ON CHARACTERIZING THE STABILITY OF TITAN'S LAKE REGIONS. F. C. Wasiak[1], H. Hames[2], J. A. Tullis[2], D. G. Blackburn[1], V. Chevrier[1], J. Dixon[1], [1]Arkansas Center for Space and Planetary Sciences, 202 Old Museum Bldg., [2]Center for Advanced Spatial Technologies, 304 JBHT, University of Arkansas, Fayetteville, AR 72701 USA (fwasiak@uark.edu).

Introduction: The polar regions of Titan continue to be imaged by Cassini's Imaging Science Subsystem (ISS), Synthetic Aperture Radar (SAR), and Visual and Infrared Mapping Spectrometer (VIMS). The evidence for liquid filled lakes is abundant and include: morphological features similar to terrestrial lakes, radar returns consistent with incident radiation in a hydrocarbon liquid, a decrease in size of Ontario Lacus in the south [1], spectra obtained by the VIMS instrument identifying ethane as a constituent of Ontario Lacus [2], and a specular reflection from the large sea known as Kraken Mare in the north-polar region [3].

The ability of Geographic Information Systems (GIS) to spatially correlate image data taken at different times, resolutions, and by different instruments, along with enhanced processing and analytical techniques, allows detailed comparison of features and the search for change.

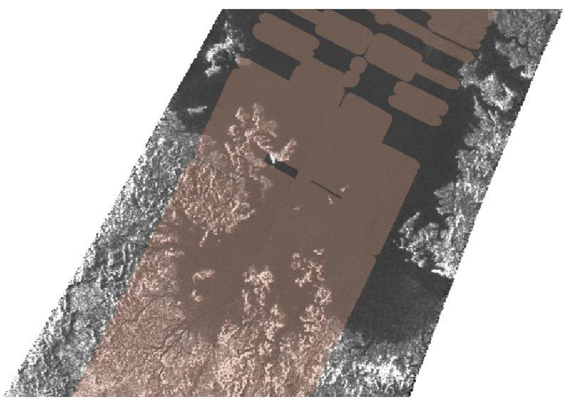

Figure 1. Cassini SAR images T29 and T64, acquired 33 months apart, show no discernable change

Lake Monitoring: Spatially referenced lake/shoreline images taken at different times are referenced to each other using temporally resistant control points such as permanent surface features beyond lakeshore boundaries. Image analysis is run on individual images to detect object edges on a pixel by pixel basis. Features within the images are defined and vector layer shape files produced. Feature layers are subsequently imported into the GIS, and individual features are selected upon which to perform vector analysis; i.e. suspected methane bodies. Shoreline and lake features are subsequently delineated from the imagery.

Spatial analysis is used to discern significant change within polygons, while feature extraction is used to discern any newly formed features such as shoreline, beach, islands, or channels that require further vector analysis.

Object Oriented Analysis: Object-oriented analysis has the advantages of combining spectral information with spatial information such as size, shape, texture, directionality, connectivity, and neighborhood relations to increase classification possibilities. Object-oriented image processing contains the domains of segmentation and classification. Segmentation aims at producing image objects, rather than pixels, having attributes of shape, texture, and relations to neighboring objects. Classification is based on a class hierarchy, and contains rules under which the images are classified, structured by relations of sub and super objects through levels for each class [4]. To translate spectral characteristics of image objects to real-world features, the object-oriented classification approach uses semantics based on descriptive assessment and knowledge; i.e. it incorporates the wisdom of the user [5].

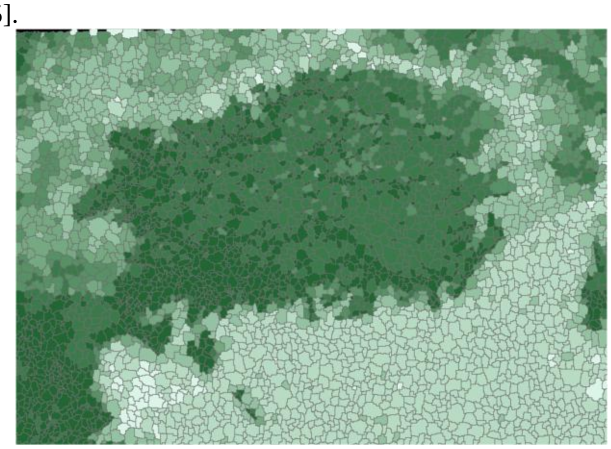

Figure 2. Cassini SAR image (April 2007) of Mayda Insula (79 N, 312 W) with homogenous pixels converted into polygons (sub-objects)

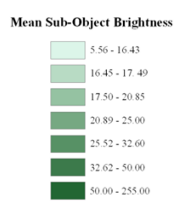

Figure 3.

Segmentation: Utilizing Definiens eCognition software, image sub-objects are extracted using a segmentation algorithm to delineate the digital imagery into polygons based on pixel brightness values and nearest neighbor analysis. Training data are selected based on visual interpretation, and homogenous groups of pixels converted into sub-polygons utilizing the mean value of pixels; i.e. multi-resolution object detection (Figures 2, 3).

Classification: Polygons are classified into land, sea, and no data by filtering FWHM brightness levels. Borders are removed, and sub-polygons converted into larger polygons of land and sea (Figure 4). Some manual clean-up is performed; e.g. dark shadows can have brightness values similar to liquid.

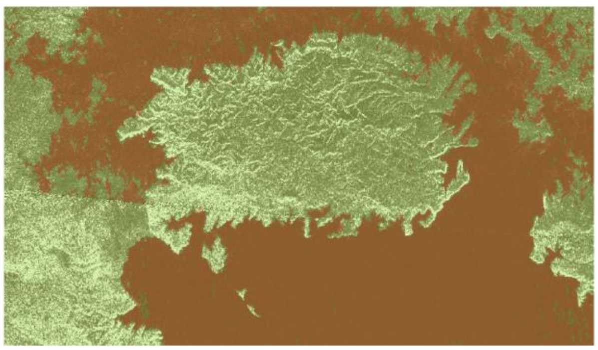

Figure 4. Borders removed and sub-polygons converted into larger polygons; i.e. land and sea

Discussion: Without the benefit of in-situ observations, object extraction operations are made through visual interpretation. To date, our analysis of temporally spaced ISS and SAR data has not detected change in northern lake or shoreline features; however, we continue our analysis and eagerly await future PDS data releases and the advancement of the Spring season for both increased temporal spacing and insolation.

References: [1] Hayes A. G. et al. (2010) *Icarus*, doi:10.1016/j.icarus.2010.08.017. [2] Brown R.H. Et al. (2008) Nature, 454, 607-610. [3] Stephan K. et al. (2010) *Geophysical Research Letters*, 37. [4] Damla, U. A. Baris, G. Ayda, A. Filiz, S. (2006) *In procees-ings of the RSPSoc annual Conference*, Newcastle, UK. [5] Blaschke, T. Strobl J (2001) GeoBIT/GIS 6: 12-17.