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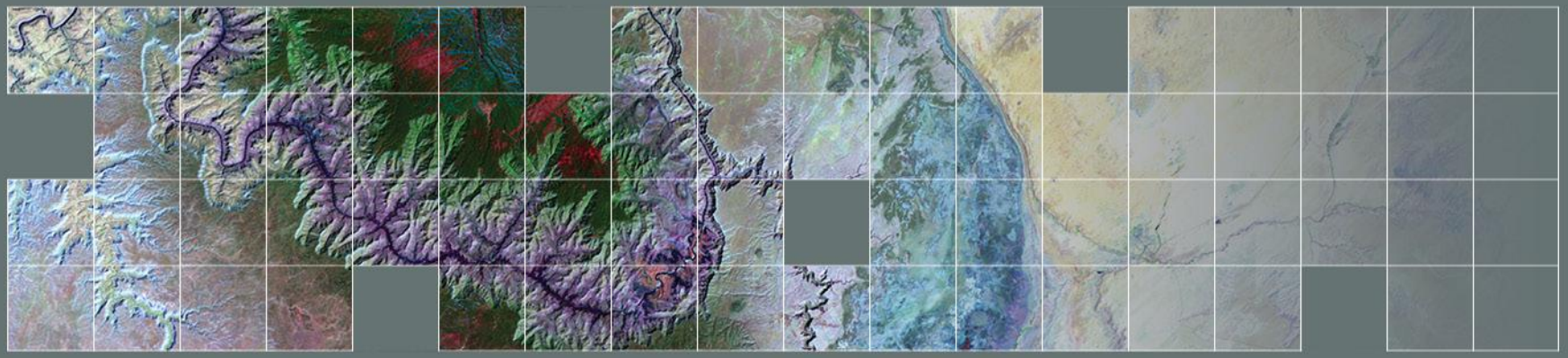
science for a changing world

Climate and Land Use Change
Earth Resources Observation and Science (EROS) Center

Analysis Ready Data



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U.S. Geological Survey

Highlights from Corvallis Discussions

- **Level-1Ts as inputs (Versions)**
- **Analysis Ready Data (Collections)**
  - Seamless (mosaicked)
  - Cloud free pixels
  - Pixel-based layers processed to higher levels of temporal aggregation
  - Advanced corrections applied
  - Includes all data in the archive
  - Provenance and traceability
- **Derived Landsat Science Products**
  - Geophysical properties, biophysical conditions
  - Land cover characteristics and dynamics

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Other Considerations

- Consider broad community requirements, and pay close attention to product definitions and standards identified in several existing international documents
- All product development activities should be prioritized.
- Consider feasibility of USGS production capabilities.
- Ultimately, products need to be generated from the full Landsat archive, including MSS. However, the need to phase development by instrument groups is recognized.
- Look to the broader community for credible approaches and products. Avoid un-vetted internal approaches.
- Algorithm Theoretical Basis Documents (ATDB) are needed for every product.
- All product specifications and production methods must be subjected to an external science peer review.

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Analysis Ready Data (ARD) Definition

- **Data processed to a level that enables direct use in quantitative applications including**
  - Exploratory data analysis and numerical modeling
  - Geospatial, multispectral, and multi-temporal manipulation for purposes of data reduction, analysis, and interpretation
- **Assumptions**
  - Geolocation – pixels align
  - Cross calibration – information is comparable
  - Data organization – efficient access to data

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Basic Properties

- **What makes data analysis ready?**
  - Consistency across the instrument record
  - Individual pixel observations
  - Terrain- and precision-correction
  - Common cartographic projection and gridding
  - Absolute calibration & spectral band adjustment
  - Surface reflectance and temperature
  - Pixel-level metadata: Cloud (including cirrus), cloud shadow, saturation, data artifact, terrain occlusion, snow/ice masks
  - BRDF normalization (driven by harmonization with Sentinel-2 MSI data)

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Collection 1 Base Layer – Surface Reflectance / Brightness Temperature

- **US Data**
  - Geometry
    - Albers Equal Area for CONUS and Alaska
    - 30-meter pixel size for all bands
  - Radiometry
    - Data Values: Scaled and calibrated 16 bit integer reflectance / temperature values
  - Metadata
    - Carry over level1 metadata and add sufficient metadata to track pixel-level characteristics
  - Other Attributes / Components
    - Collection Based (Version #, Collection #)
    - QA Band
      - Unsigned 16- or 8-bit integer format
      - Is carried through from Level-1 that includes cloud, cloud shadow, cirrus, terrain occlusion, artifacts, snow/ice, and saturation
    - Sun and sensor viewing angles [most likely generated from coefficients]
- **Stored in consistent geometric tiles to support seamless data access**
  - The method (size of tiles and format) will support the access use cases
- **Data are delivered in formats defined by use cases**

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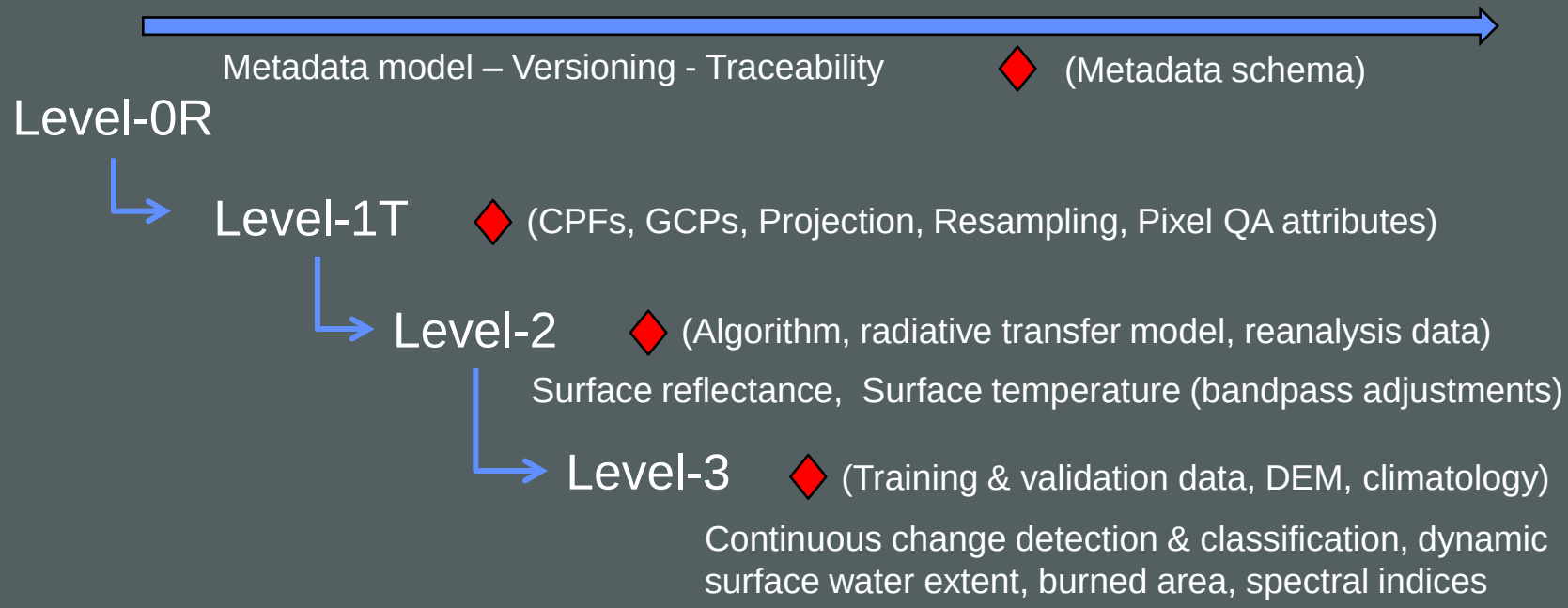
Product Roadmap Considerations



- **Analysis ready data are geophysical parameters generated at Level-2**
- **Higher level information products generated at Level-3**
- **Level-2 and -3 products are geometrically aligned, units are traceable, uncertainty analyses are documented, data and metadata stored for efficient access (Information Warehouse)**
- **API enables access to perform screening, filtering, temporal compositing, data reduction, exploratory analysis, information retrieval**

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ARD Projection Parameters

- U.S. projection parameters consistent with National Land Cover Dataset and LandFire products
- Global projection specifications are TBD

USGS Product Projection Parameters			
Projection: Albers Equal Area Conic			
Datum: World Geodetic System 84 (WGS84)			
	Conterminous U.S.	**Alaska**	**Hawaii**
First standard parallel	29.5°	55.0°	8.0
Second standard parallel	45.5°	65.0°	18.0
Longitude of central meridian	-96.0°	-154.0°	-157.0
Latitude of projection origin	23.0°	50.0°	3.0
False Easting	0.0	0.0	0.0
False Northing	0.0	0.0	0.0

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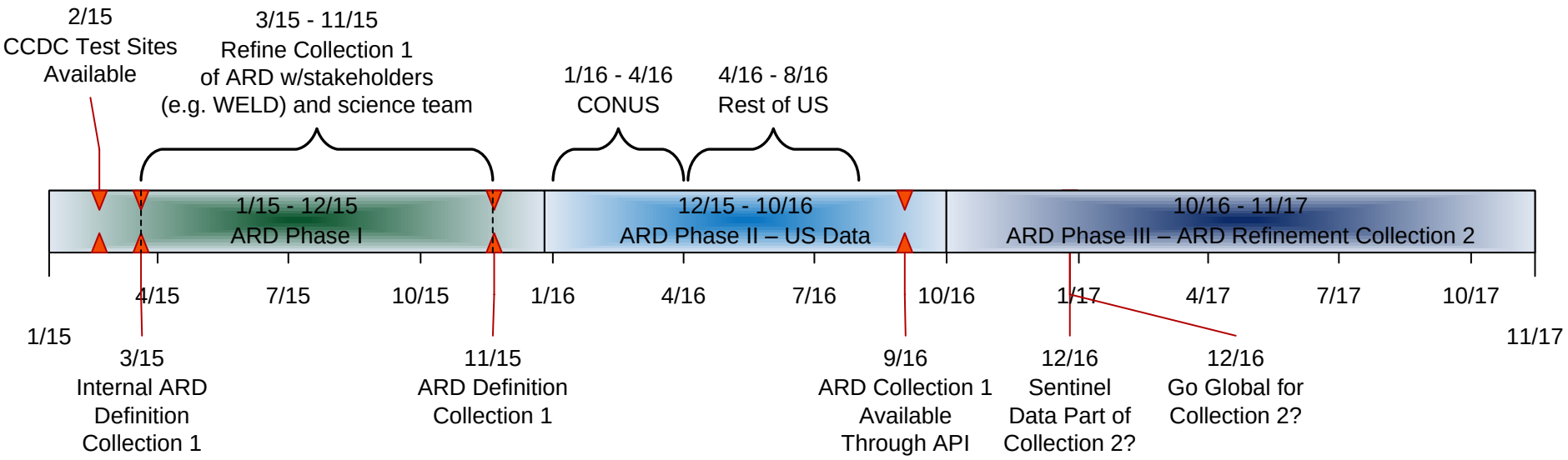
EROS Notional ARD Timeline



Continuous Change Detection Algorithm