ECMWF / EUMETSAT NWP-SAF Workshop

The Assimilation of Hyper-spectral Geostationary Satellite Observations

22-25 May 2017

Assimilation Opportunities and Applications Working Group Notes

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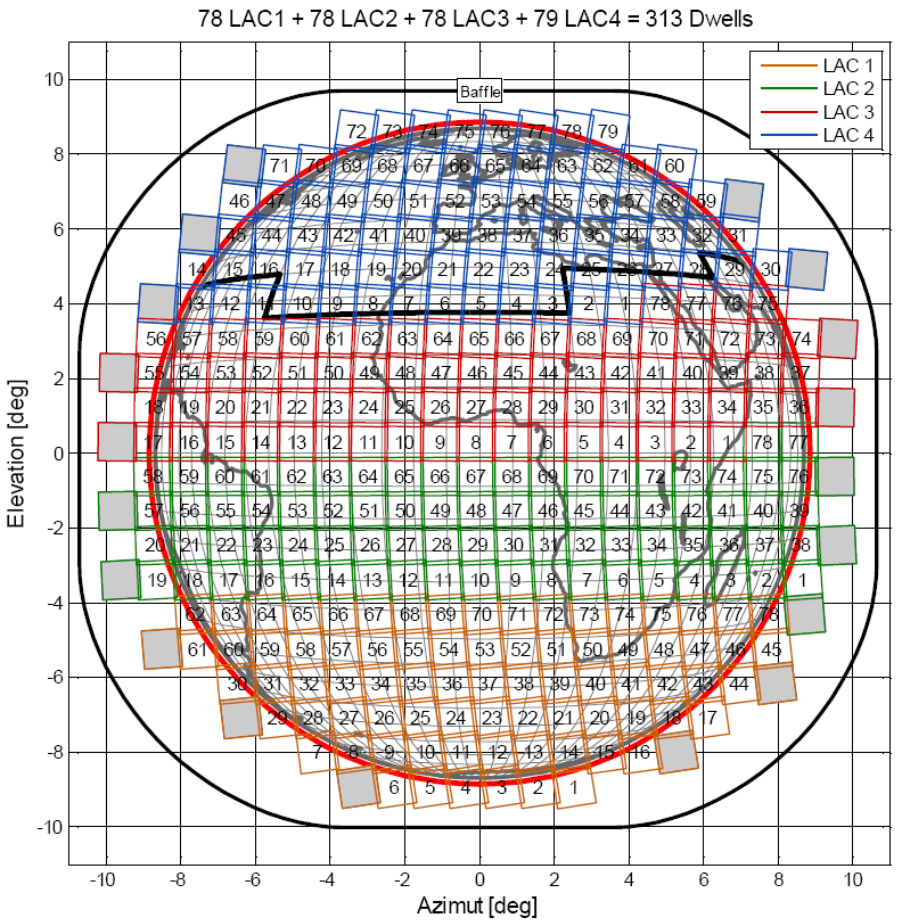
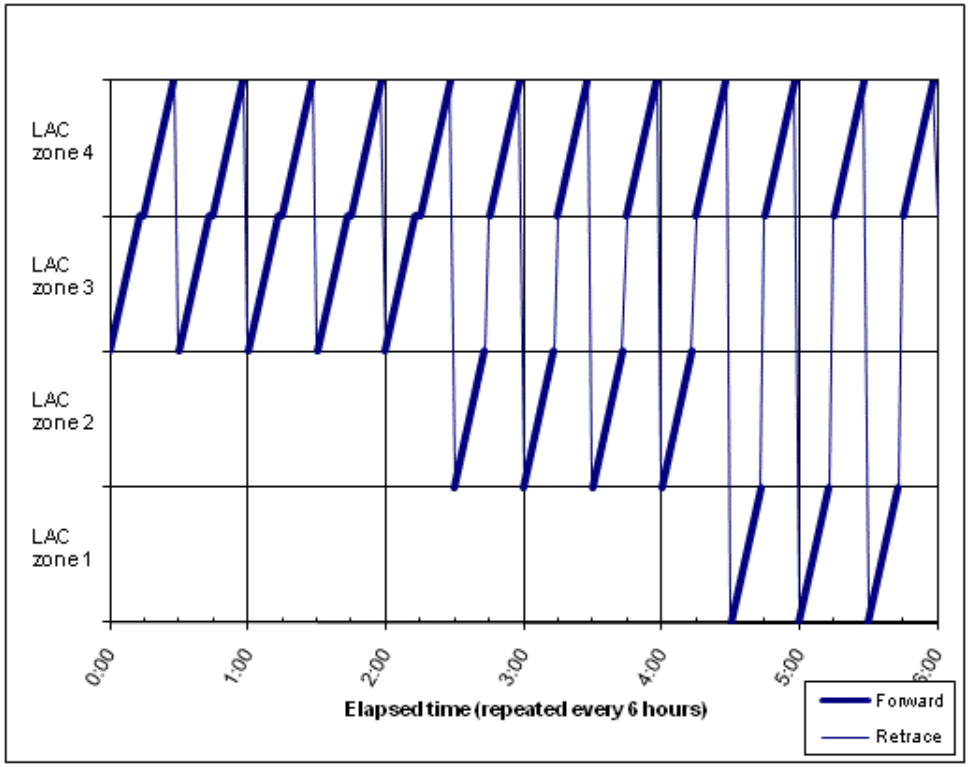
Measurement Schedule

- The current measurement schedule with uneven distribution of observations spatially and temporally should be revisited.
  - Infrequent measurements in Southern Hemisphere may result in poorer analysis.
- Recommendation: Investigate possibilities to even out sampling in LACs 1,2&3. For our applications a requirement for triplets may be relaxed.

Measurement Schedule





Can we cope with a different SRF for each detector

- Having a different SRF for each detector will be burdensome on RT community and may inhibit timely exploitation of the measurements.
- Some users may still assume a common SRF. We should quantify the errors this introduces.
- Recommendation: SRFs should be harmonised between detectors, but the introduction of additional noise, including spatially correlated noise, needs to be monitored.

Apodisation

- The Gaussian (heavy) apodisation attenuates the signal from the first resonance representing line structure in the 15µm band.
- The group feels that with the use of correlated errors, we can still exploit these data without loss of impact
- However, we already already have some capability to simulate unapodised radiances and we can also easily convert light to heavy apodisation
- Recommendation: MTG-IRS data should be distributed with light apodisation.
- Recommendation: A tool to convert light to heavy apodisation should be included in the IRSPP package.

Exploiting full spectral, spatial and temporal information from MTG-IRS (1)

- The ability to use full spatial and temporal sampling is limited by the requirement for thinning.
  - This is required because of the influence of spatially and temporally correlated errors.
- A greater understanding of these errors, their source and mitigation strategies will be important to improve utilisation.
  - Correlated errors arising from representivity errors may become less of an issue as we move towards convective scale models.

Exploiting full spectral, spatial and temporal information from MTG-IRS (2)

- The finest spatial scale features will often be associated with clouds.
- To exploit the high spatial resolution information from MTG-IRS will require improved use of clouds.
- Recommendation: Continue to invest resources in infrared cloudy radiance assimilation and, in particular, in improved radiative transfer, modelling and DA.

Principal Component Scores (1)

- Dwell versus global principal component training was discussed
- Global training is preferred because of higher signal to noise ratio and greater simplicity and robustness.
- Recommendation: More information should be provided to the MAG to justify the adoption of dwell-based PCAs.
- Recommendation: IRSPP should have options for both dwell and global based PC training.

Principal Component Scores (2)

- Principal component score dissemination should include quality flags indicating high residuals in the reconstructed spectrum.
- Recommendation: If the reconstruction error exceeds a certain threshold, residuals (or the full spectrum) should be automatically disseminated to allow better representation of the full spectrum

Principal Component Scores (3)

- Assimilation of compressed data can be via:
  - Direct principal component assimilation
    - Probably after transformation to a different PC basis.
    - Still need to solve cloud issues
  - Reconstructed radiances
    - Need to be able to characterize spectrally correlated errors
  - Transformed level 2 products.

Observation Errors

- Are current diagnostic methods good enough?
- Can we validate the diagnostically derived errors and can we justify the tuning of these errors for them to produce positive impact.
- Reconditioning is often required
- Recommendation: Invest more resources into physically-based estimates of correlated observation error.

Cloud and Aerosol Detection

- Cloud and aerosol detection is mostly adequate for impact in NWP but improvement should be pursued.
- Improved surface characterization is important for better cloud/aerosol detection.
- For MTG-IRS we should try to use more spatial and temporal information for cloud and aerosol detection.
- Recommendation: Produce an AVHRR cluster like product for IRS using the on-board imager.

Land Surface Characterisation

- High quality land-surface emissivity climatologies are important as *a priori* data for land surface analysis.
  - More field campaigns are necessary
- There is a need to better account for view angle dependence.
- A simultaneous derivation of aerosol, cloud, surface emissivity and surface temperature (plus the atmosphere) is required. This will most likely be achieved through the adoption of coupled data assimilation.

Wind information from MTG-IRS

- Wind information will be obtained through level 2 retrievals or in 4DVar via the tracer effect.
- The derivation of winds from level 2 temperature and humidity fields is supported and its current “aspirational” status is welcomed.

GIIRS

- The MTG-IRS community are very interested in obtaining data from GIIRS as early as possible.
- Experience gained with manipulating real hyperspectral geostationary data will be invaluable to the exploitation of MTG-IRS. For example:
  - Spin up of principal components
  - Testing of winds derivation from L2 products.

Summary of IRSPP Wish-list

- Ability to process raw IRS data
  - Include the ability to produce both dwell-based and globally-based PCA scores
- A tool to transform between PCA bases.
- A tool to transform between light and heavy apodisation.
- Output formats should include those that support parallel asynchronous I/O.