Homogenisation of GERB and CERES fluxes.

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verview

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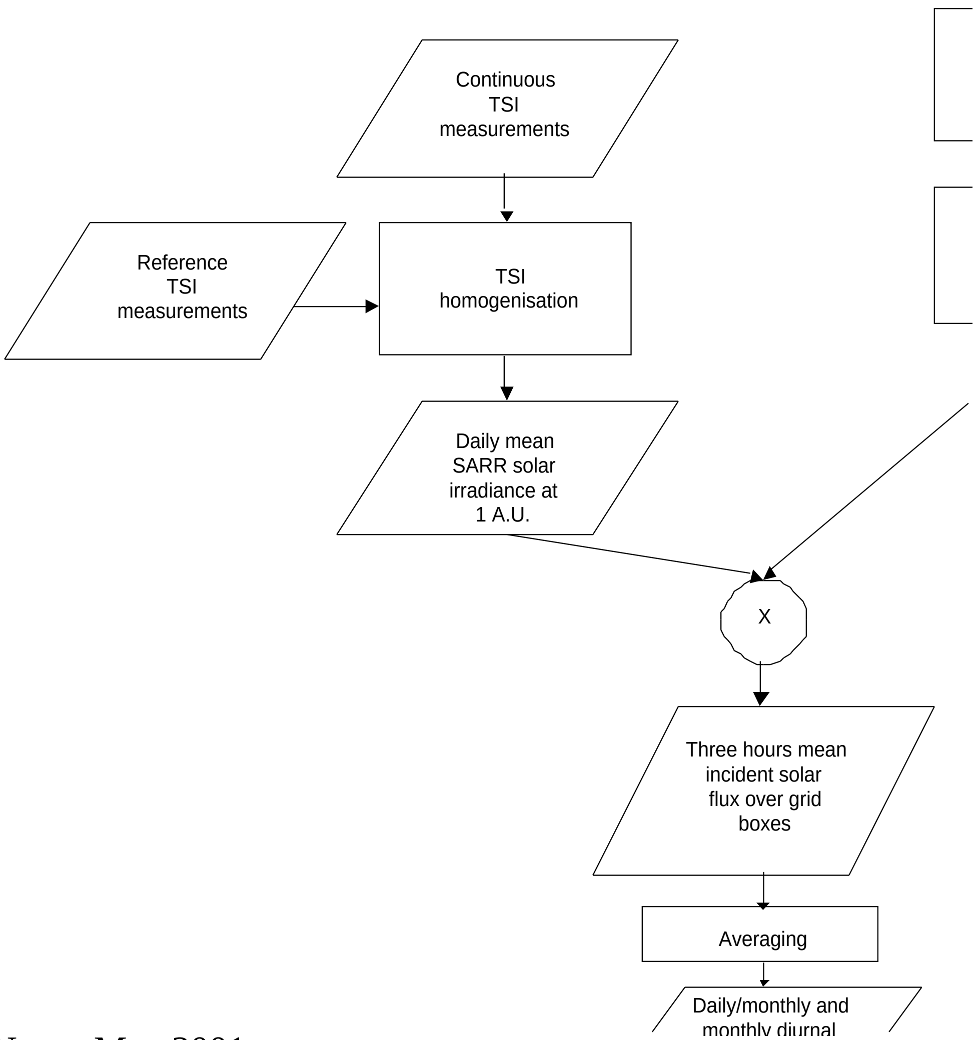
Context: Climate Monitoring
AF

- Sattelite Aplication Facilities (SAF 's): projec
initiated by EUropean METeosat SATellite
(EUMETSAT) organisation for better
exploitation of (future) satellite data
- Climate Monitoring SAF: aims to derive
satellite products with good quality and whic
are consistent in time

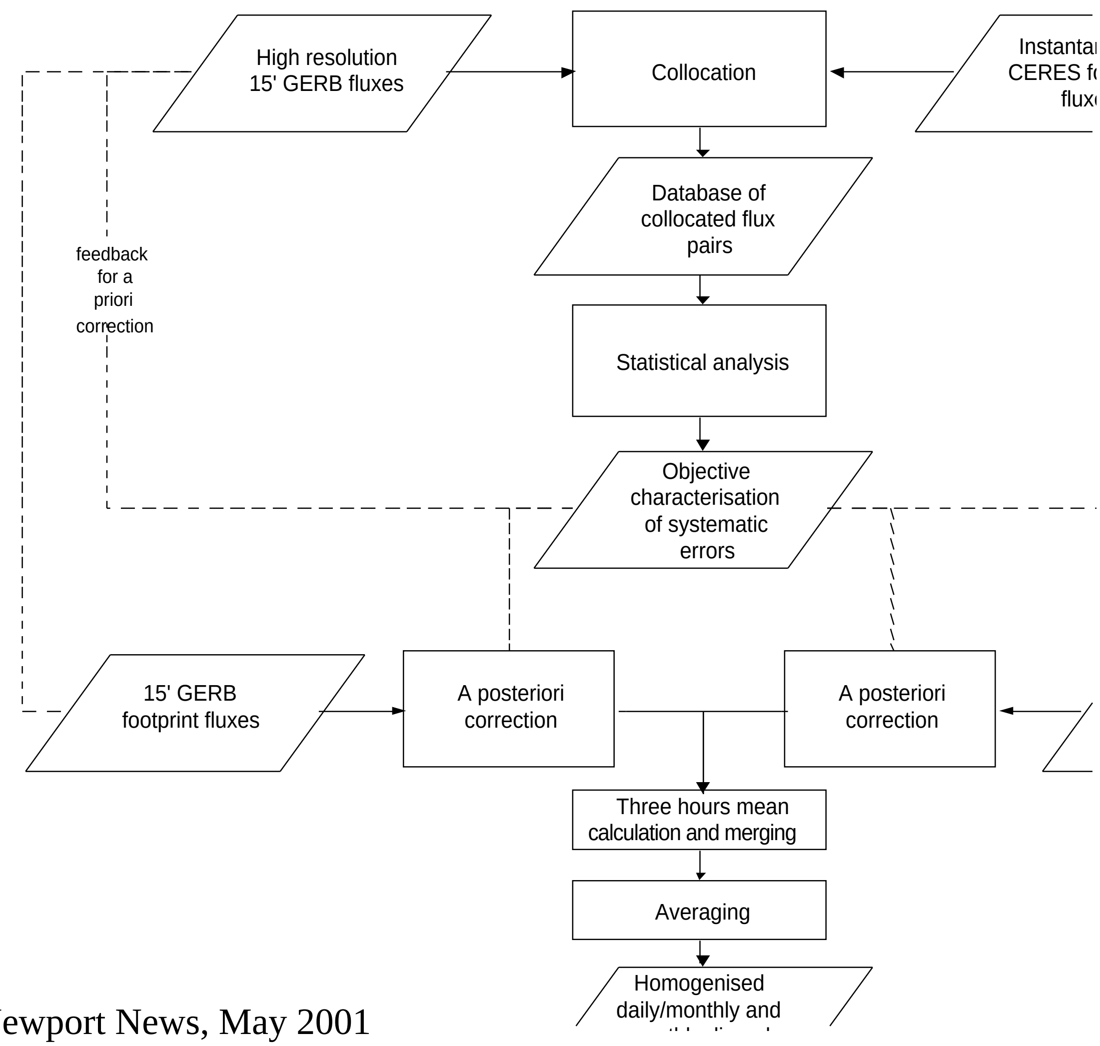
ole of RMIB in CM SAF

- Derive radiative fluxes at top of atmosphere
- Input sources for incoming solar irradiance: solar irradiance measurements
- Input sources for reflected solar irradiance an emitted thermal irradiance: GERB and CERE

owchart for incoming solar adiance



owchart for reflected solar and nitted thermal irradiance



Homogenisation of GERB and ERES fluxes

- Homogenisation = merge datasets without introducing discontinuities
  – statistical analysis : estimation of systematic differences in function of known parameters
  – a posteriori correction : removal of systematic differences

Nature of expected errors

- Satellite measurement -> Unfiltered radiance
  - processing: calibration, unfiltering
  - expected errors depend on scene type
- Unfiltered radiance -> Flux
  - processing: angular modelling
  - expected errors depend on scene type and viewin
    angles

1 General homogenisation ethodology

- To homogenise the data form two sources, a comparison and the choice of a reference is needed.
- Difference = source 1 - source 2
  = (source 1 - reference) - (reference - source 2
  = error 1 -error 2

2 Definition of comparison cases d bins

- Comparison/homogenisation can be done independently for number of cases c:
  - radiances, thermal flux: 3 surface scene types oc land, desert
  - solar flux: 3 surface scene types x solar zenith an intervals

omparison method = regression

- e.g. flux comparison

$$F_{CERES} = A + B\ F_{GERB}$$

- perfect agreement <-> A=0, B=1
- cloud classes are treated implicitely
  - solar: low values <-> clear sky
    high values <-> cloudy sky
  - thermal: low values <-> cloudy sky
    high values <-> clear sky

- For every comparison case c data has to be compared for different angular bins b:
  - radiances: viewing zenith angle intervals
  - fluxes: viewing zenith and relative azimuth angle intervals

1 Radiance homogenisation

ıse co-angular radiances only

eference = (GERB + CERES)/2

$\text{rror}_{\text{GERB}}$= (GERB - CERES)/2

$\text{rror}_{\text{CERES}}$=(CERES-GERB)/2

2 Practical implementation

- regress CERES versus GERB radiances

$L_{CERES}=A + B\ L_{GERB}$

- homogenise radiances

$L^{homog.}_{CERES}=-A/2 + [1+(1- B)/2]\ L_{CERES}$

$L^{homog.}_{GERB}=A/2 + [1-(1- B)/2]\ L_{GERB}$

- homogenise fluxes - step 1

$F^{homog.}_{CERES}=-\pi A/2 + [1+(1- B)/2]\ F_{CERES}$

$F^{homog.}_{GERB}=\pi A/2 + [1-(1- B)/2]\ F_{GERB}$

1 Flux homogenisation

- good reference = mean flux averaged over all viewing angles
  - removes most of the systematic errors dependent angles
- problem GERB: mostly backscatter measurements

➡ reference = Σ_bCERES $\cos(\theta_{vz}) \sin(\theta_{vz})$ / $\Sigma_b \cos(\theta_{vz}) \sin(\theta_{vz})$

2 CERES flux homogenisation

- choose GERB data for one fixed GERB view
angle bin b_{GERB} as intermediate reference
- For every possible CERES viewing angle bin
: regress CERES fluxes versus GERB fluxes
fixed GERB viewing angle bin b_{GERB} :

$$F_{CERES}(b)=A(b) + B(b)\ F_{GERB}(b_{GERB})$$

culate reference regression parameters

$$\Sigma_b \, A(b) \cos(\theta_{vz}) \sin(\theta_{vz}) \, / \, \Sigma_b \cos(\theta_{vz}) \sin(\theta_{vz})$$
$$\Sigma_b \, B(b) \cos(\theta_{vz}) \sin(\theta_{vz}) \, / \, \Sigma_b \cos(\theta_{vz}) \sin(\theta_{vz})$$

nogenise CERES fluxes relative to reference

$$^{mog.}{}_{CERES} = \mathbf{A} - A(b) + (1 + \mathbf{B} - B(b)) \, F_{CERES}(b)$$

B GERB flux homogenisation

- GERB fluxes for all possible bins can be homogenised by regression against homogenised CERES fluxes

Needed data

- CERES in RAPS mode : all viewing zenith angles and relative azimuth angles are covere
- All surface scene types and solar zenith angle intervals need to be covered in METEOSAT field of view
- e.g. 6 RAPS days in August 1998 for TRMM

Conclusions

- A method has been proposed to homogenise GERB and CERES fluxes.
- The method removes the angular dependent systematic differences between GERB and CERES.
- The method will be tested using the 6 CERES RAPS days in August 1998 using GERB like data derived from METEOSAT.