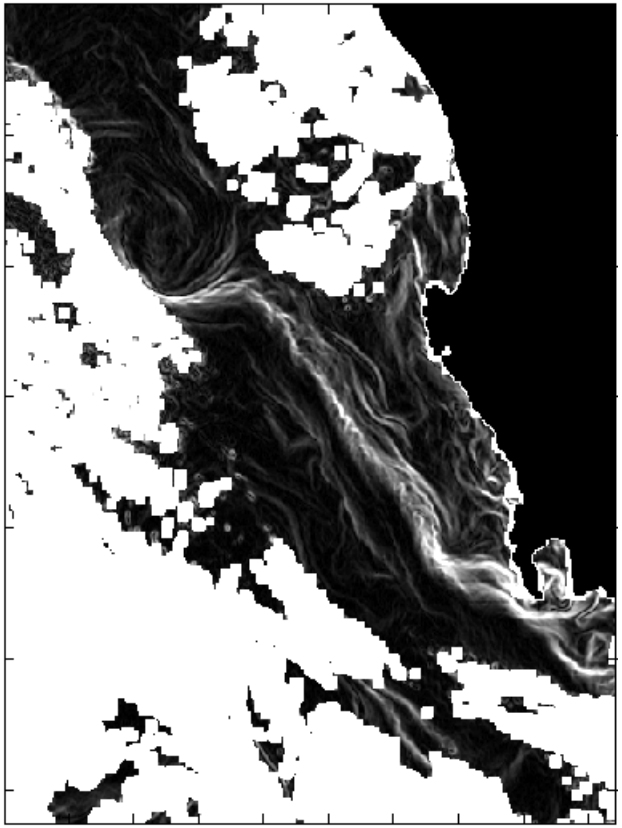
Step 2: Determine SST gradient ridges

Step 3: Determine spatially connected cold SST regions

Step 4: Discard SST segments found in Step 3 that do not border the ridges found in Step 2

Step 5: Statistical Test

Steps



Search Space

SST Gradient Ridges

Segments bordering Ridges

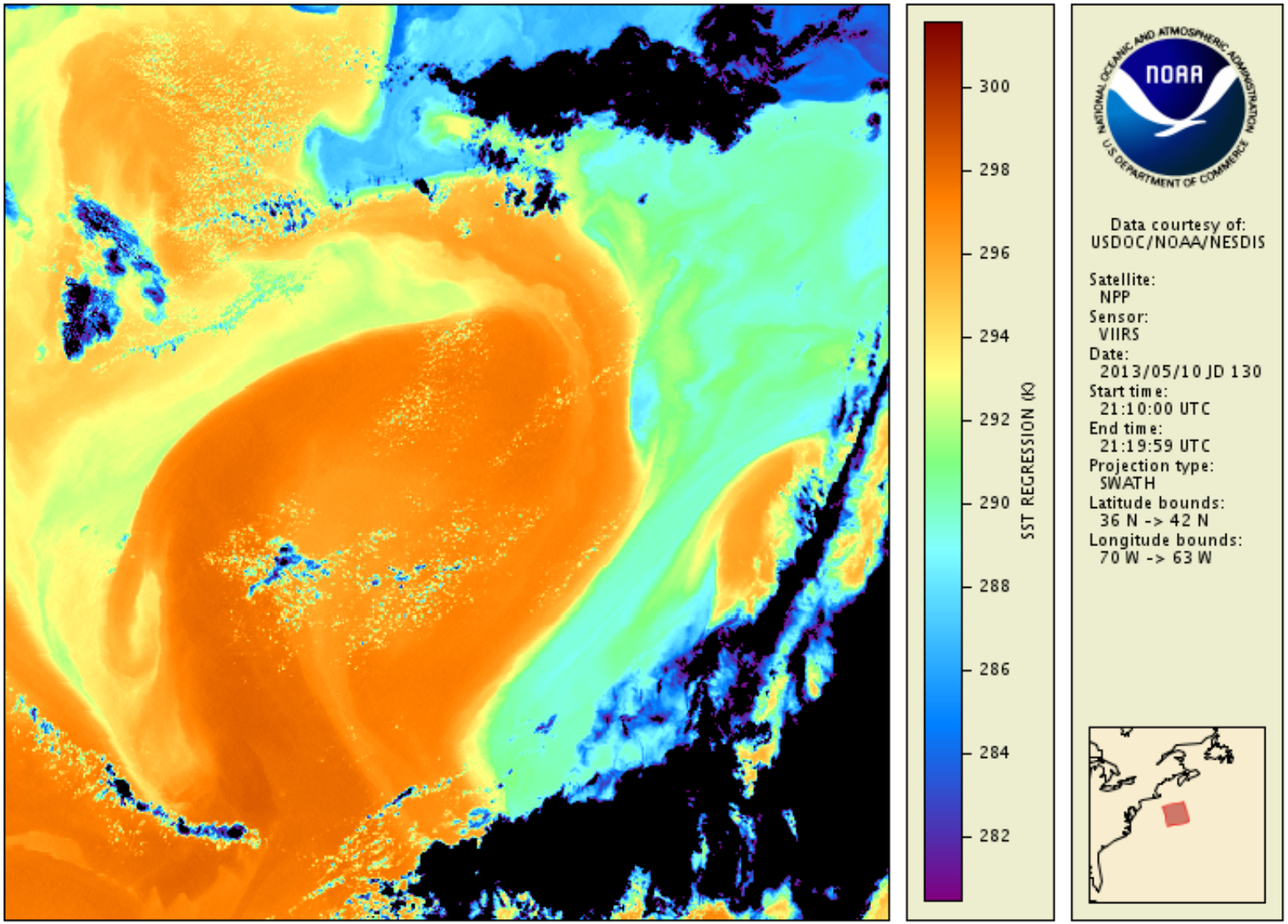
Potentials and Limitations

Considered 2 sets of VIIRS data:

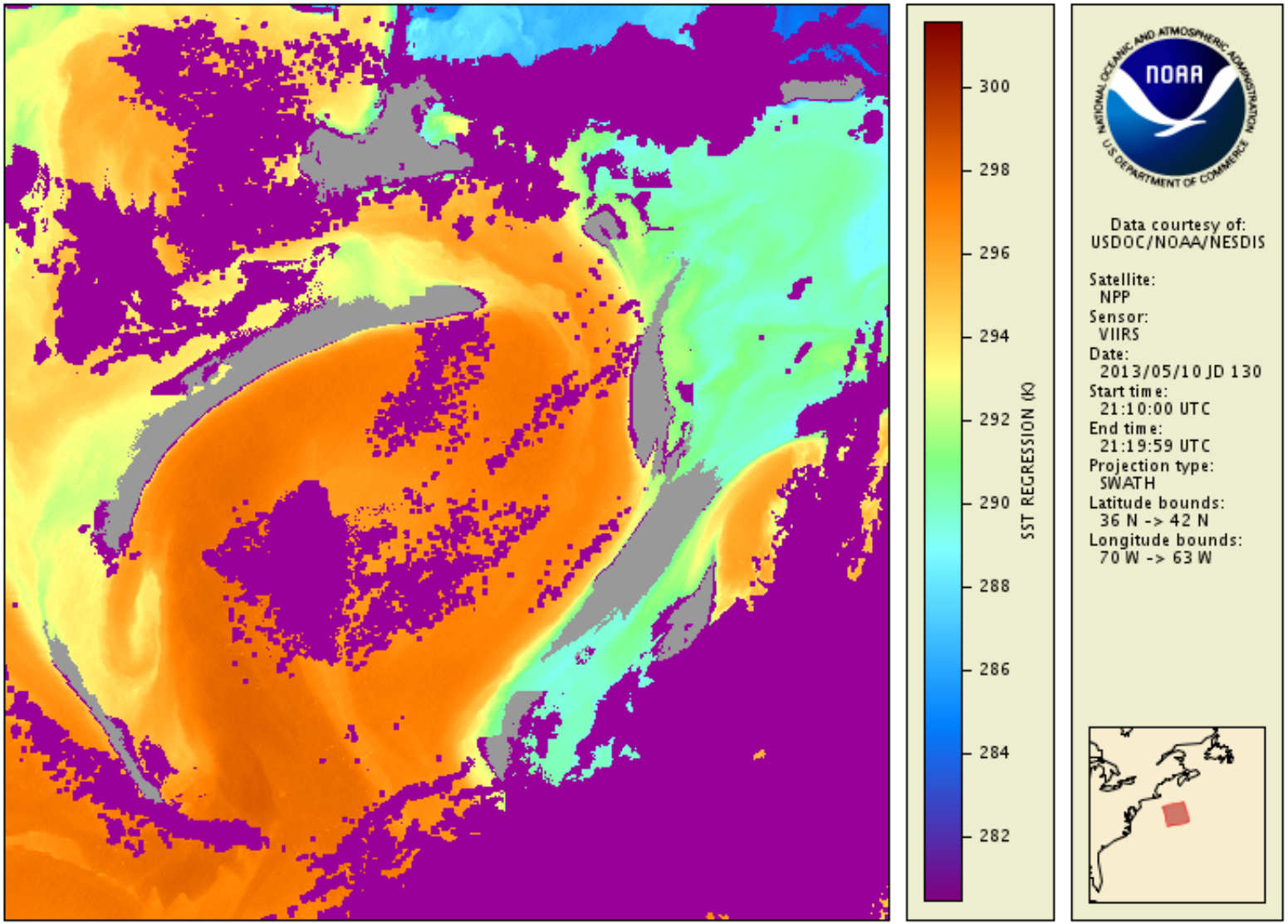
- 48 hand picked and cropped regions with typical clear sky misclassification
- 144 granules representing 1 day global observations

Results were visually inspected and analyzed;
Success rate is promising but more work is needed.

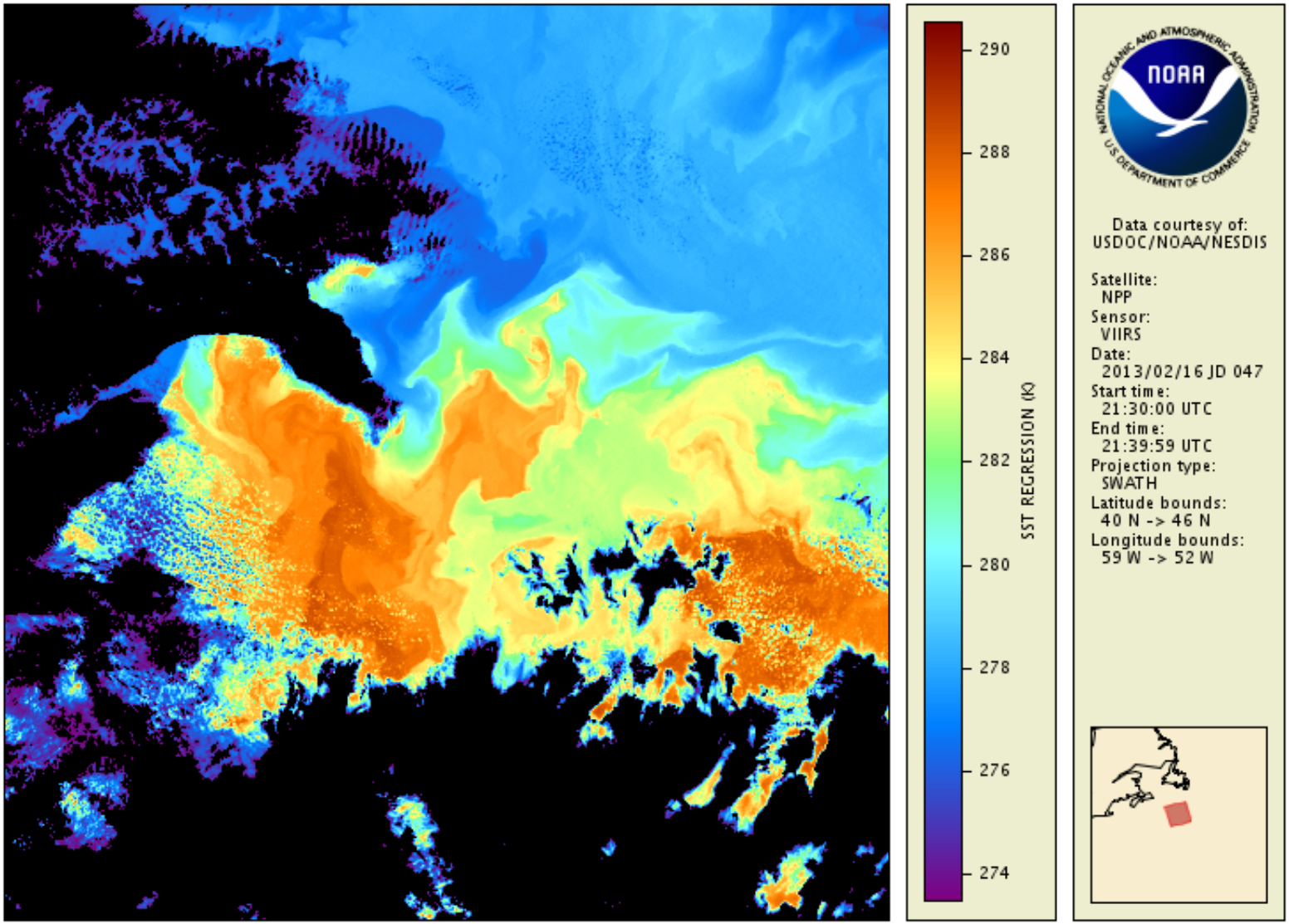
Gulf Stream, 05/10/13 (day)



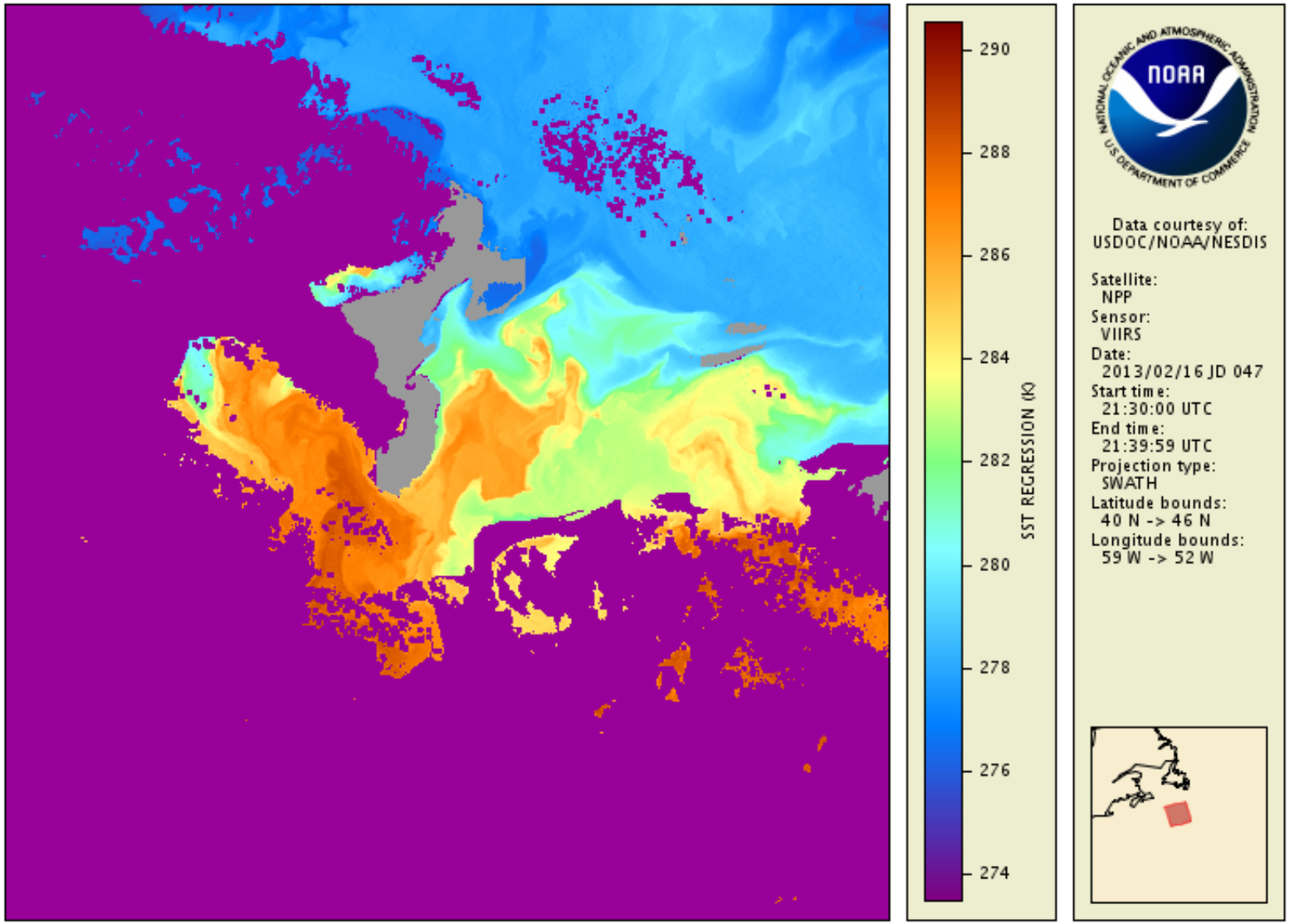
Gulf Stream, 05/10/13 (day)



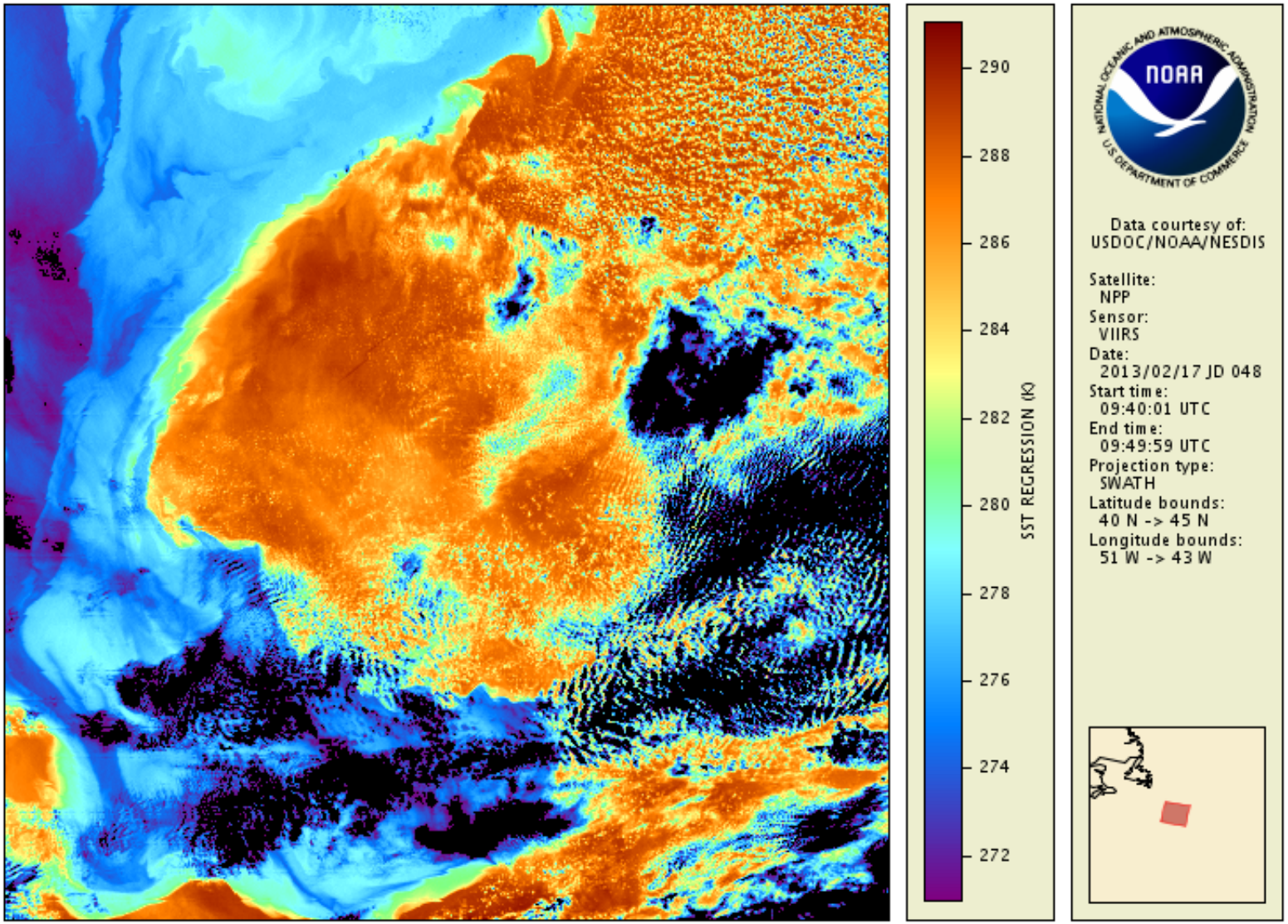
Gulf Stream, 02/16/13



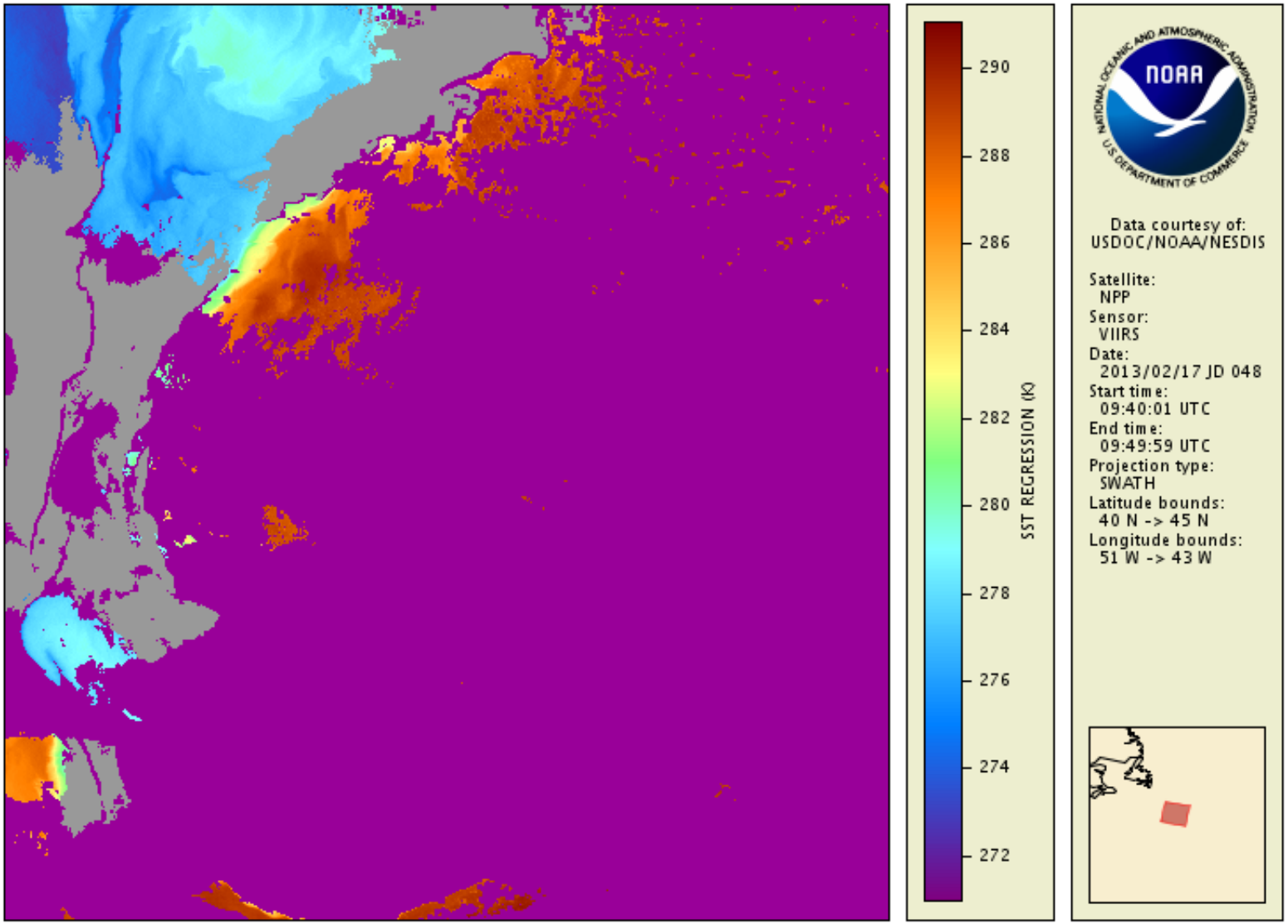
Gulf Stream, 02/16/13



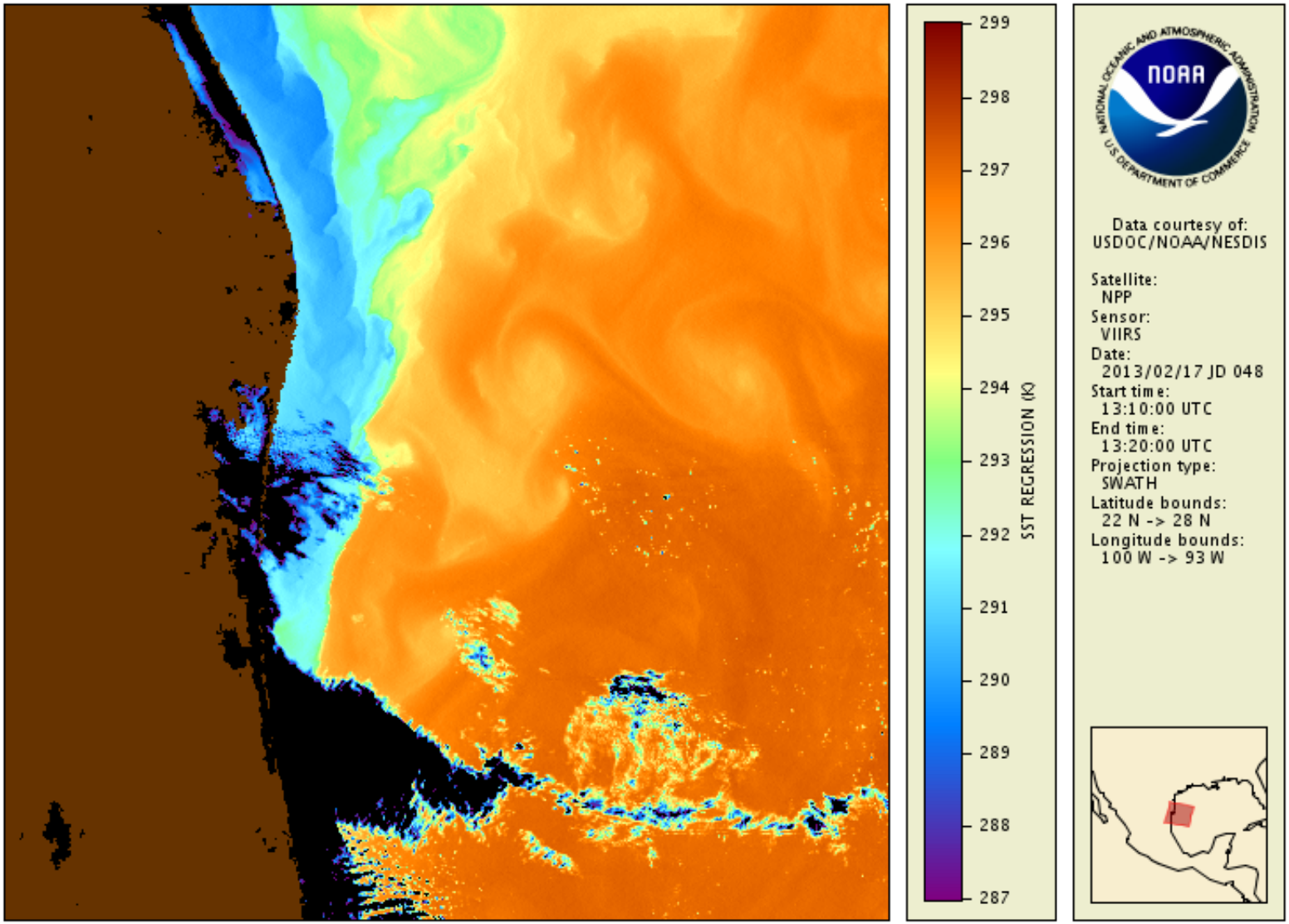
Gulf Stream, 02/17/13



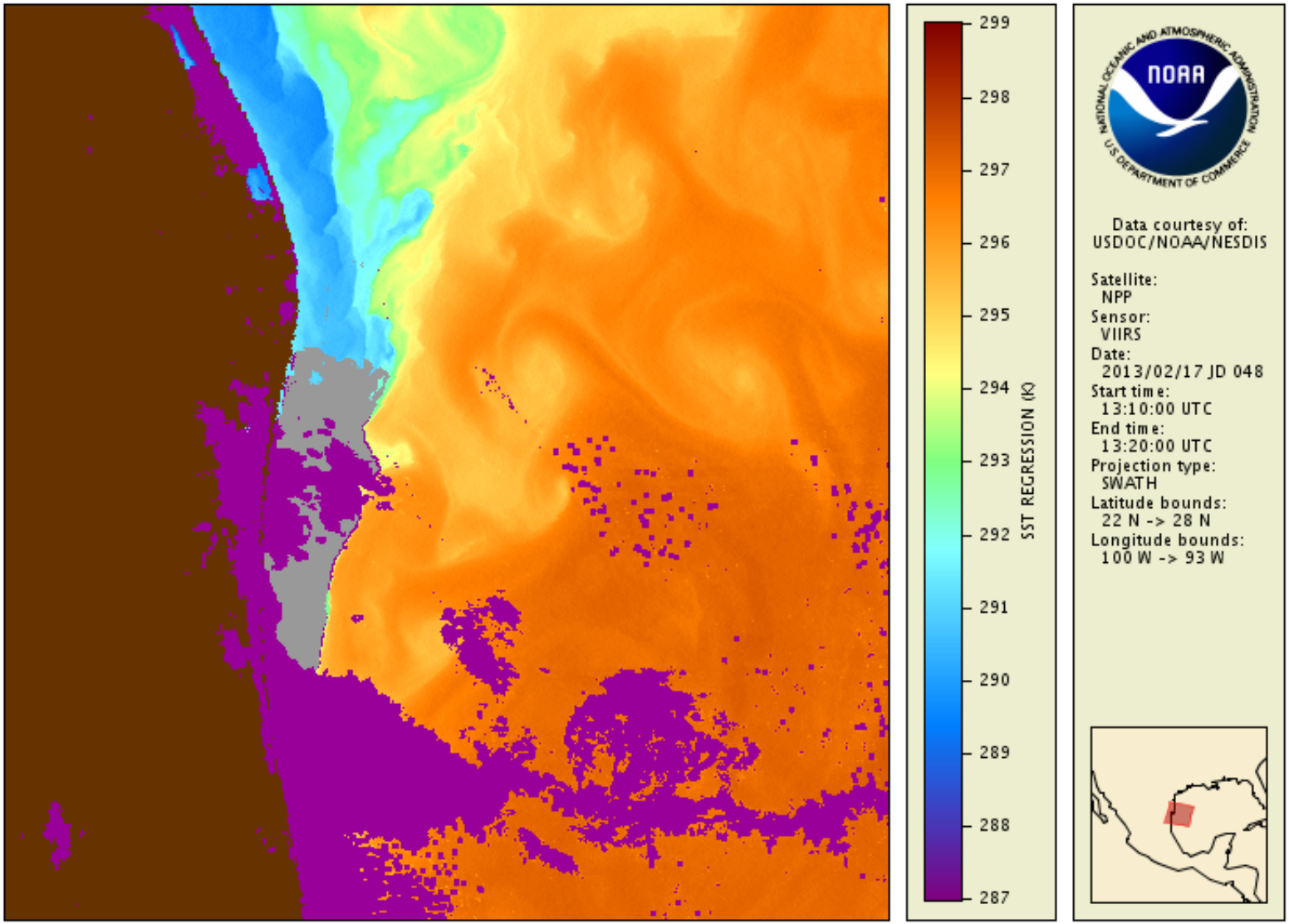
Gulf Stream, 02/17/13



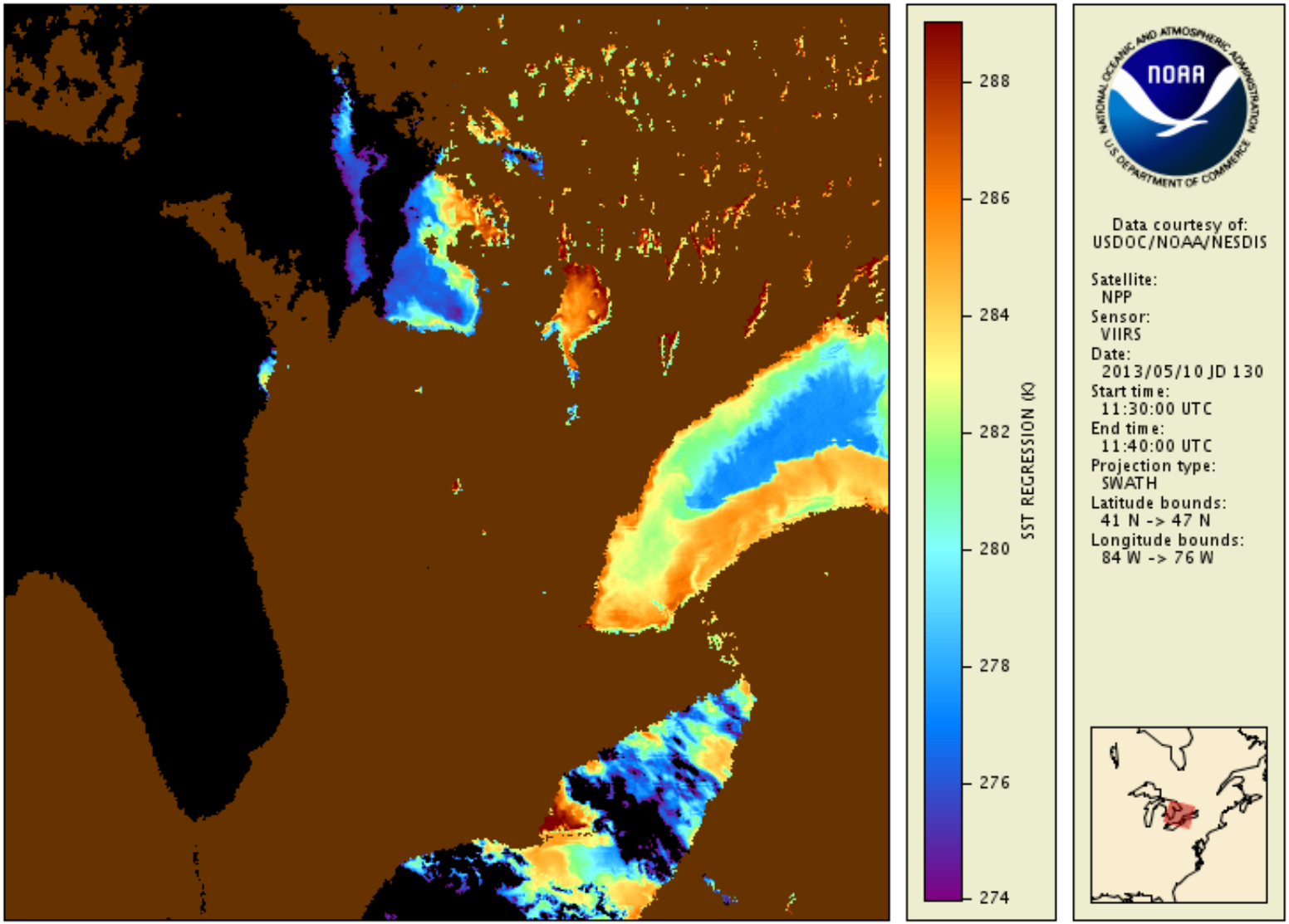
Gulf of Mexico, 02/17/13



Gulf of Mexico, 02/17/13



Great Lakes, 02/17/13



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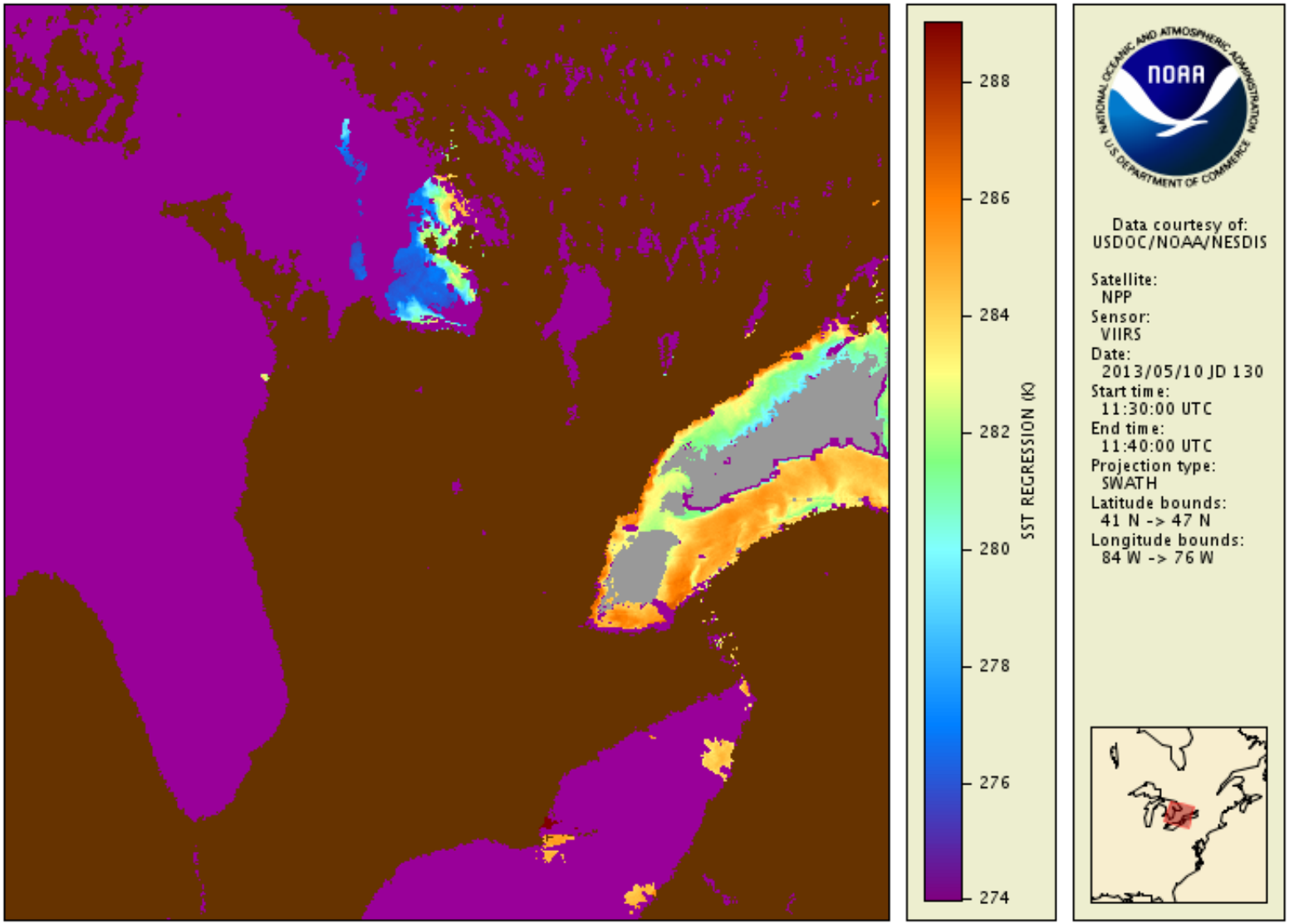
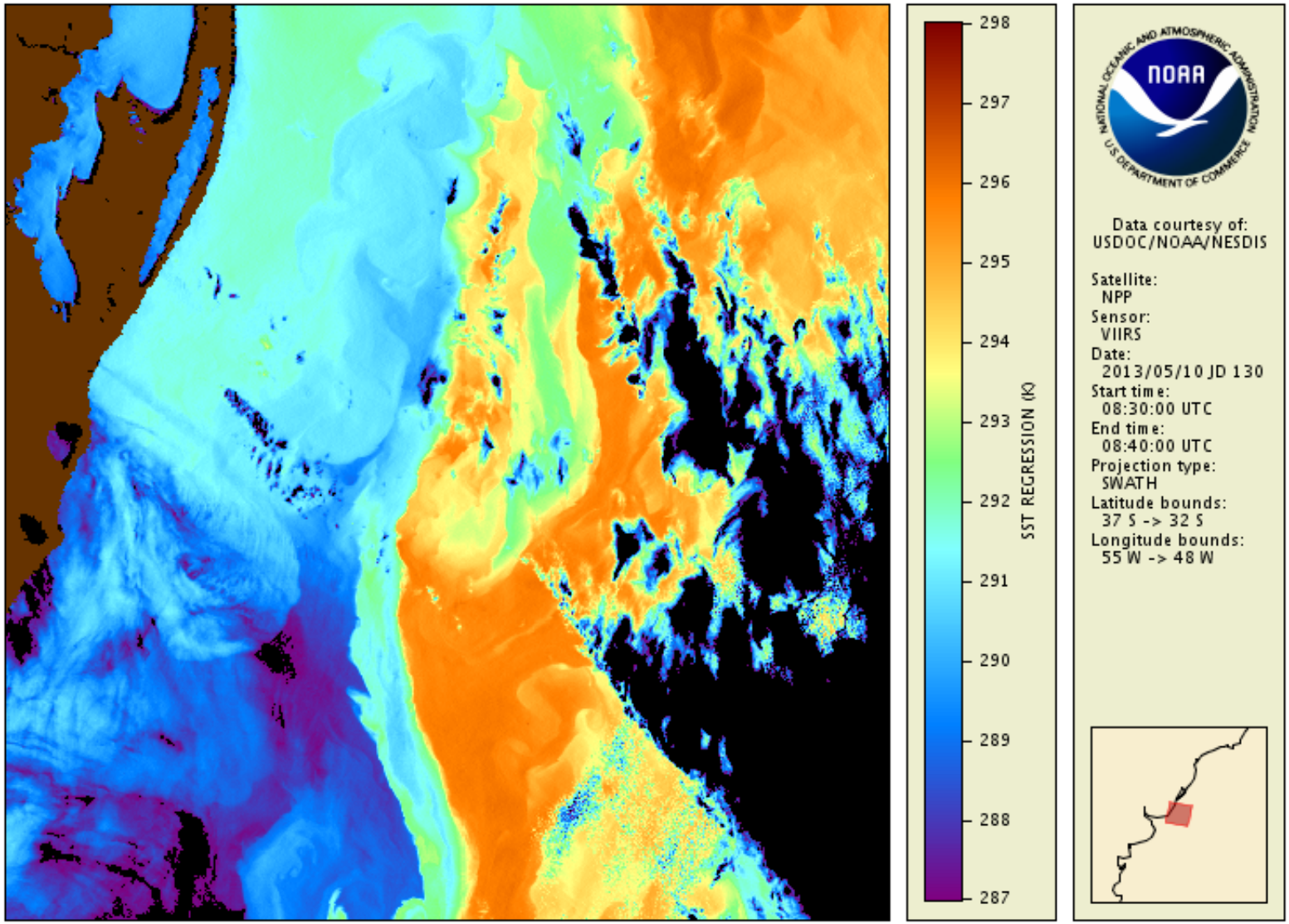


Uruguay, 05/05/13 (night)



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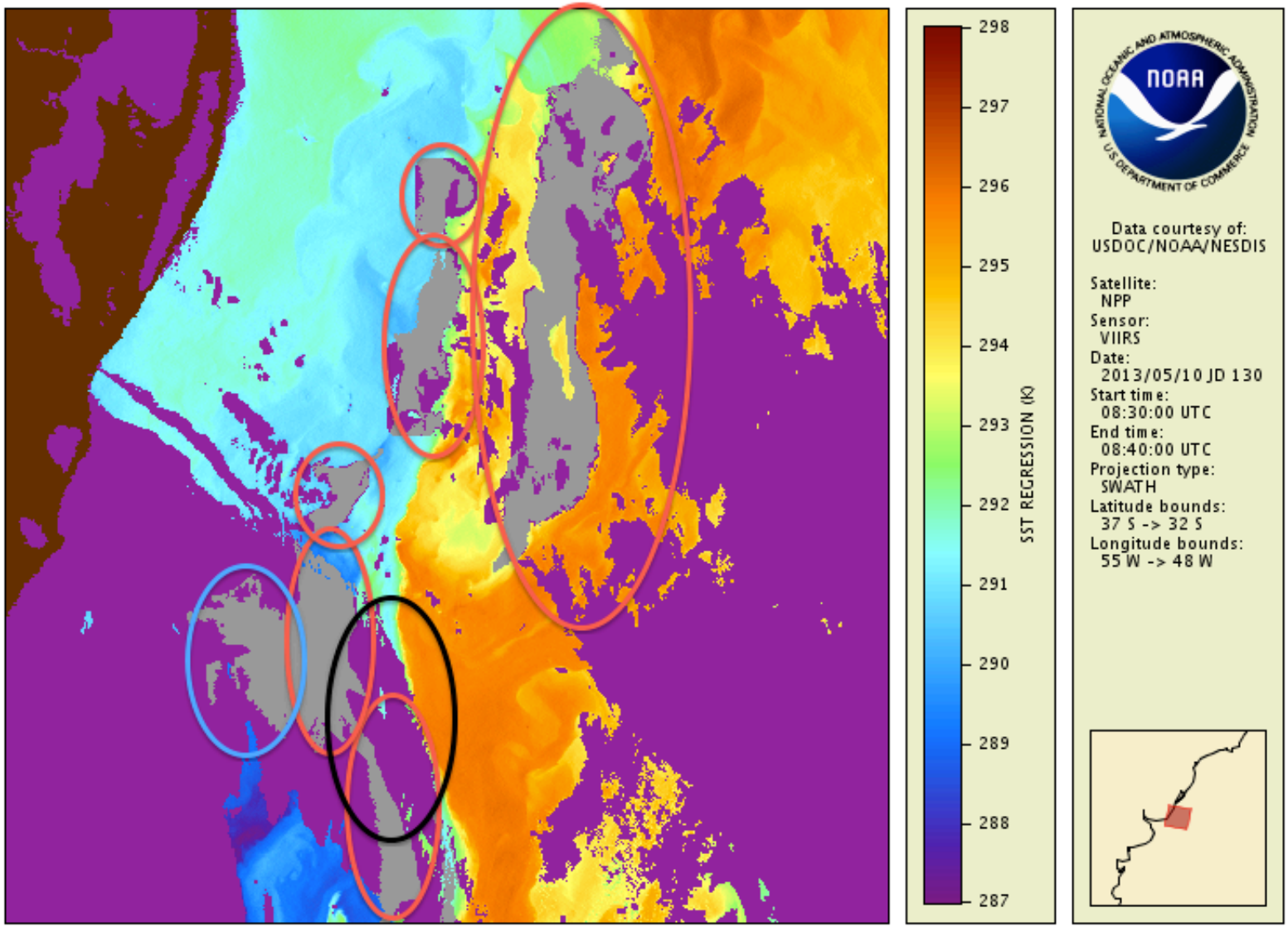
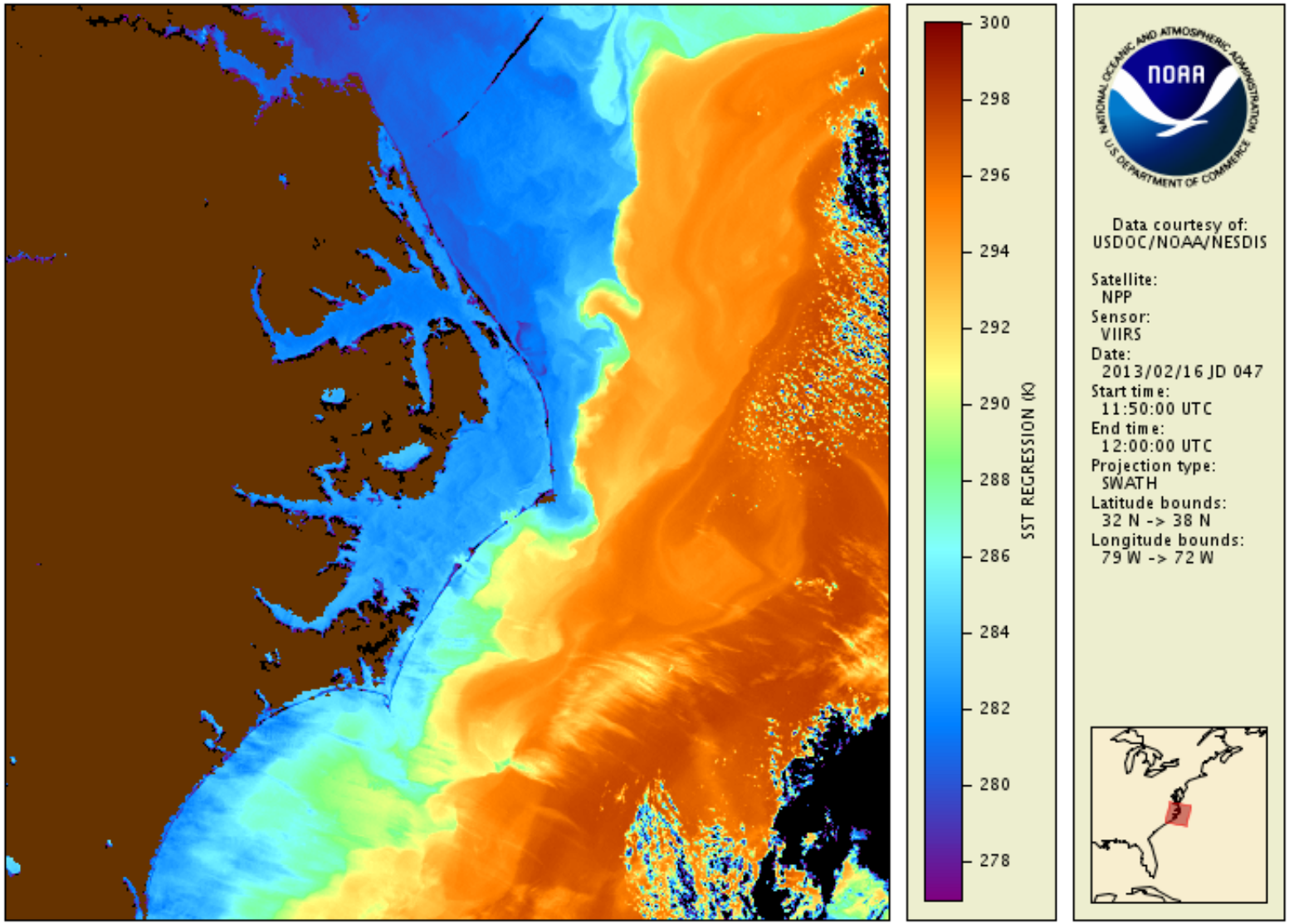
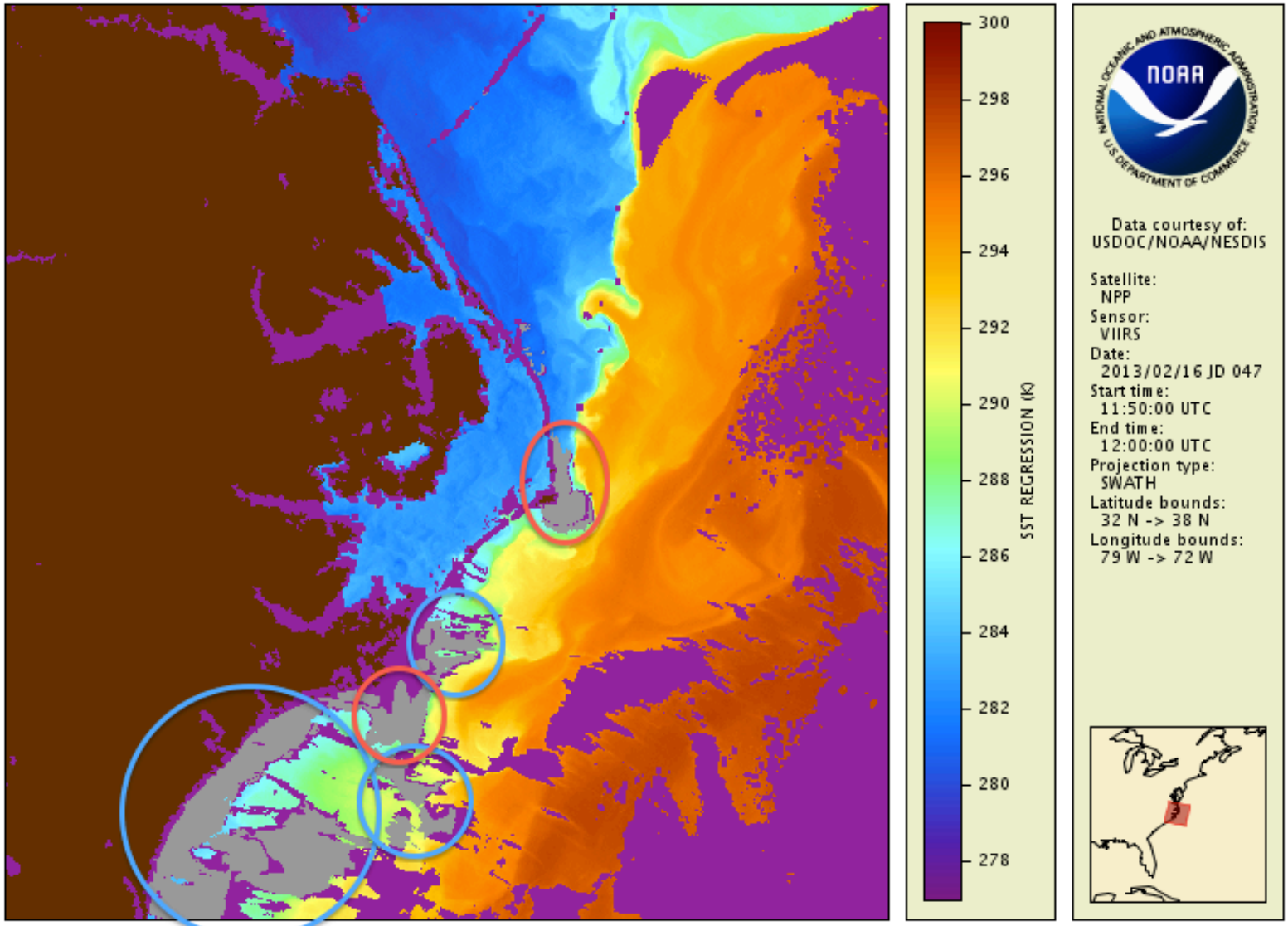


Pamlico Sound, 02/16/13 (night)



Pamlico Sound, 02/16/13 (night)



Conclusion

- A supplemental algorithm to the current ACSPO Clear-Sky Mask based on pattern recognition is being explored.
- Our preliminary analyses suggest that some of the limitations inherent to the current ACSM may be alleviated and SST coverage improved.
- The improvements are mostly noticeable in the areas interesting to ACSPO users, including dynamic areas of the ocean and coastal zones.
- Future work will include tuning the algorithm, with emphasis on resolving the remaining cloud leakages.