Update of the CERSER TeraScan Cataloguing System and the TeraScan Image Processing Scripts

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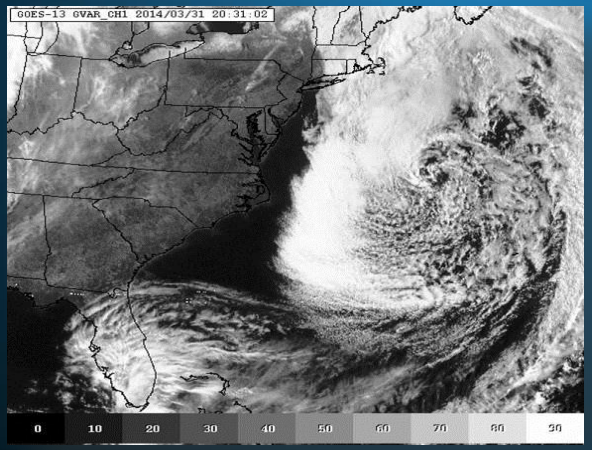
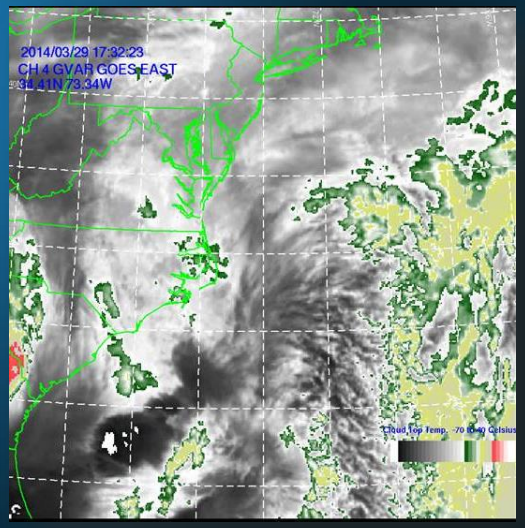
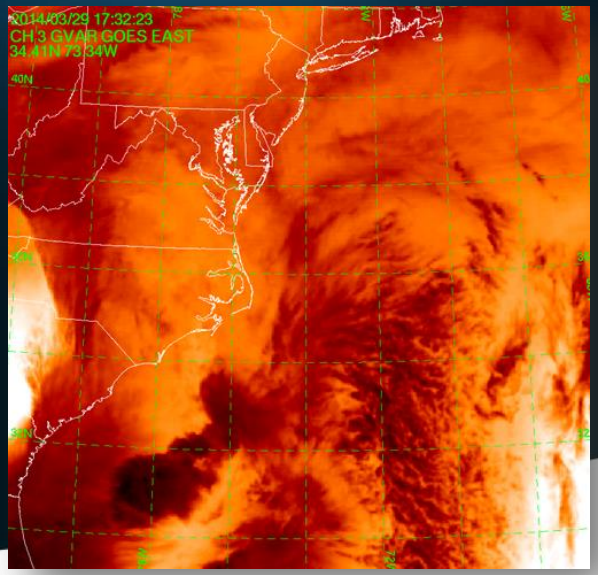






Abstract

The Center of Excellence in Remote Sensing Education and Research (CERSER) on the campus of Elizabeth City State University is currently tasked with the responsibility of receiving remotely sensed data from orbiting National Oceanic and Atmospheric Administration (NOAA) Polar Operational Environmental Satellites (POES) and the Geostationary Operational Environmental Satellites (GOES). This data is collected by SeaSpace TeraScan systems installed in the CERSER labs in Dixon-Patterson Hall.

In 2005, the processing system underwent a major update due to a migration to a new operating system. A minor update was needed at this time to deal with a second operating system migration and display of the processed images on the CERSER web site. Since then, a second transfer to a new server was made in 2013. The cataloguing system went down at this time and was not repaired due to technical issues with the TeraScan system. The 2014 team corrected issues within the current server directory system and updated the data script to process images from the GOES-13 satellite received by the TeraScan system. Software and languages utilized for this task included ImageMagick, PHP, HTML, Dreamweaver, phpMyAdmin, and MySQL.

Along with this operating system update, a major script development was needed on the TeraScan processing equipment due to an upgrade in hardware. The ground station upgrades included a 3.7m X/L band, a 3.6m C band, and a 5.0m L band dishes, along with accompanying computing hardware. This new script processes both infrared and visible light images received from the GOES-13 satellite into the Tagged Image File (TIFF) Format.

Goals

- CERSER Script Failures
- Modify/Develop TeraScan Script
- Rewrite CERSER Processing Script

What is TeraScan?

- Purpose
- Satellite Data Reception
- Satellite Frequency
  - L-Band
  - Wavelength Range (1 -2 GHz)

TeraScan

- 6 Different Channels/Bandwidths:
  - Channel 1 (visible) - Cloud cover and surface features during the day
  - Channel 2 (Infrared) - Low cloud/fog and fire detection
  - Channel 3 (Infrared) - Upper-level water Vapor
  - Channel 4 (Thermal Infrared) - Surface or cloud top temperature
  - Channel 5 (Thermal Infrared) - Surface or cloud top temperature and low-level water vapor
  - Channel 6 (Thermal Infrared) - Carbon dioxide band: Cloud detection

TeraScan

- Software platform on TeraScan: RedHat Linux
- Graphical User Interface (GUI's)
  - TeraVision
  - TeraMaster

Data Processing in TeraScan

- Configuration Directory
  - batch.ingest
  - gvarin
  - gvar.local
- GOES VARiable Format (GVAR) data

TeraScan Modification Script

jdridgeway787 — jridgeway@ecsu-goes-east:/opt/terascan/pass/config...

```
aquadb.global.fog          hirid.pgs                swhrpt.global
aquadb.global.skewt        hirid.rgb                swhrpt.image
aquadb.image               hrit.archive             swhrpt.local
aquadb.local               hrit.clouds              swhrpt.seawifs
aquadb.local.composite     hrit.export              teradb.archive
aquadb.local.fog           hrit.export.coms         teradb.callback
aquadb.local.skewt         hrit.global              teradb.concat
aquadb.modis               hrit.image               teradb.export
aquadb.modis.laads         hrit.local               teradb.global
aquadb.rgb                 hrit.lowcloud            teradb.global.fog
aquadb.rgb.transfer        hrit.olrpwa              teradb.global.skewt
aquadb.vulcan              hrit.pgs                 teradb.image
batch.ingest               hrit.rgb                 teradb.local
chrpt.global               hrit.sst                 teradb.local.composite
chrpt.local                hrpt.archive             teradb.local.fog
chrpt.mvisr                hrpt.atovs               teradb.local.skewt
fyhirid.archive            hrpt.atovs.global        teradb.modis
fyhirid.clouds             hrpt.atovs.local         teradb.modis.laads
fyhirid.export             hrpt.avhrr               teradb.rgb
fyhirid.global             hrpt.export              teradb.rgb.transfer
fyhirid.image              hrpt.global              teradb.vulcan
[jridgeway@ecsu-goes-east configproc]$ pwd
/opt/terascan/pass/configproc
[jridgeway@ecsu-goes-east configproc]$
```

Data Processing in TeraScan

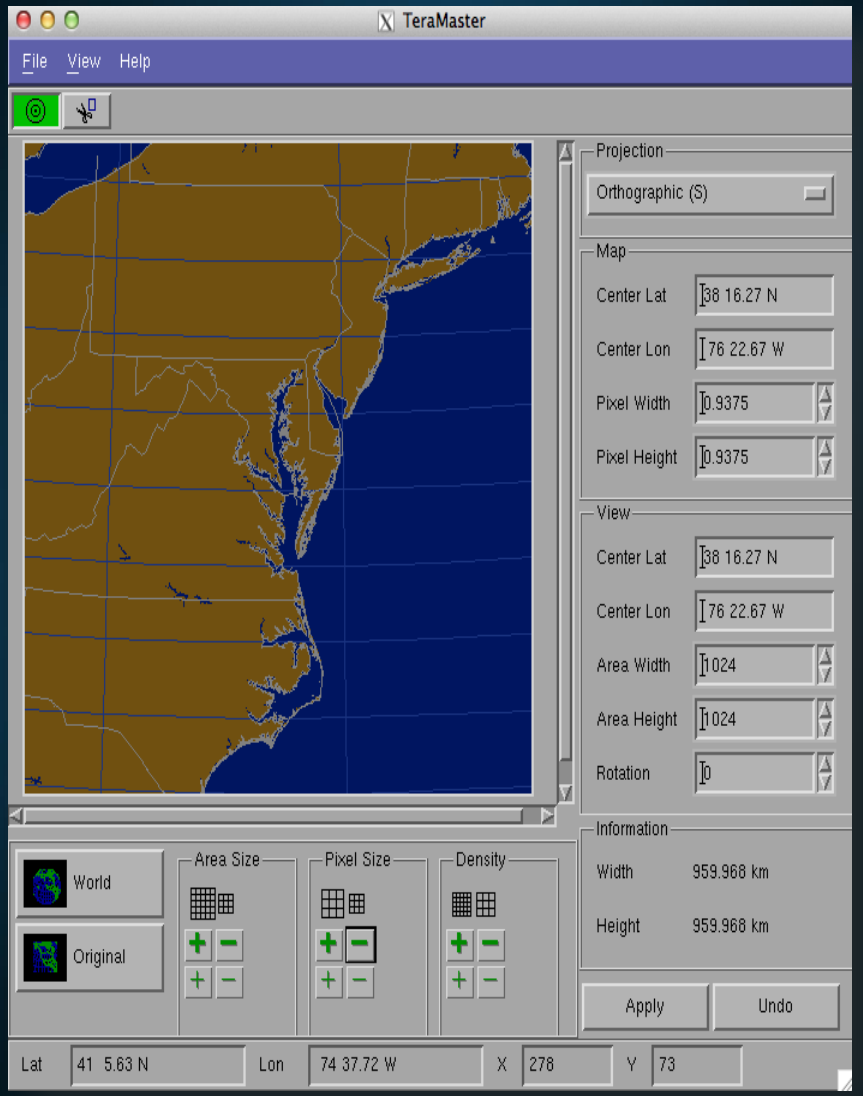
$PASSDIR/configproc/gvar.local

```
[Remap]
active: yes
function: simple_remap
output_files: Remap
scrub_age_hours: 480
{
   [GoesWest_CONUS]
   cover_area: GoesWest_CONUS
   cover_percent: 90
   sensor_resolution: yes
   input_directory: products/tdf/whole_pass/gvar
   input_files: 20*.gvar
   remap_variables: gvar_ch*
   output_template: %yyyy.%mmdd.%hhmm.%satel.gvar
   save_directory: products/tdf/Local/gvar/level1
   save_files: 20??.????.????.*.gvar


   [GoesEast_CONUS]
   cover_area: GoesEast_CONUS
   cover_percent: 90
   sensor_resolution: yes
   input_directory: products/tdf/whole_pass/gvar
   input_files: 20*.gvar
   remap_variables: gvar_ch*
   output_template: %yyyy.%mmdd.%hhmm.%satel.gvar
   save_directory: products/tdf/Local/gvar/level1
   save_files: 20??.????.????.*.gvar
}
```

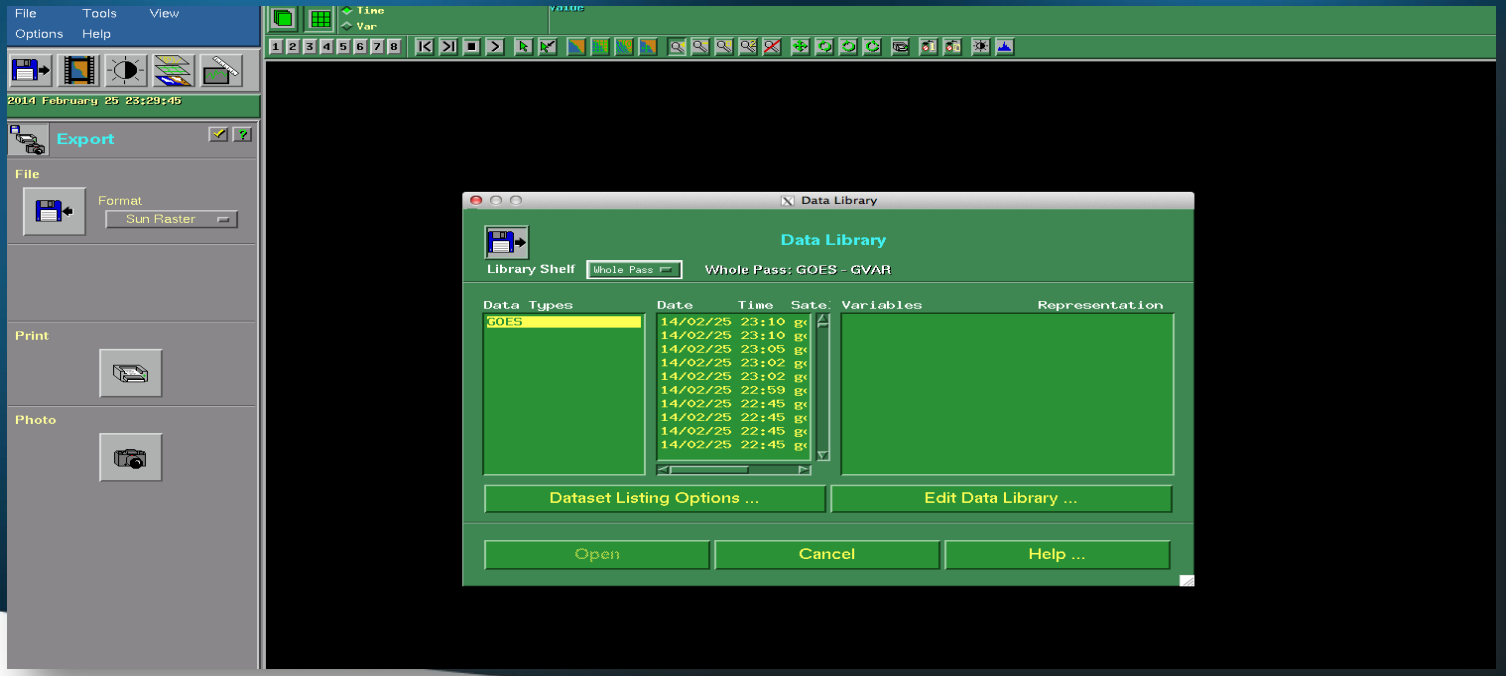
Area Of Interest

- Terminal
  - login to TeraScan Server
  - launchpad
- TeraMaster
  - create an area of interest (AOI) or Master
  - save AOI



Modifying Configuration File

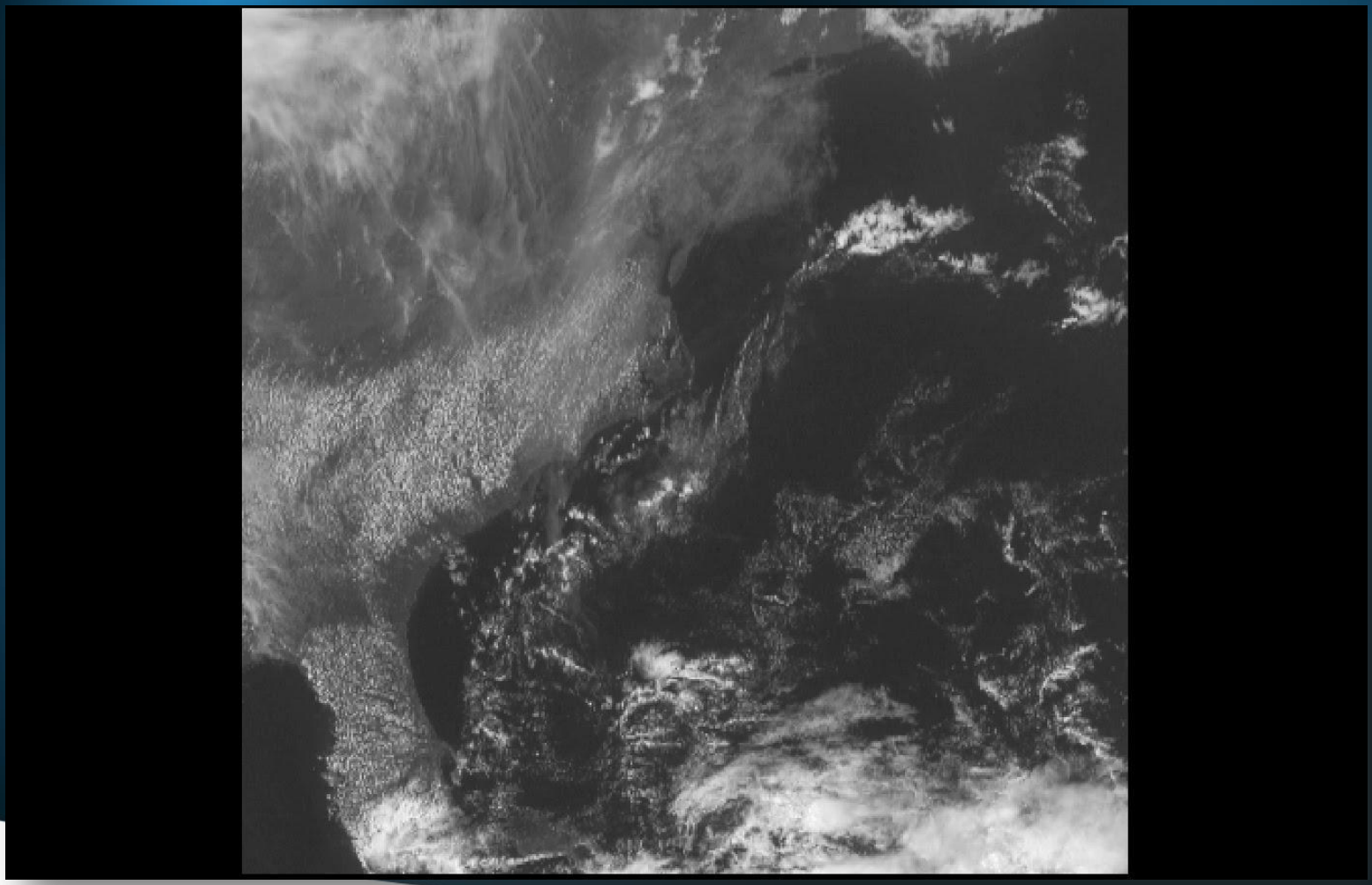
- Script
  - configproc
  - function
  - parameters
- TeraVision



TeraMaster Modifications

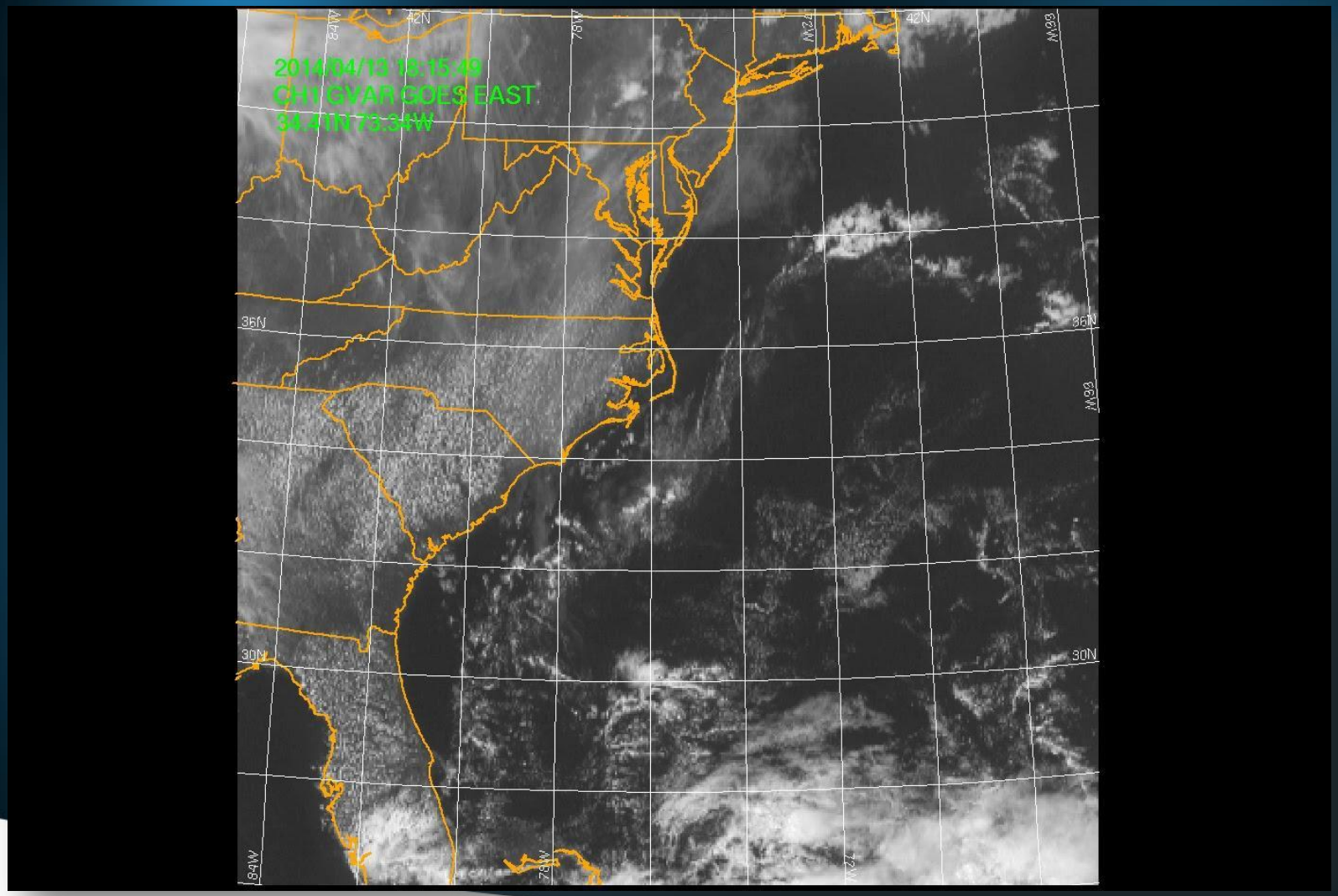
```
[GoesEast-Local]
active: yes
cover_area: practiceMaster2
cover_percent: 90
sensor_resolution: yes
input_directory: products/tdf/whole_pass/gvar
input_files: 20*.goes-13.gvar
remap_variables: gvar_ch*
output_template: %yyyy.%mmdd.%hhmm.%satel.gvar
save_directory: products/tdf/Local/gvar/level1
save_files: 20??.????.????.*.gvar
```

TeraVision Images



Naked Channel 1 April 13 2014 18:15:49

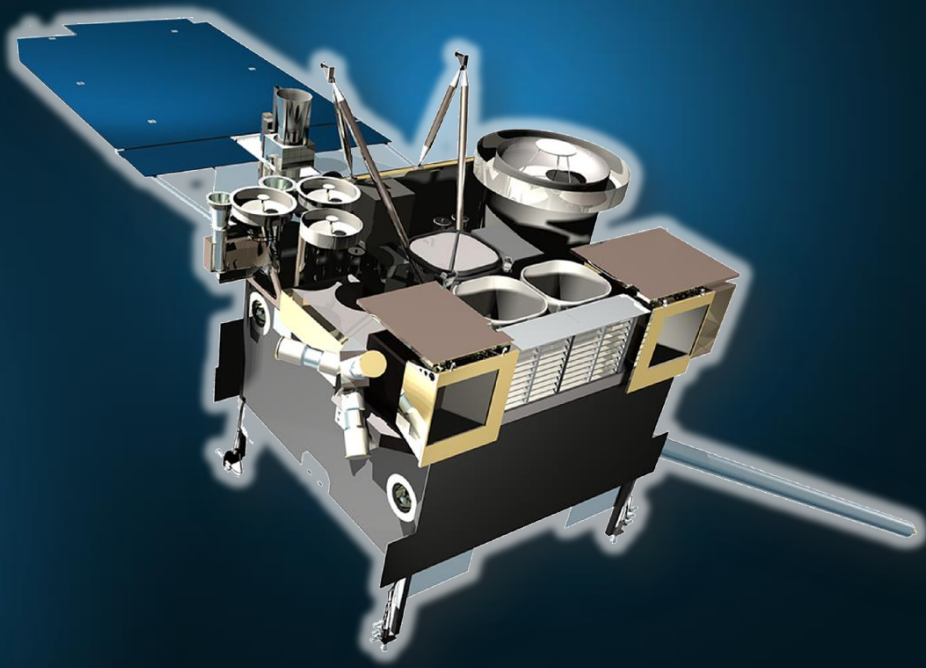
TeraVision Images



Channel 1 April 14 2014 18:15:49

CERSER Server Script Failures

- Update of the database
  - GOES data
- Directory Permissions
  - Picture Archives Directory



Server Side Script

- Languages used:
  - PHP
  - MySQL
  - HTML
- First used Active Server Page (ASP)
  - Was rewritten when switched from Windows to Macintosh

PHP

- Introduction
- Project Use

MySQL

- Introduction
- Project Use

HTML

- Introduction
- Project Use

Dreamweaver

- Introduction
- Project Use

phpMyAdmin

- Introduction
- Project Use

ImageMagick

- Introduction
- Project Use

ICal

- Introduction
- Project Use

Parse Title to Database

- Title being used for database
- 36 characters
  2014.0302.2001.goes-13.gvar_ch3.tiff
- “substr” a PHP function

```
67  //CHECK and Process GOES Satellite Info
68  if (substr($satName, 15, 4)=='goes')
69  {
70      $sat= substr($satName, 15, 7);
71      $cnvrtDate= substr($satName, 5, 2).'/'.substr($satName, 7, 2).'/'.substr($satName, 0, 4);
72      $cnvrtTime= substr($satName, 10, 4).'Z';
73      if(substr ($satName, 30, 1)=='1')
74          $product='Channel 1 Visible 0.52-0.72 mm' ;
75      else if (substr($satName, 30, 1)=='2')
76          $product='Channel 2 Infrared 3.78-4.03 mm' ;
77      else if (substr($satName, 30, 1)=='3')
78          $product='Channel 3 Vapor 6.47-7.02 mm' ;
79      else if (substr($satName, 30, 1)=='4')
80          $product='Channel 4 Upper Vapor 10.2-11.2 mm' ;
81      else if (substr($satName, 30, 1)=='s')
82          $product='Sea Surface Temperature' ;
83  }
```

Parse Title to Database

2014.0305.1531.goes-13.gvar_ch1.tiff

Characters	Data
1-4	Year
6-7	Month
8-9	Day
11-14	Time(Z)
16-22	Satellite Name
24-31	Product (band)
32-36	File Extension (.tiff)

Checking for GOES Image

”IF” statement looks for “goes” starting at position 15.

2014.0305.1531.goes-13.gvar_ch1.tiff

```
67    //CHECK and Process GOES Satellite Info
68    if (substr($satName, 15, 4)=='goes')
```

Storing Satellite Name

Parsing the satellite name

2014.0305.1531.goes-13.gvar_ch1.tiff

```
70        $sat= substr($satName, 15, 7);
```

Storing Reformatted Date

Parse and reformat the date into month/day/year

2014.0305.1531.goes-13.gvar_ch1.tiff

```
71        $cnvrtDate= substr($satName, 5, 2).'/'
.substr($satName, 7, 2).'/'.substr($satName, 0, 4);
```

Storing Time

Parsing the Greenwich Mean Time (GMT)

2014.0305.1531.goes-13.gvar_ch1.tiff

```
72        $cnvrtTime= substr($satName, 10, 4).'Z'
```

Storing the Product

Parsing the product from the image title

```
73  if(substr ($satName, 30, 1)=='1')
74      $product='Channel 1 Visible 0.52-0.72 &#181;m' ;
75  else if (substr($satName, 30, 1)=='2')
76      $product='Channel 2 Infrared 3.78-4.03 &#181;m' ;
77  else if (substr($satName, 30, 1)=='3')
78      $product='Channel 3 Vapor 6.47-7.02 &#181;m' ;
79  else if (substr($satName, 30, 1)=='4')
80      $product='Channel 4 Upper Vapor 10.2-11.2 &#181;m' ;
81  else if (substr($satName, 30, 1)=='5')
82      $product='Channel 5 Thermal IR 11.5-12.5 &#181;m' ;
83  else if (substr($satName, 30, 1)=='6')
84      $product='Channel 6 Thermal IR 12.9-13.7 &#181;m' ;
85  else if (substr($satName, 30, 1)=='s')
86      $product='Sea Surface Temperature' ;
```

Parse Product to Database

Products

Option	Text String
“1”	Channel 1 Visible 0.52-0.72 μm
“2”	Channel 2 Infrared 3.78-4.03 μm
“3”	Channel 3 Vapor 6.47-7.02 μm
“4”	Channel 4 Upper Vapor 10.2-11.2 μm
“5”	Channel 5 Thermal IR 11.5-12.5 μm
“6”	Channel 6 Thermal IR 12.9-13.7 μm
“S”	Sea Surface Temperature

Inserting Record into Database

- MySQL Query

```
109  //Perform Insert Record Query <<<<<<<<<<<<<<<<
110  //Place SQL Query into the $query variable
111  $query = "INSERT INTO images (imgdate, time, satellite, product, description, event)
              VALUES ('" . $cnvrtDate . "', '". $cnvrtTime . "', '" . $sat . "','".$product."', '', 0)";
116  //Perform Query and place result into $result for troubleshooting
117  $result = mysql_query($query);
```

Resize/Rename/Copy IMG

- ImageMagick
  - Converted TIFF files to JPEG format
  - Resized images
  - Copy images into four directories:
    - Actual
    - Medium
    - Low
    - Thumbnail

Resize/Rename/Copy IMG

- Renaming image:
  - $lastID as variable
  - “mysql_insert_id()” PHP function
- Use $lastID to rename the new file

```
116   //Obtain ID Number for this record
117   $lastID = mysql_insert_id();
```

```
//>>>>>>>>>>>>>>>>>>> START IMAGEMAGICK CONVERSIONS <<<<<<<<<<<<<<<<<<<<<<<
//$imageMagick = 'C:\\Applications\\ImageMagick-6.6.7\\bin\\convert.exe';
//COPY original file and rename using lastID variable
$orgFile = $dir . $satName;
$newfile = 'Actual/' . $lastID . '.tiff';

//>>>>>>>>>>>TESTING ONLY<<<<<<<<<<<<<<<<<<COMMENT OUT WHEN TESTING COMPLETE
echo "Original File: " . $orgFile . "<br> New File: " . $newfile . "<br><br>";
if (!copy($orgFile, $newfile))
{
    echo "failed to copy $file...\n <br><br>";
}

//Copy original tiff to Tiff
$cnvrt = '/opt/local/bin/convert ' . $orgFile . ' Actual/' . $lastID . '.TIFF';
exec($cnvrt);

//Convert original tiff to medium jpg
$cnvrt = '/opt/local/bin/convert ' . $orgFile . ' medium/' . $lastID . '.jpg';
exec($cnvrt);

//Convert original tiff to low jpg
$cnvrt = '/opt/local/bin/convert ' . $orgFile . ' -resize 50% low/' . $lastID . '.jpg';
exec($cnvrt);

//Convert original tiff to thumbnail
$cnvrt = "/opt/local/bin/convert -size 120x120 '" . $orgFile . "' -thumbnail 120x120^
         -gravity center -extent 120x120 'thumbs/" . $lastID . ".jpg'";
exec($cnvrt);

//DELETE Original File
echo "<br><br>DELETING ORIGINAL FILE<br><br>".$orgFile."<br><br>";
unlink($orgFile);
```

Results

- Images are able to process
- Permissions were changed:
  - Images can be modified for database
- Parsing of title is successful
- Resizing, Renaming, and Copying of images is still successful.

Conclusion

- Able to use GUI's to modify/develop script in TeraScan
- Production of images, even though they are low in resolution
- Daily Automated Process was not completed
  - To process and finalize images to send from TeraScan server to CERSER server
- Images from TeraScan are reduced in size
- PHP is still a functioning language to process TeraScan produced images.

Future Work

- To accomplish a daily automated process of images from the TeraScan server to the CERSER server
- To increase the image size of the pictures in the script and have a script that will connect from the TeraScan server to the CERSER server.
- Add channels to TeraScan software
- Rewrite script to add the NOAA satellite information.
- When other channels are added to the GOES.

Acknowledgements

- Dr. Linda Hayden
- Andrew Brumfield
- Seaspace

Demonstration

- http://cerser.ecsu.edu/

Questions