



Creating a Digital Surface Model of the Commonwealth of Virginia

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Virginia Geographic Information Network

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2014 GIS and Remote Sensing Research Symposium





VGIN was established in 1997 in Virginia Code to:

"foster the creative utilization of geographic information and oversee the development of a catalog of GIS data available in the Commonwealth".

- **Standards & guidelines**
- **Basemap layers**
 - imagery, road centerlines & addressing
 - addressing, elevation, cadastral
- **Services** gismaps.vita.virginia.gov/arcgis/rest/services
- **GIS Clearinghouse** vgin.maps.arcgis.com
- **GARDEN** collaboration with universities garden.vgingis.com

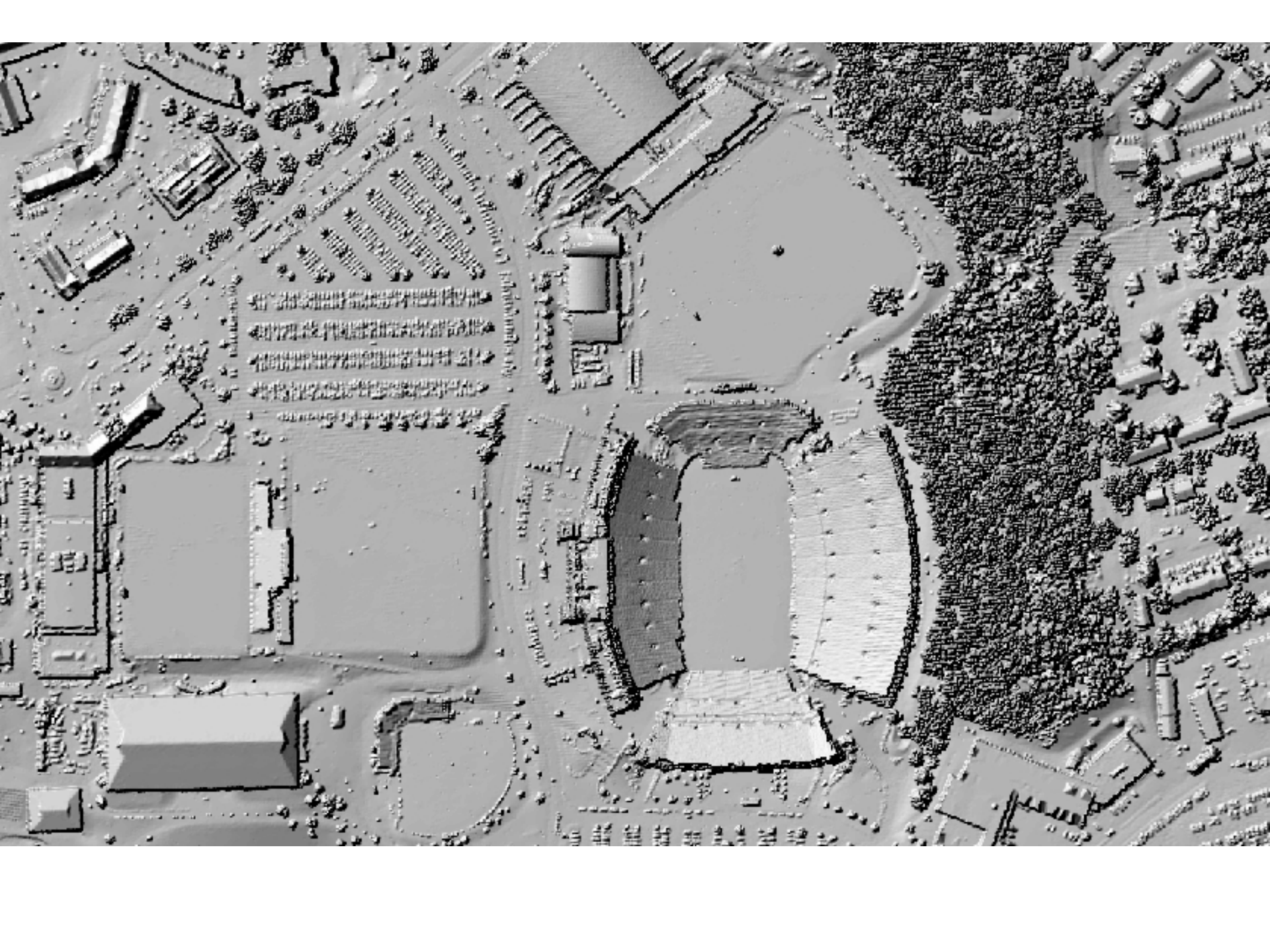


Virginia Geographic Information Network



Definitions

- **Digital Elevation Model (DEM)** - ground surface topography
- **Digital Surface Model (DSM)** - elevation of all features including the ground, building, trees, etc.





Project Objectives

- Develop a digital surface model (DSM) of the entire area of the Commonwealth of Virginia for the best, most recent, and available data.
- Serve this DSM as a publicly available elevation web service, suitable for visualization and analysis
- Utilize the DSM web service within the Virginia 3D Broadband Viewer.



Partners & Contributors



- VGIN
- Virginia Tech
 - Enterprise GIS
 - CGIT
- LiDAR Data Providers
 - USGS, NGA, FEMA, NRCS, DMME
 - Local governments
 - CIT State Broadband Initiative (Photo DSM)





Potential Application Examples from CGIT

- Wireless broadband coverage and RF propagation
- Assessment site suitability for vineyards
- Solar radiation assessment
- Transportation safety





OFFICE OF TELEWORK PROMOTION & BROADBAND ASSISTANCE

[? Help](#)

Virginia Broadband 3D View

[2D Map](#) [3D Map](#) [Aerial](#) [Topographic](#)

1. What would you like to do?

[View Vertical Assets and Coverage](#)

2. Find Location

[Address](#) [City or County](#) [Lat & Long](#)

Enter Address & City

403 cork Drive

Blacksburg VA

[View](#)



controls in the top left corner to navigate. You can also click and drag to pan map; use the mouse

[Home](#) [Existing](#)

Winter Solstice Solar Radiation (WH / m2)

Terrain

Value



High : 4474

Low : 163

Buildings - Winter

Value

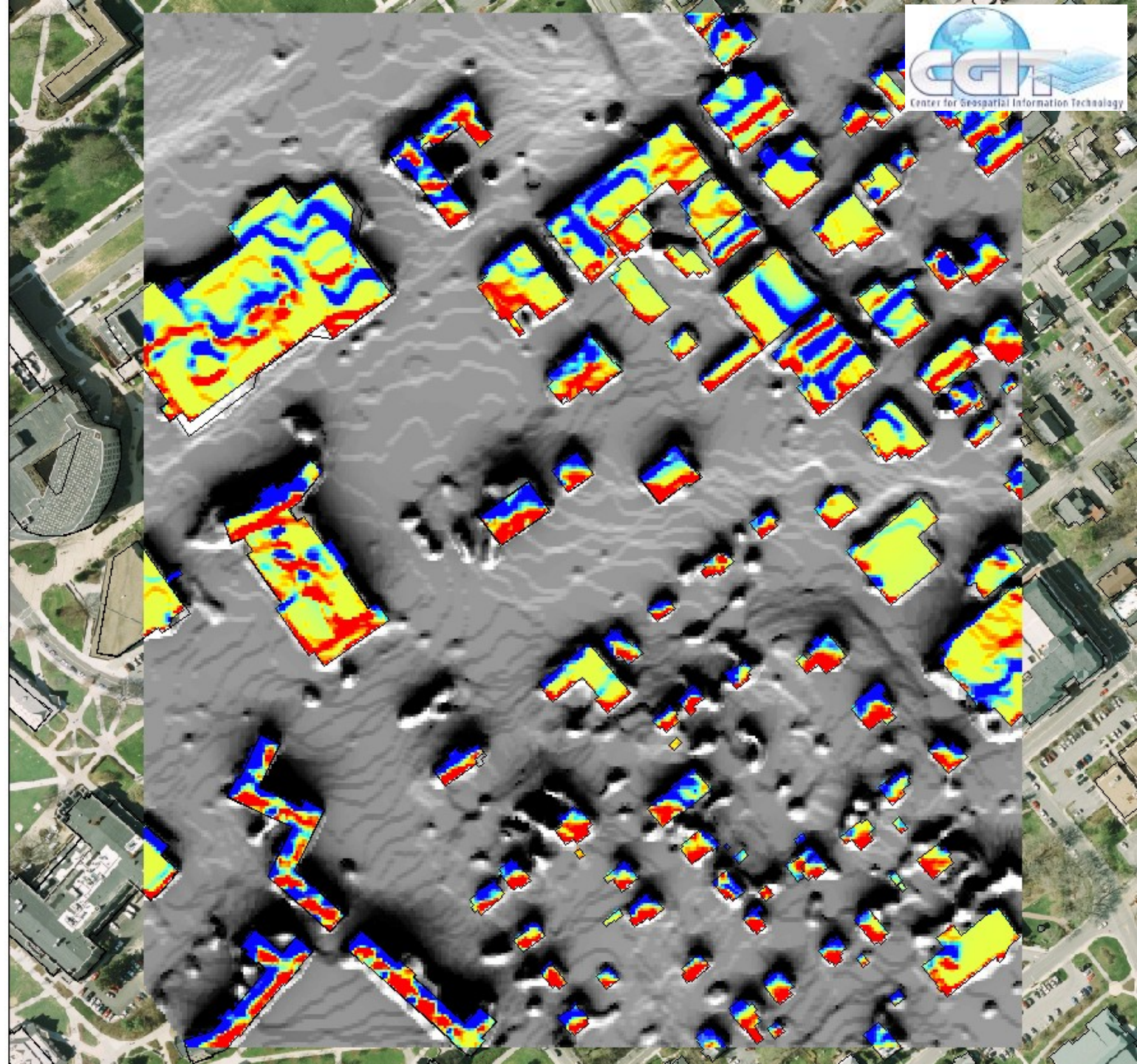


High : 2022

Low : 61

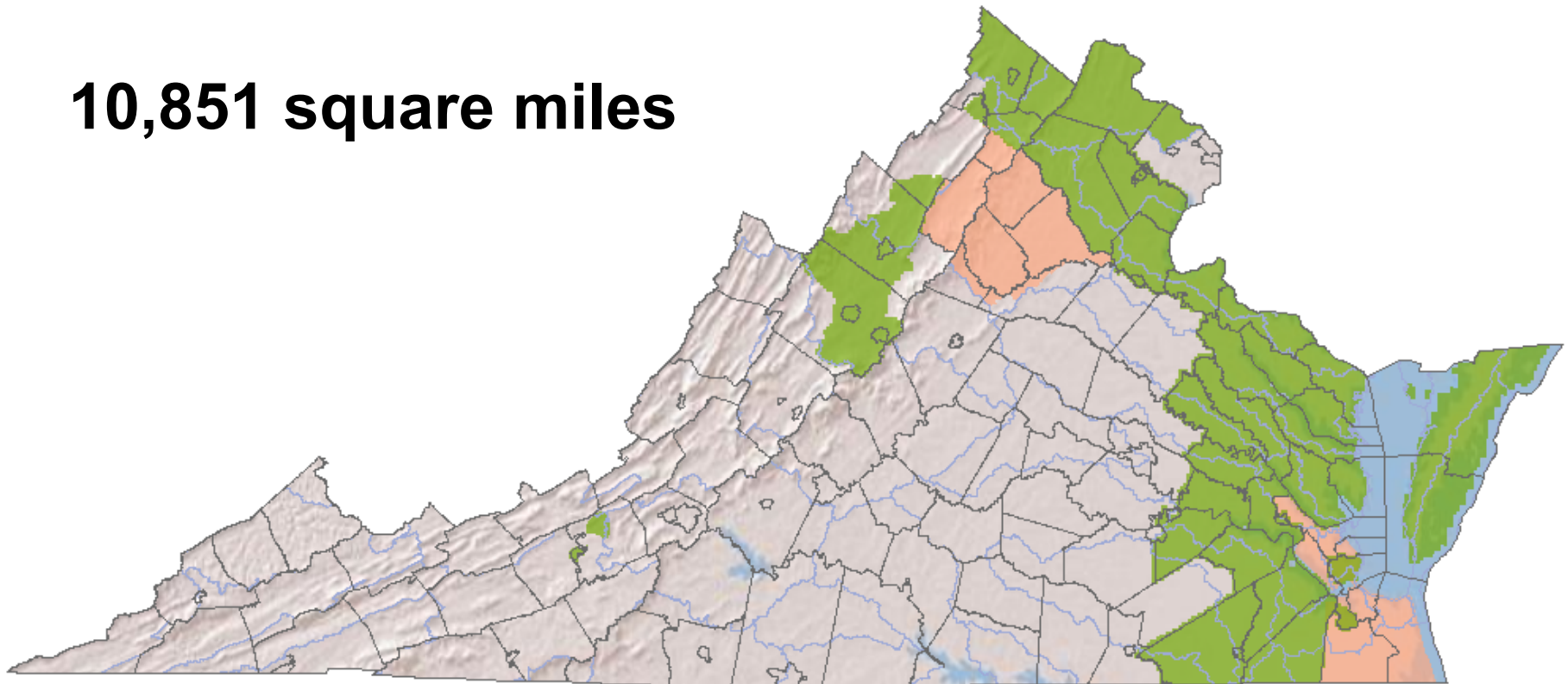
Incoming solar radiation using a 5-m DSM produced using the SimActive Correlator 3D software with the 1-m VBMP stereopair imagery and metadata as input.

CGIT 02/10/2011
sforza@vt.edu

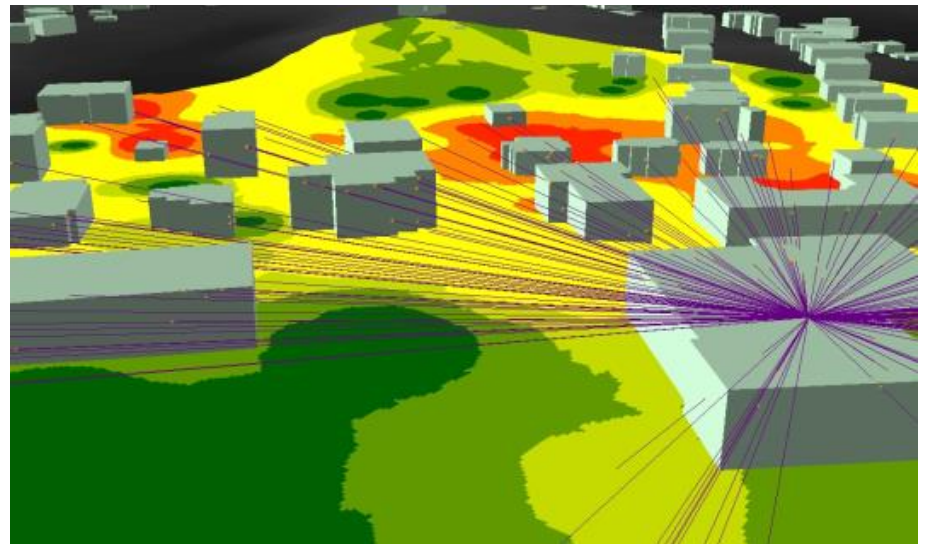
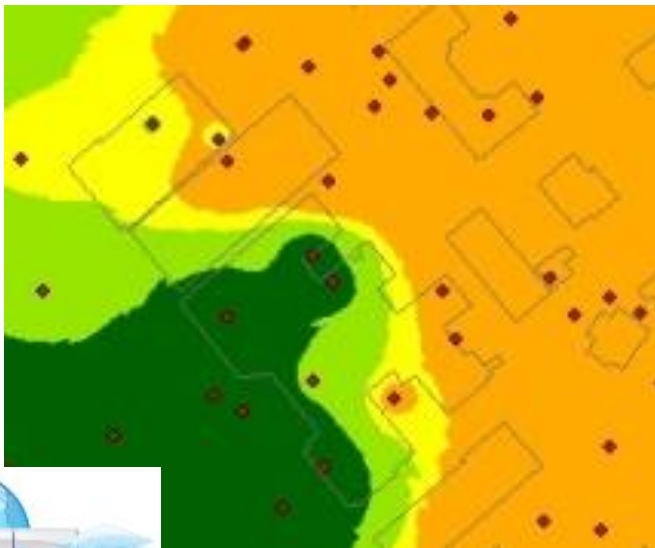
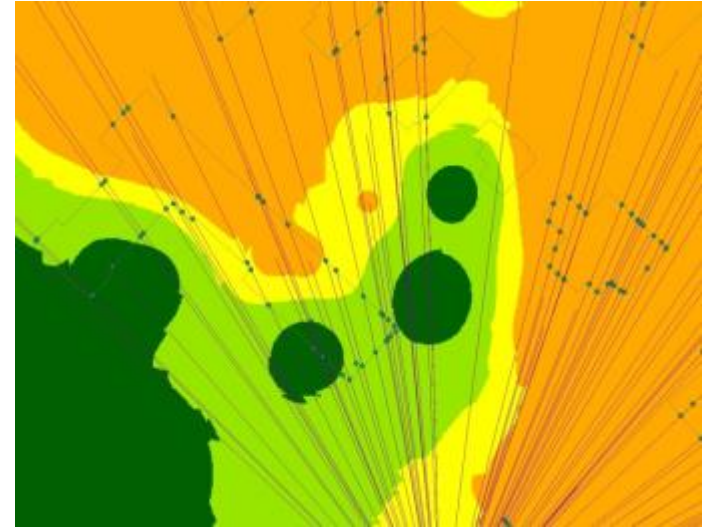
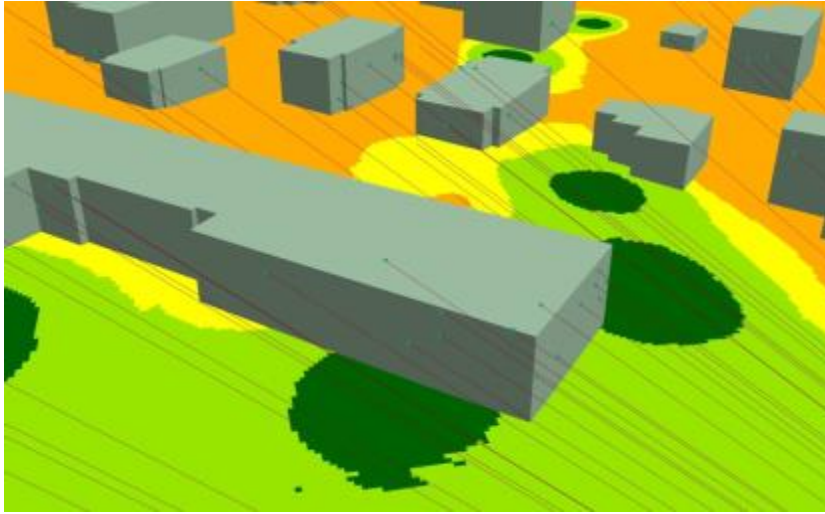


Data Sources -LiDAR

10,851 square miles

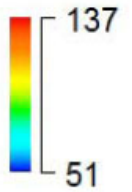
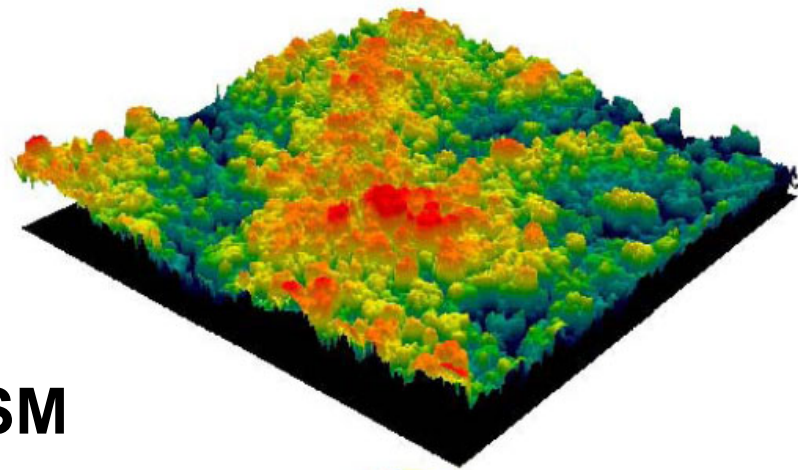


3D Building Extraction and Urban Scale RF Model using Statewide DSM and DTM

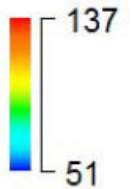
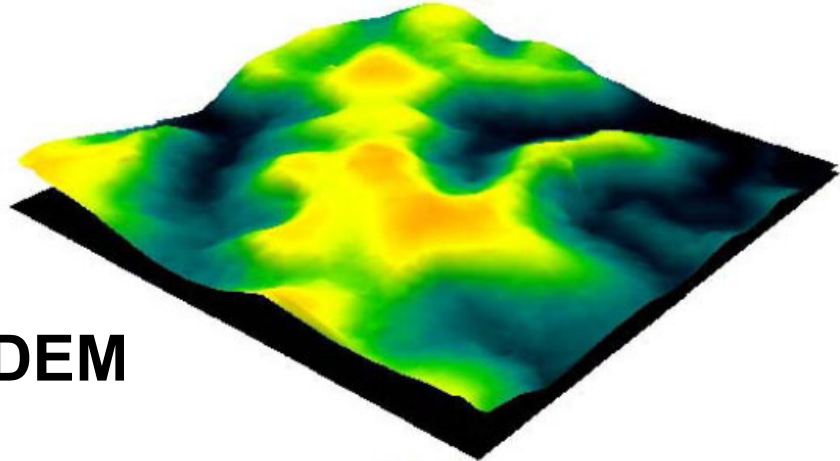


Creating a Forest Canopy Height Model

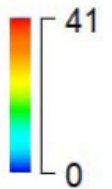
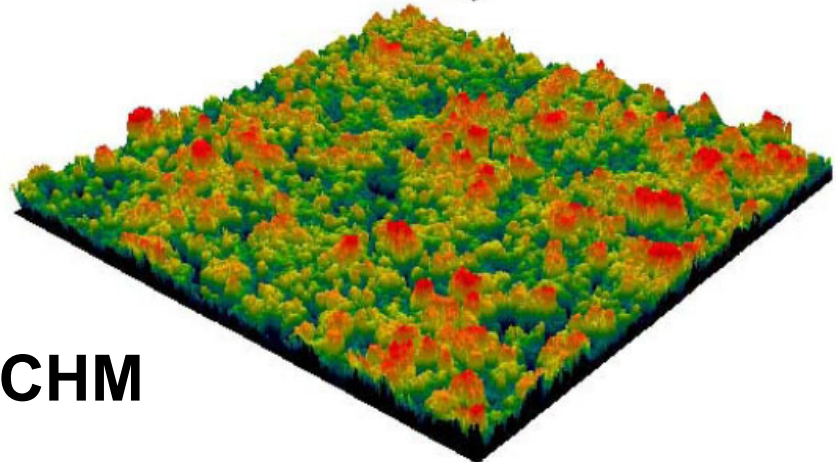
DSM



- DEM



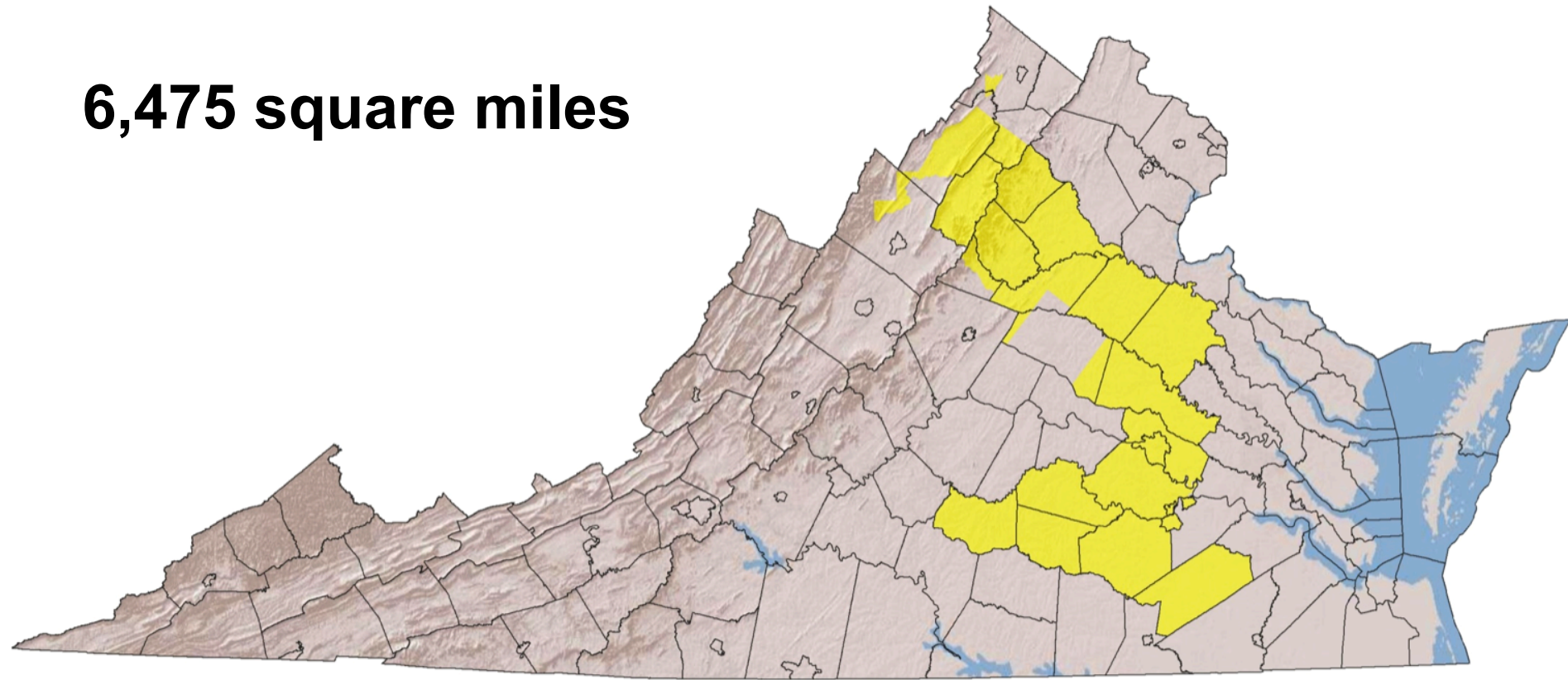
= CHM





2014 LiDAR Projects

6,475 square miles





Project Area and Costs

	Sq Miles	Cost
2010	4,151	\$ 1,152,683
2011	5,480	\$ 1,773,083
2012	1,222	\$ 559,300
2013	933	\$ 379,000
2014	6,475	~ \$ 2,000,000
	18,261	~ \$ 6,000,000

43% of Virginia



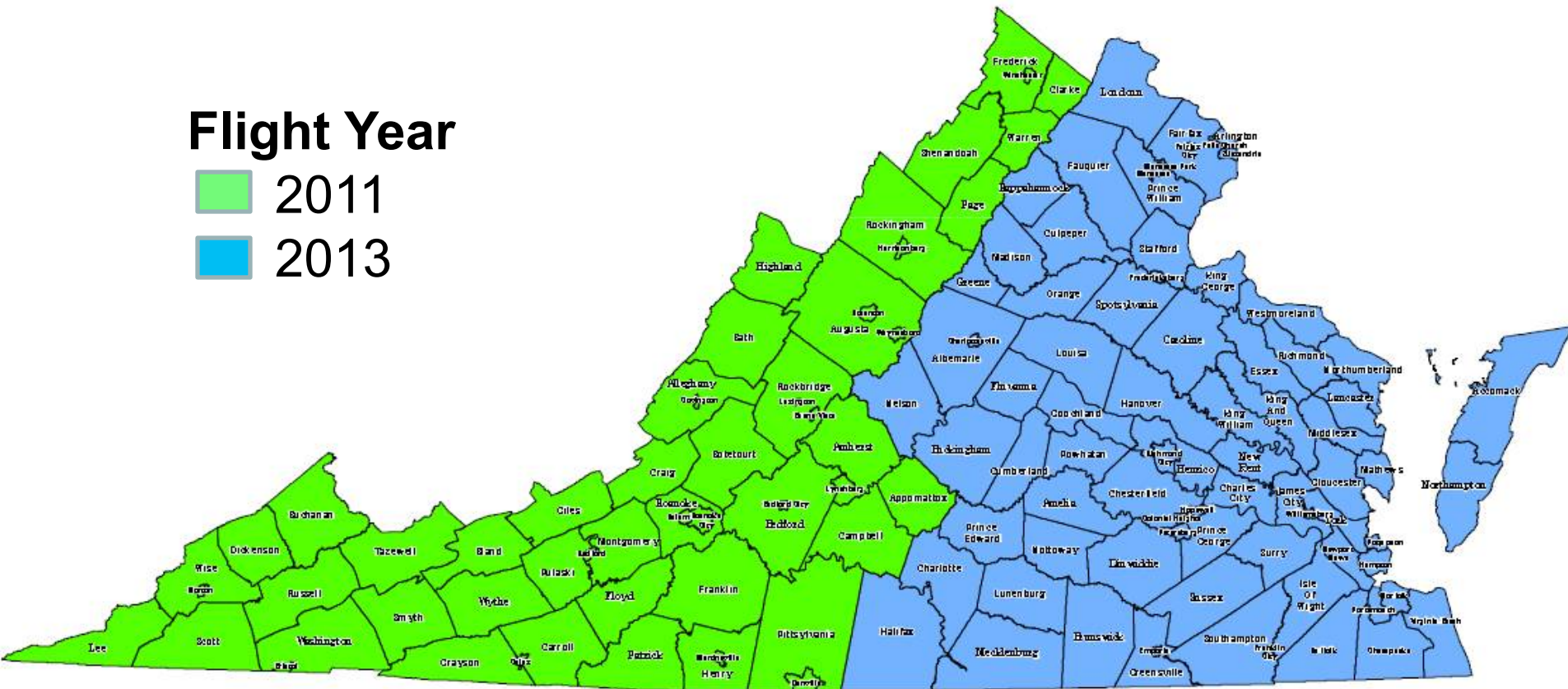
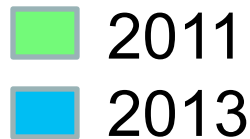
Methods - LiDAR

- Use first returns of the point cloud, filtering out “noise” points.
- First returns can be loaded into terrain datasets or rasterized into DEMs
- Can also use the point cloud files directly with
 - LAS datasets
 - Mosaic datasets of LAS files
 - Mosaic dataset of LAS datasets



Data Sources – Stereo Photography

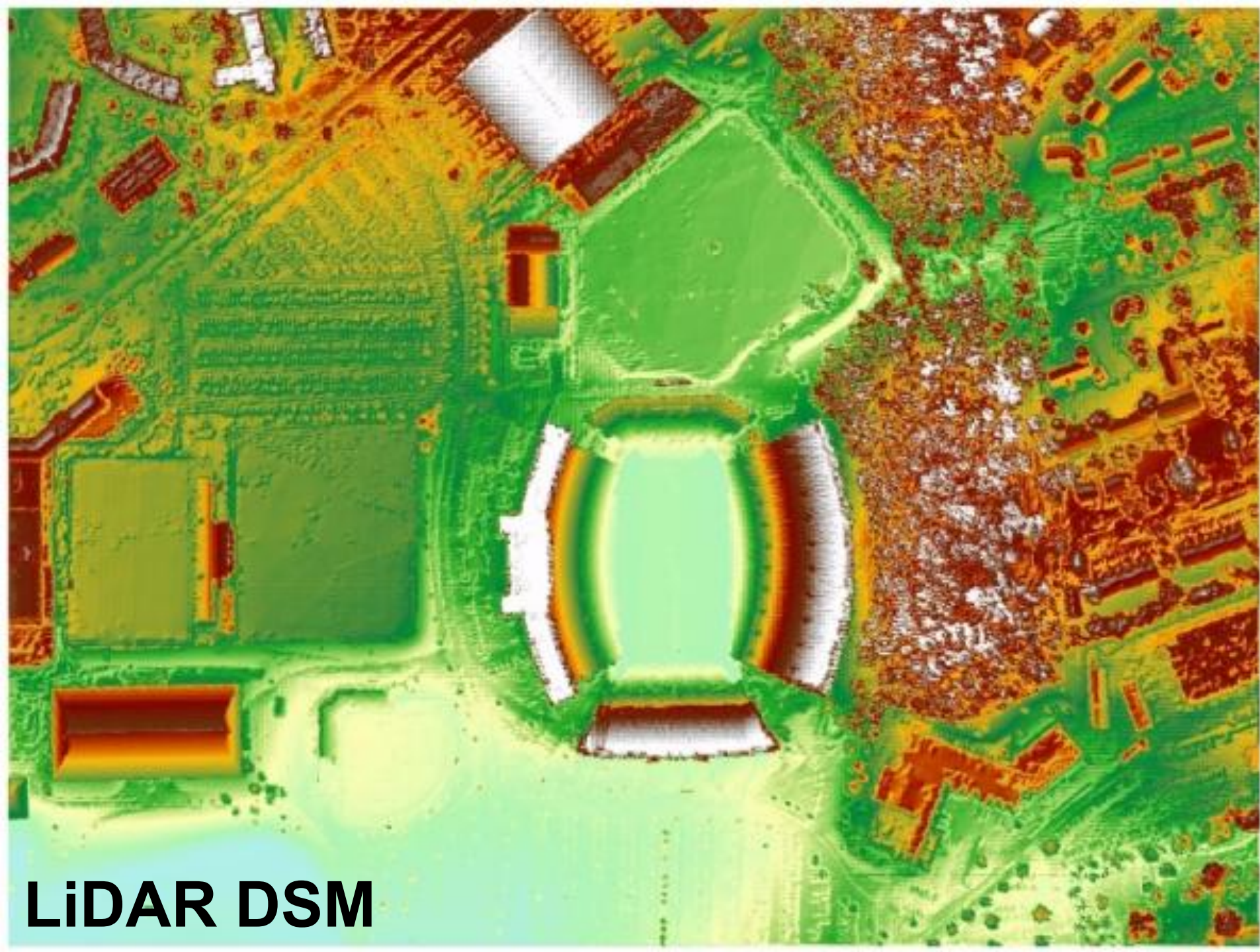
Flight Year



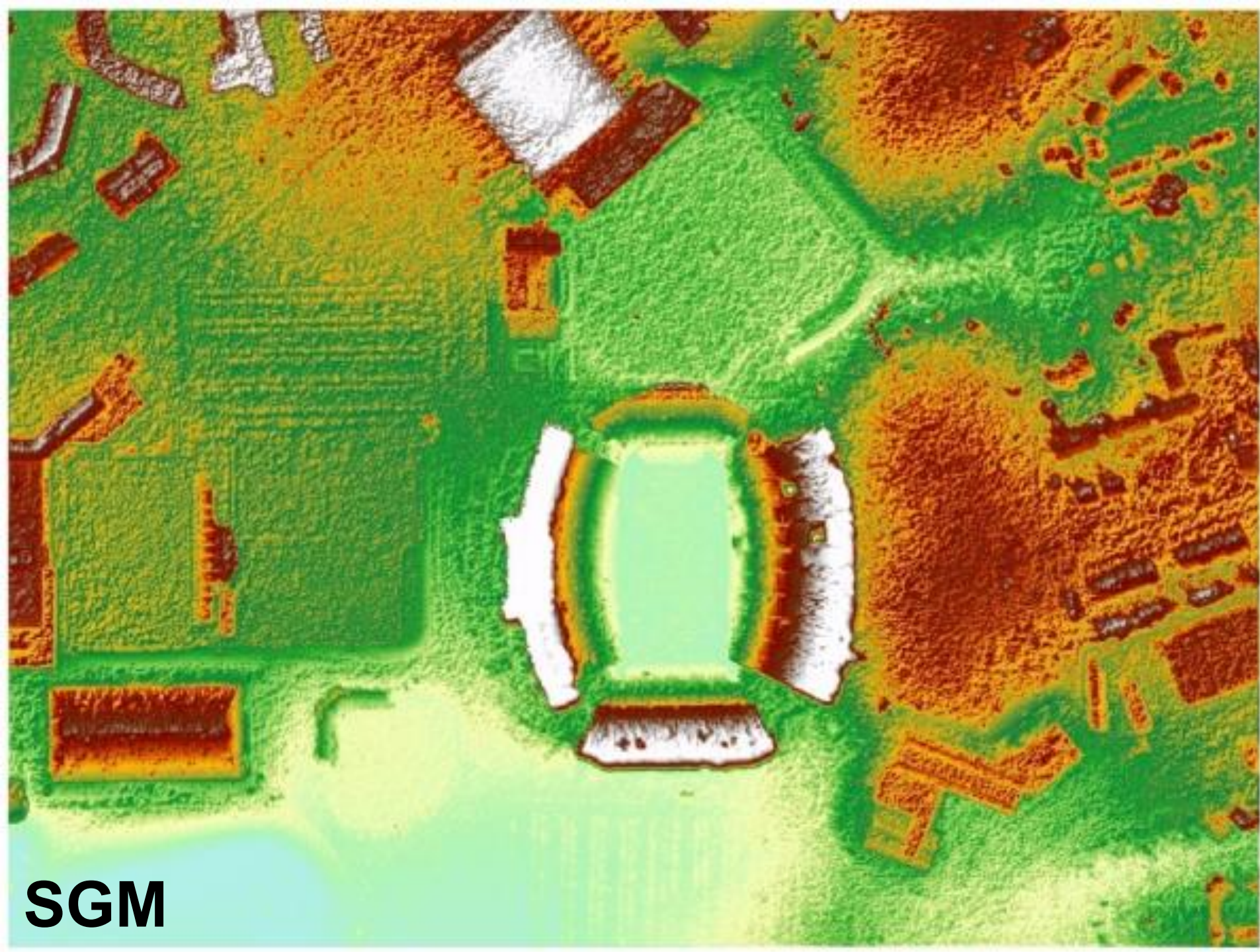


Methods – Stereo Pairs

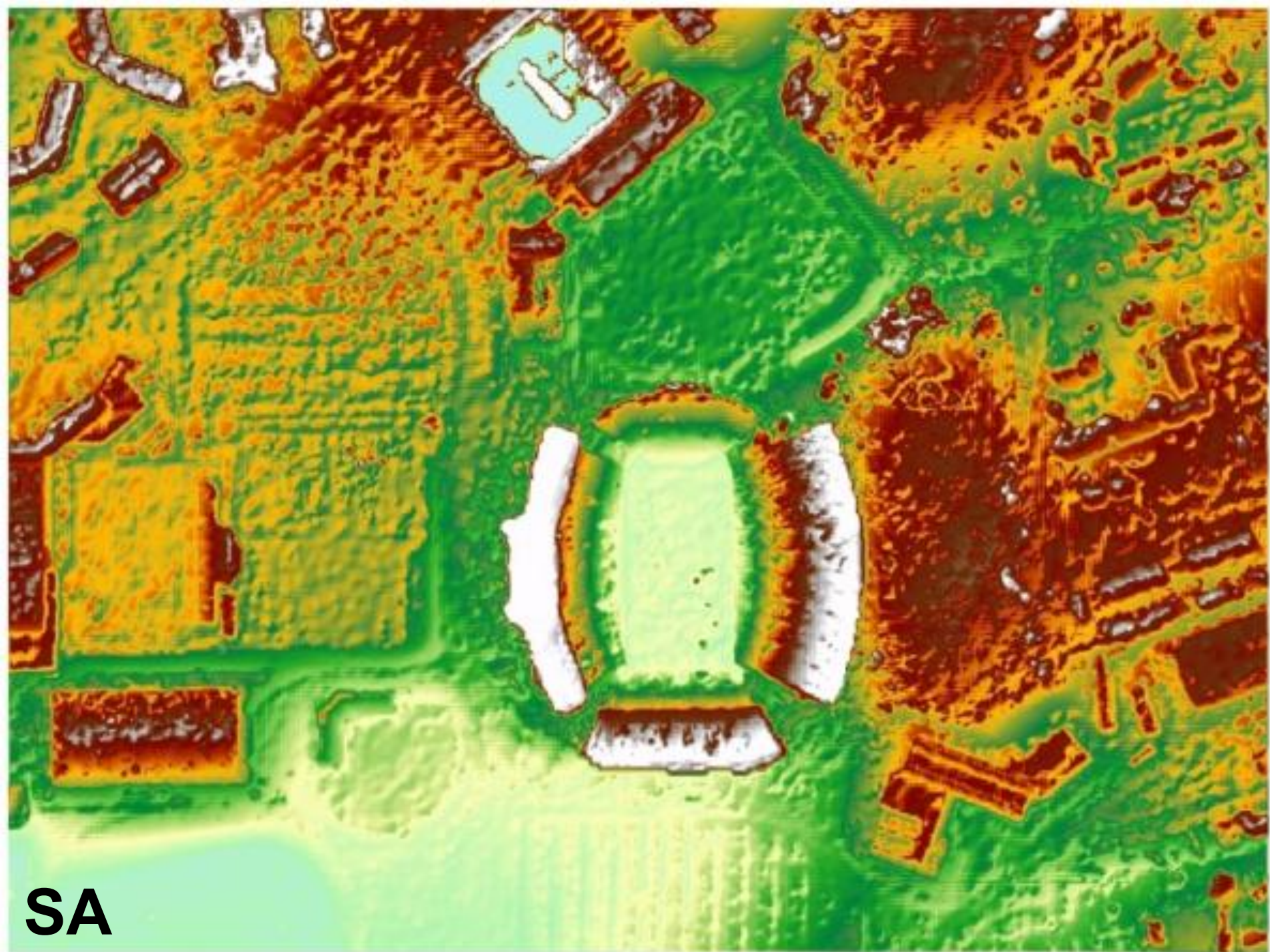
- Autocorrelation
 - Automated methods for locating features in two or more stereo pairs and computing their elevations
- Several commercial algorithms available
- We tested two
 - SimActive's 3DCorrelator
 - Integrgraph's SGM (Semi-global Matching)



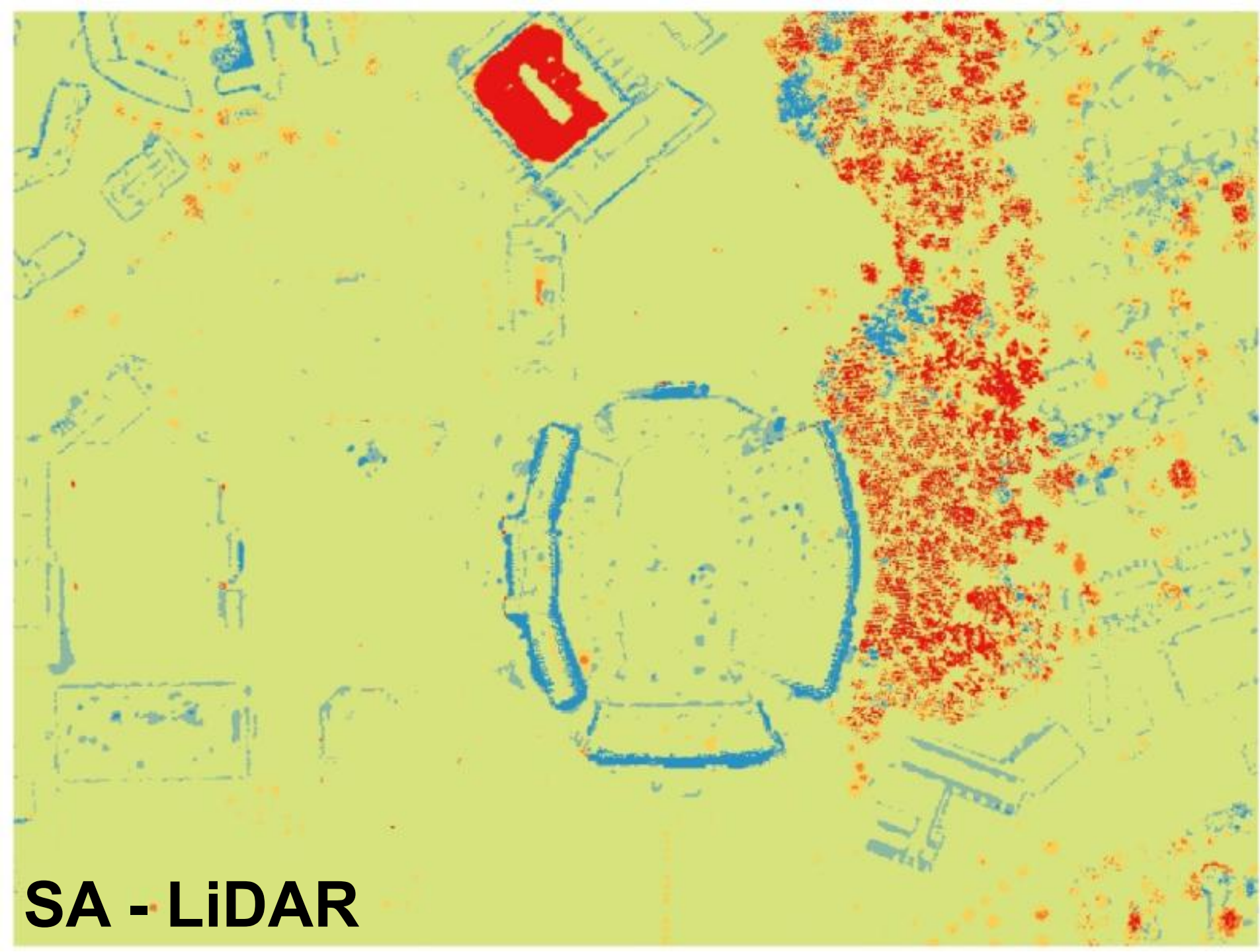
LiDAR DSM



SGM



SA



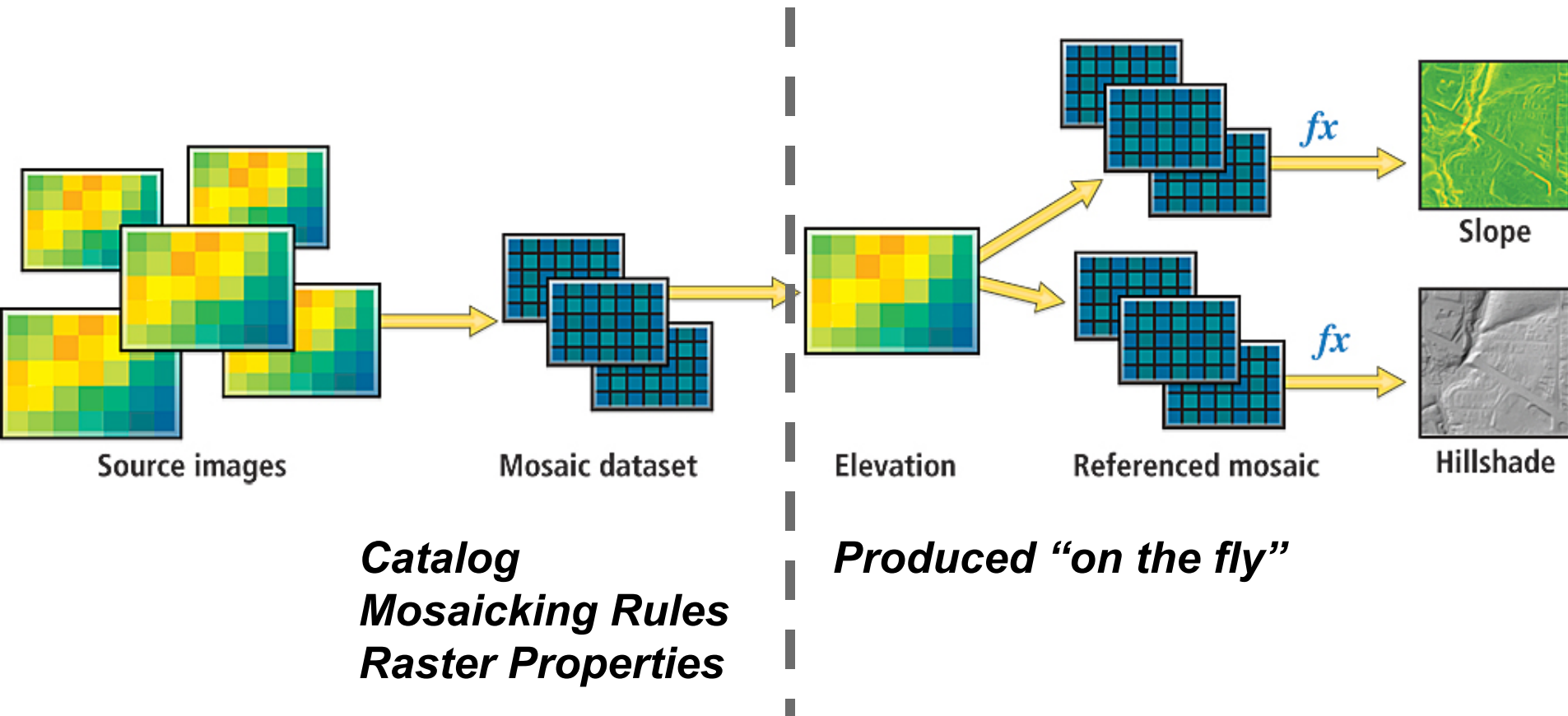
SA - LiDAR

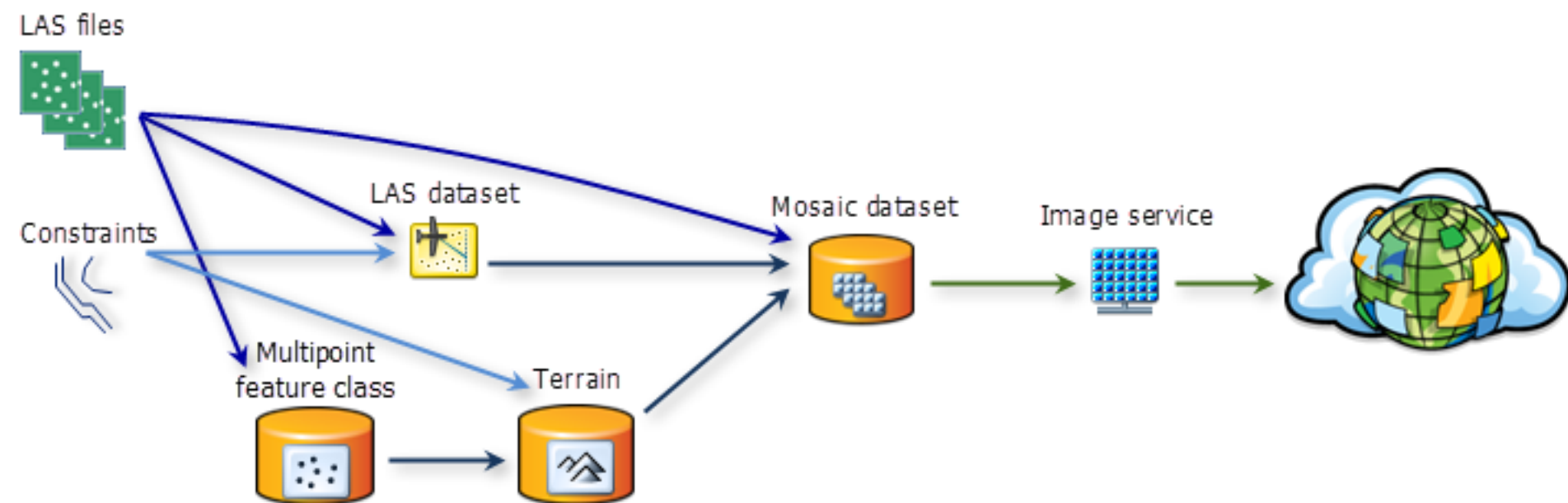


Data Production and Management

- Sanborn processed the 2011 and 2013 imagery with SA to create DSM and delivered it as tiled LAS files
- VGIN performed QA/QC on Sanborn product
- VGIN gathered LiDAR data as LAS tiles
- VGIN has the VMBP digital terrain model of mass points and breaklines derived from traditional photogrammetry (update 2011/2013)

Mosaic Datasets





- VGIN transferred data to Virginia Tech's Enterprise GIS Group
- VT Enterprise GIS will use ArcGIS Image Server Extension to serve



Remaining Steps

- Determine whether to use:
 - Breaklines
 - LAS datasets, terrains or LAS files to build mosaic datasets
 - LAS format or compressed zLAS format
- Determine service capabilities
 - DSM
 - DEM (ground surface) for LiDAR areas
 - DEM from VBMP DTM for non-LiDAR areas
 - LAS files downloads
- Create and publish services



Virginia GIS Clearinghouse

Virginia Geographic Information Network

Featured Content



**Download VBMP Road
Centerline (RCL) Data**



VGIN RCL Submittals



**VGIN Address Point
submittals**



VGIN Composite Geocoder

Virginia's Statewide GIS Clearinghouse hosted by the Virginia Geographic Information Network (VGIN) and the Virginia Information Technologies Agency (VITA). The GIS Clearinghouse is a repository of geospatial data produced and used by state agencies in Virginia, localities in Virginia, our Federal partners, non-profits, and colleges and universities in Virginia. Questions? email [John Scrivani](#)

GARDEN

Geospatial Archive Resource and Data Exchange Network



About GARDEN - Home

GIS Data

Instructions for Use

Terms of Service

Enterprise GIS
2060 Torgersen (0197)
Blacksburg, VA 24061

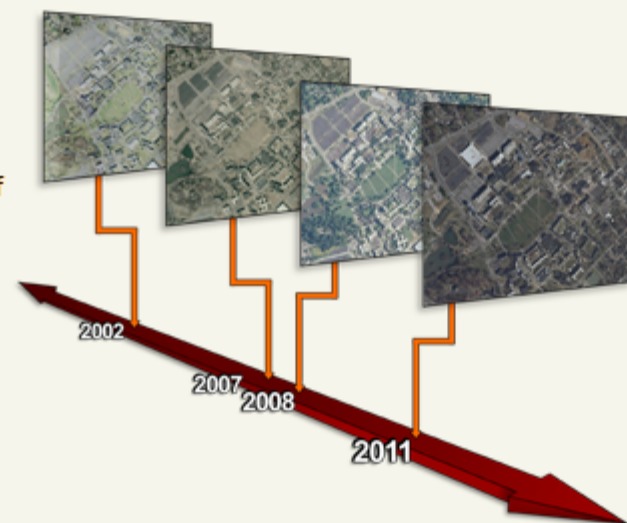
Email the EGIS
or call us at (540) 231-2178

GARDEN

VA Geospatial Archive Resource and Data Exchange Network

The GARDEN project is a joint initiative between the Virginia Geographic Information Network (VGIN) and leading universities in the Commonwealth of Virginia. Through GARDEN, participating universities serve as a "mirror" for VGIN's datasets, providing a locally hosted, faster performing set of map layers to faculty, staff and students, while providing redundancy and geographic diversity of off-site storage locations to VGIN.

Virginia Tech's GARDEN node is hosted at
<http://garden.gis.vt.edu>.





Other GARDEN Sites

- William & Mary garden.wm.edu
- In development
 - VCU
 - University of Richmond
 - Mary Washington
 - JMU
 - Radford



Questions ?