ALOS K&C#12

Special Session on GEO FCT

Notes of Science Team discussions on relevant science products and requirements for a coordinated multi-sensor acquisition strategy for global forest (and wetlands) monitoring

Functionality of forests

- Extent of forest resources
- Health
- Diversity
- Productive functions
- Protective functions
- Socio-economic functions

Information requirements

- Forest cover
- Rate of increase by country
- Hotspots of change
- Primary forest and loss or modification
- Plantation forest and rate of change
- Species
- Carbon function and biomass
- Disturbance and degradation
- Biological diversity
- Water and soil conservation
- Cadastral information
  - Important to include for EO data classification

Hotspots

- Use a deforestation hotspot map, however generated
- MODIS (e.g., fire maps or ALOS ScanSAR to pick up areas of change allowing space agencies to then focus efforts on areas where most needed
- Use X or C-band or high resolution data (E.g., PRISM) to look at canopy disturbance
- Optical or L-band to look at forest/non-forest boundary changes or regrowth
- Examples
  - Tracking legal/illegal deforestation
  - Fire activity and damage
- Need to have capacity to detect unexpected change
  - Storm damage

Annual forest – non forest

- Narrow time-window
  - Similar observation time
- Agreed definitions of forest
  - Canopy cover
- Transparent forest/non-forest algorithm
  - That utilises intensity and/or coherence or optically-derived measured at relatively high resolution
  - Fixed thresholds are difficult (e.g., because of rainfall)
    Use of multi-temporal metrics and single-date data is of limited use.
  - Seasonal data are often useful
  - L-band preferred for forest/non-forest discrimination
  - L-BAND HV AND HH USEFUL
- Long time-scale for operation
- Appropriate to forest carbon tracking initiatives
- Appropriate to users
  - Developing countries
  - Sophisticated users
  - National-international governments/organisations
- Requirement for long term continuity of sensors

Forest Types

- X and C-band useful for forest type.
  - Canopy structure difference
- Dual season L-band useful for forest type
  - Relative biomass difference
  - Wetland forest types/peat swamps
    - Flooding/soil moisture
- Beneficial to integrate optical data
  - Savannas
- Texture measures may enhance discrimination of forest types
- Specific to regions
- Finer resolution provides better mapping
- Tropical plantations and agroforesty
  - Combinations of X, C and L-band
  - Use of time-series datasets

Forest Change

- Time-series of data
  - At least every six months
    - Plantations in Indonesia
    - Clearing cycles observed in Indonesia and Brazil (e.g.)
- Transitions
  - Disallowed transitions
    - Non-forest to primary forest
- Monthly change for hotspots
  - Including infrastructure, forest degradation
  - C-band useful for looking at degradation if have L-band or other baseline of forest area.
- Need to consider dieback and phenology and disaggregate
  - Combinations of L-band and X/C band with optical

Degradation

- First define forest area
  - Use L-band or optical data or time-series of X and C-band to first define forest area
- Requirement for finer resolution X-band
  - Small differences in canopy structure
- Some potential with L-band
  - Selective logging (removal of large amounts of woody material)
  - Fire damage so using combinations of L-band and optical data and regrowth following burning.
  - Fire scars within the forest (tropical forest & wooded savannas) using L-band
  - Biophysical differences in forests manifested within L-band data

Land cover

- Requirement to differentiate annual and perennial agriculture
  - Time-series
- Clearing mechanisms
  - Initial cutting (elevated L-band HH)
  - Burning (from optical and probably L-band HV)
    - Identify when debris is removed (high L-band HH > low L-band HH)
    - Post-pasture treatment (burning
    - Use of heavy machinery (parallel lines of HH; full res)
    - Stem injection (high L-HH, low optically-derived or C/X band-derived cover; confusion with rough ground in some cases)
  - Include within time-series (e.g., with regrowth mapping
- Grasslands and shrublands following clearing and burning
  - High optically-derived cover or from X/Cband, low L-band HH – regrowth or shrublands – need to be aware of sugarcane and large grasses.
- Infrastructure
  - Finer resolution data are likely to be more useful
- Plantations
  - Acacia difficult using PALSAR data only because of rapid accumulation of biomass using FBD but texture in AVNIR-2 or maybe other optical data might provide discrimination.

Tree cover (% canopy cover)

- Percentage crown cover by forest type
  - Need to separate natural forest from plantations and agroforestry) and differentiate natural forest cover
- Landsat can be used to obtain direct estimate of canopy cover
- Potential equivalent estimates from X and C-band but not L-band (directly)
- MODIS products may be integrated (VCF)

Regenerating (secondary) Forests

- Based on relative differences in L-band HH and HV and coherence to more mature forests
- Time-series of radar data
- Combinations of L-band and optically-derived cover/X/C-band SAR (savannas and maybe shrublands)
- Link the information on the post-clearing history with regrowth as input to models of carbon/biodiversity recovery

Biomass stocks

- L-band SAR (particularly HV intensity)
- Combininig with optical data (e.g., cover and height may potentially provide better retrieval
- Algorithms use HH and HV to retrieve stem and crown biomass separately and sum to total
- Coherence (winter, boreal)
- Time-series within a year but even interannually (e.g., for remnant or intact forest) can increase reliability and saturation level.
- Massive time-series considering overlap areas can potentially give estimates with no saturation at all.
- Inconsistencies attributable to*
  - Rainfall, snowfall
  - Sensor parameters
  - Forest structure (open and closed forests)

Biomass change

- Time-series of intensity data or biomass maps
- Forest change
  - Age class assuming relates to biomass (in some cases)
- Inclusion of growth model
  - Comparison of intensity etc. from simulated forests with actual data
- Relative height
  - RADARSAT/TerraSAR-X
  - TerraSAR-X tandem
  - Comparisons with SRTM (e.g.,mangroves)
  - Integration with LiDAR (e.g., ICESAT)
  - (Relative to mature forest)