

A satellite image of Earth showing the continent of Africa and surrounding regions. The image is overlaid with white text. The text reads: HELIOSAT 3, Science, Results and Products. Below this, the name Jethro Betcke and his affiliation Oldenburg University are listed. At the bottom left, there is a copyright notice (c) EUMETSAT 2003. At the bottom right, the location and date Freiburg, February 23, 2005 are provided.

HELIOSAT 3

Science, Results and Products

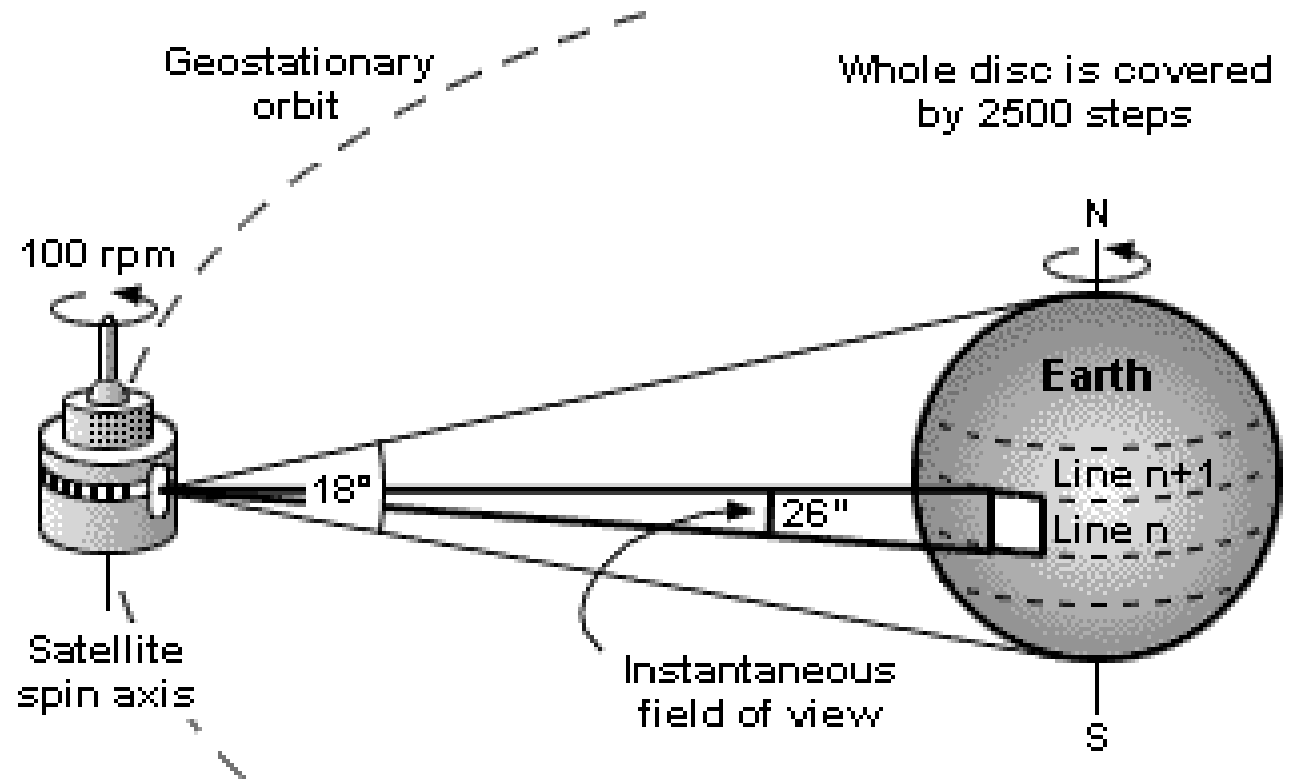
Jethro Betcke
Oldenburg University

- Radiation data
- Previous situation
 - Meteosat7
 - HELIOSAT-1 Method
 - Products
- New situation
 - MSG (Meteosat-8)
 - HELIOSAT-3 Method
 - Products
- Results
- Conclusions

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- Resource assessment
 - Planning and design of solar energy systems
 - Quality control of solar energy systems
 - Design of daylighting systems
 - Control of active buildings
 - Agriculture
 - Climate research

- Pyranometer
 - Local measurement accurate, but expensive
 - For interpolation dense network required
 - Maintenance
- Reference solar cell
 - Cheaper as pyranometer
 - Specific spectral response
 - Maintenance
- Satellite
 - Cheap
 - High spatial coverage
 - As accurate as a 50kmx50 km pyranometer grid

Geostationary Meteosat

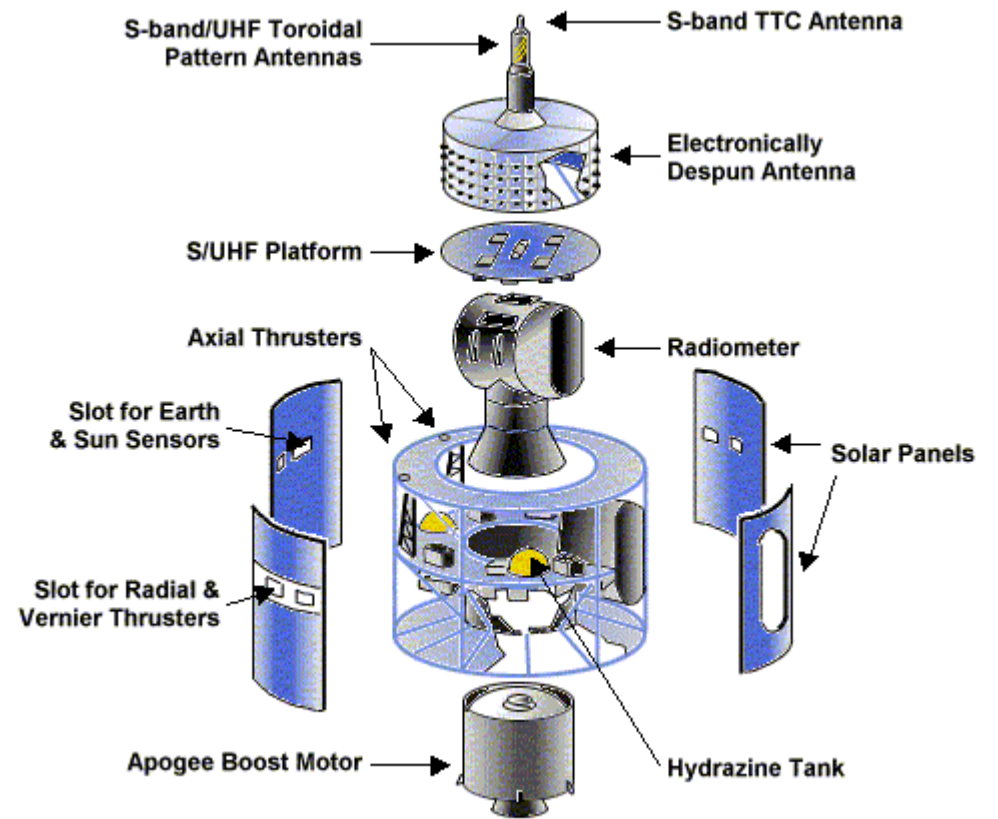
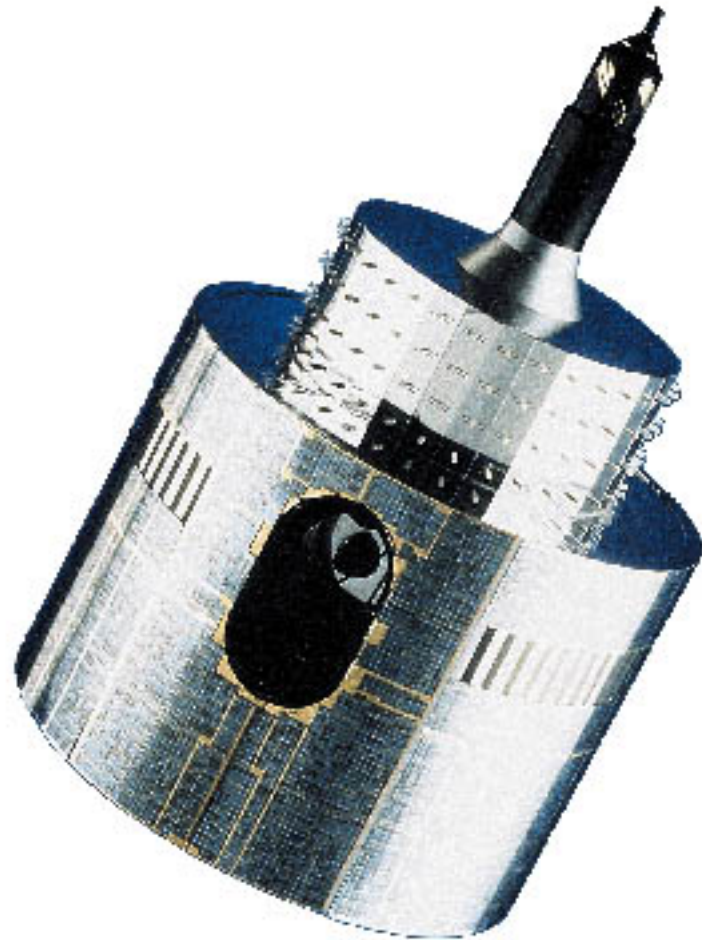


Parameter

Value

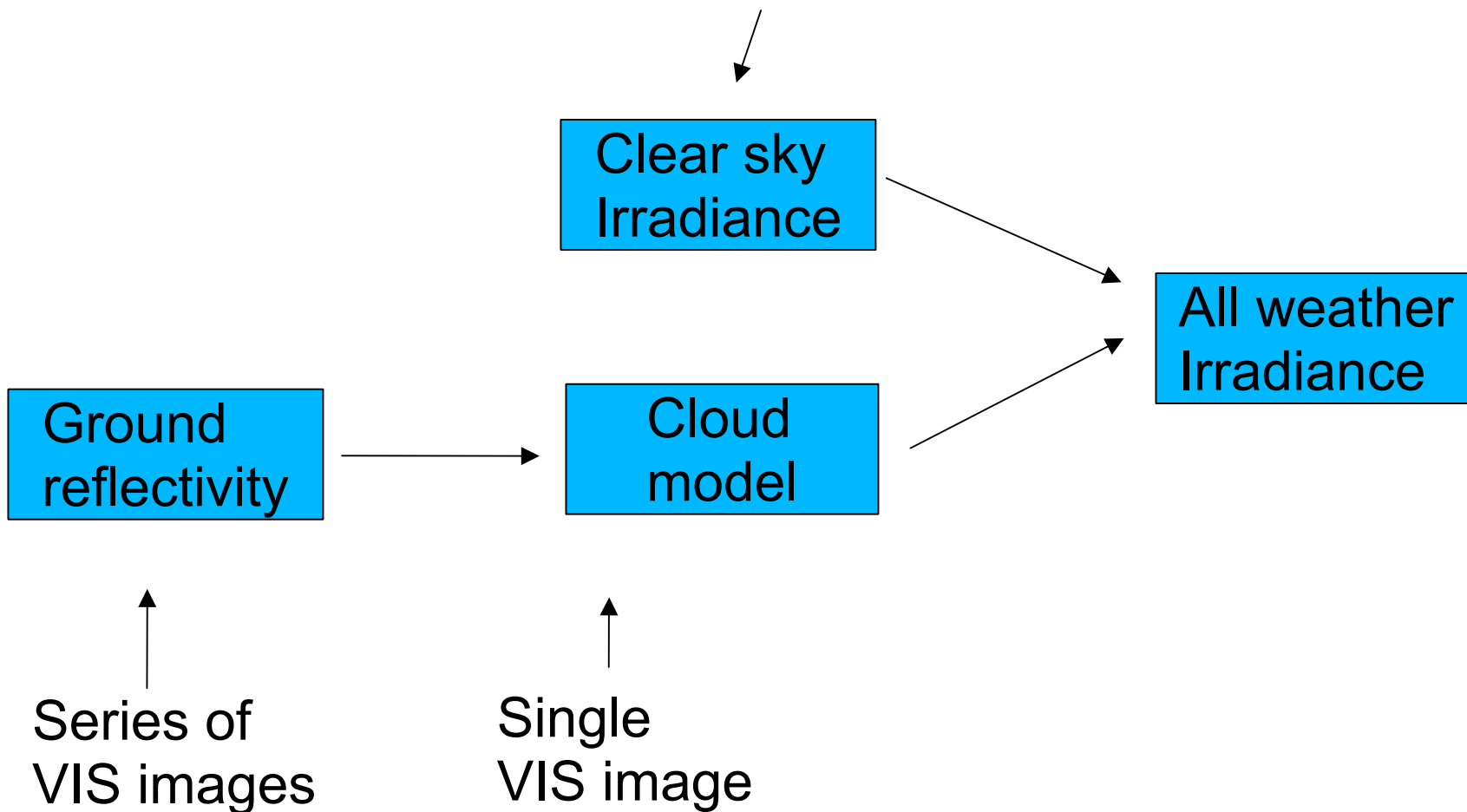
Height above equator	35,785 km
Orbit radius	42,155 km
Orbit circumference	264,869 km
Arc length per degree	736 km
Orbital velocity	11,066 km/h = 3.07 km/s

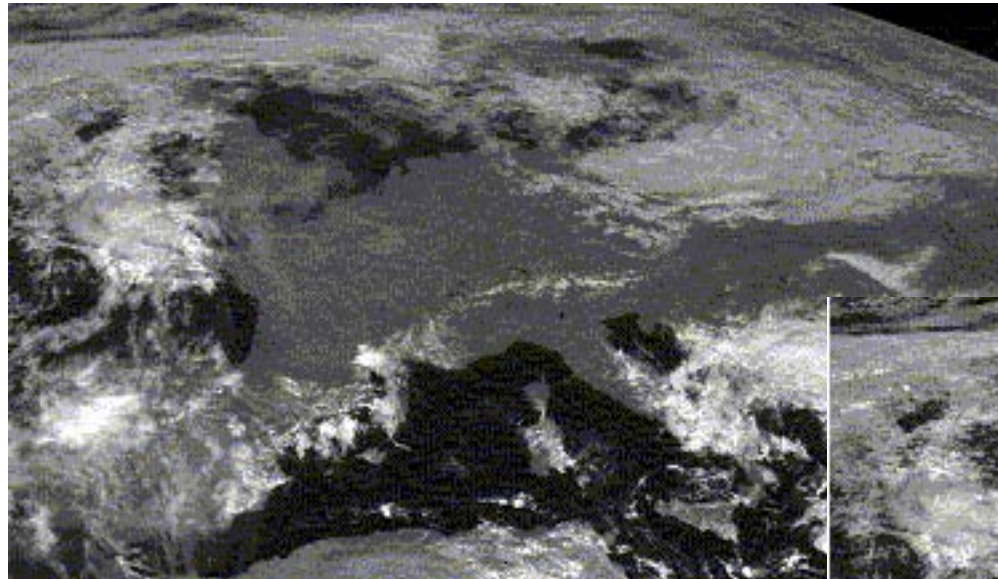
Meteosat



- Visual channel
 - Pixel size 2.5 km x 2.5 km (sub satellite)
 - Frequency: every half hour
- 2 Infrared channel
 - water vapour
 - surface temperature

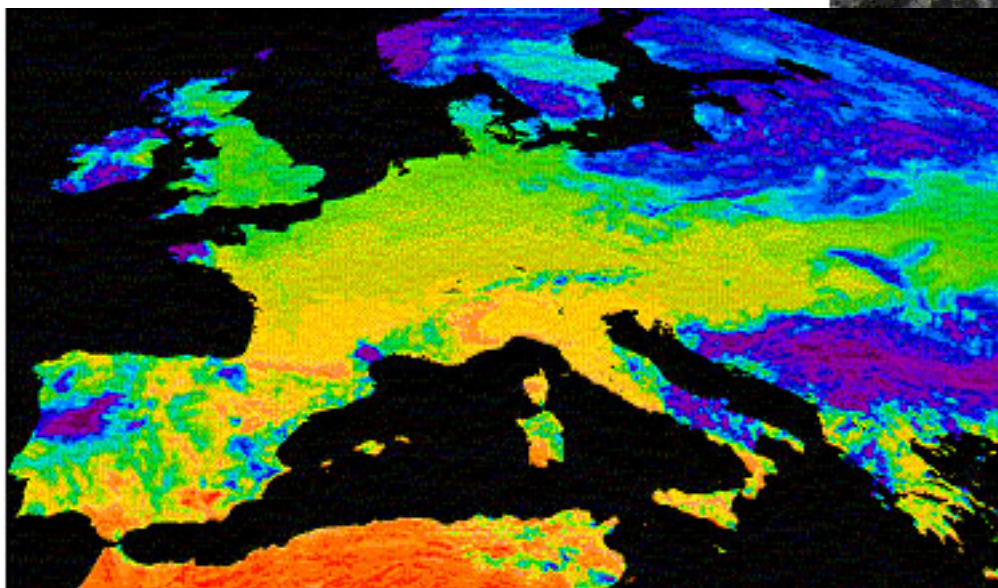
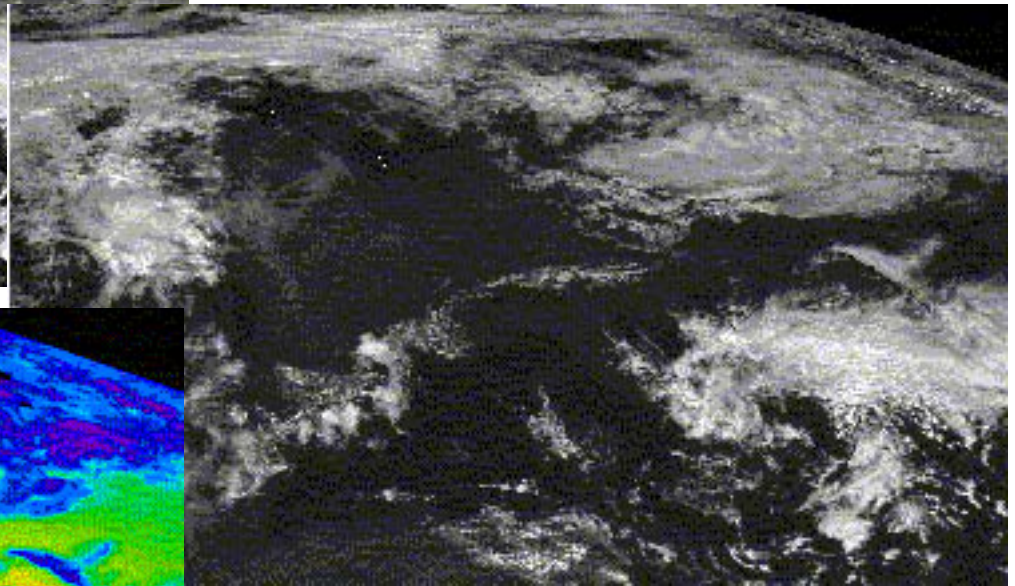
Climatological atmospheric
data
(overall value for turbidity)





METEOSAT image

Cloud index



Radiation map

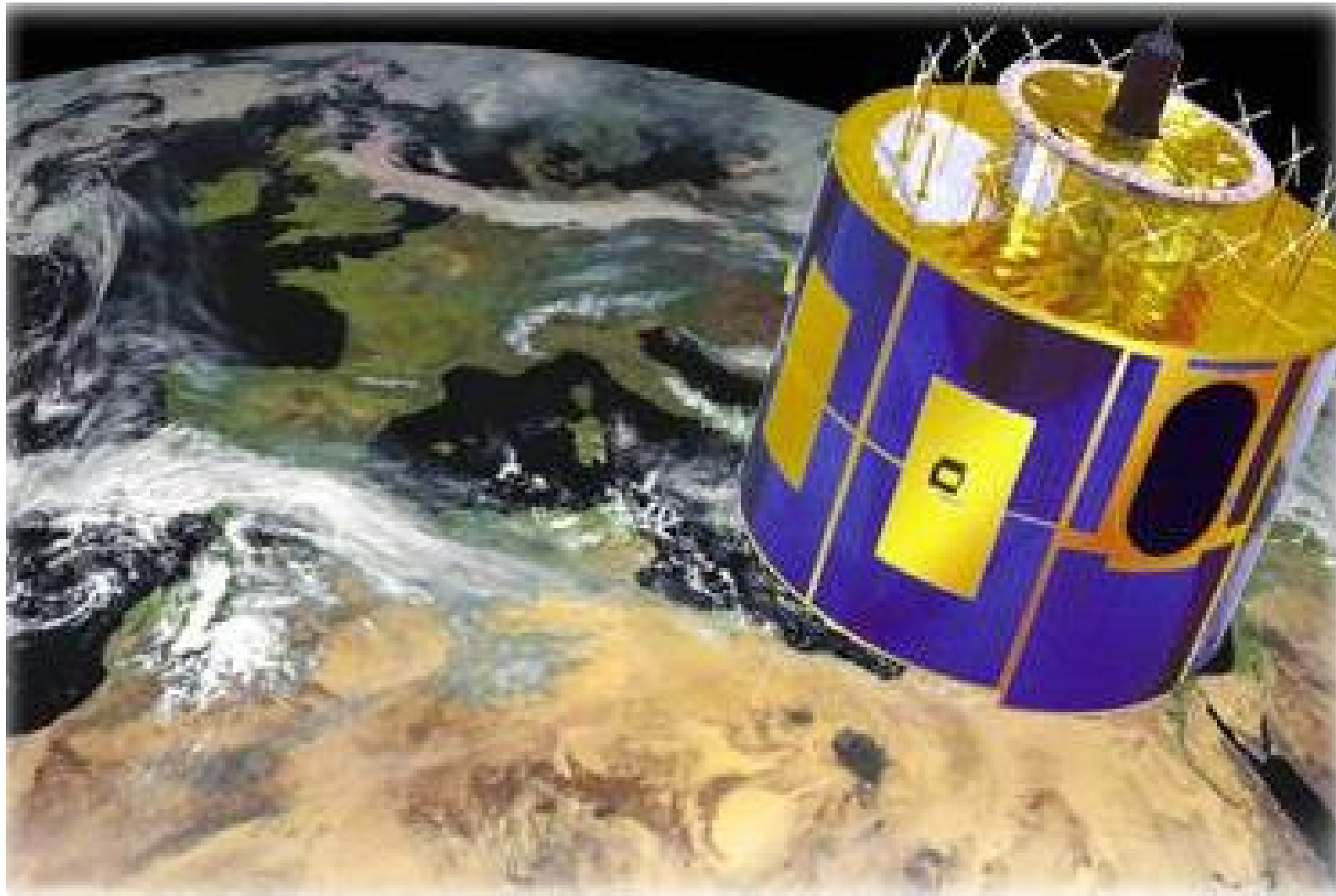
October 1, 2002,
12 UTC

Products of previous scheme (HELIOSAT-1)

- Global irradiance
- Direct and diffuse components by separation model
- Highest temporal resolution: 30 min
- Highest spatial resolution: 2.5 km x 2.5 km
- Time series
- Irradiance maps

- Global irradiance
 - 25-30% for hourly values
 - ~13% for daily values
 - ~8% for monthly values
- Diffuse irradiance
 - ~35% for hourly values
 - ~20% for daily values
 - ~13% for monthly values

New Opportunities Meteosat Second Generation



Meteosat Second Generation: major improvements

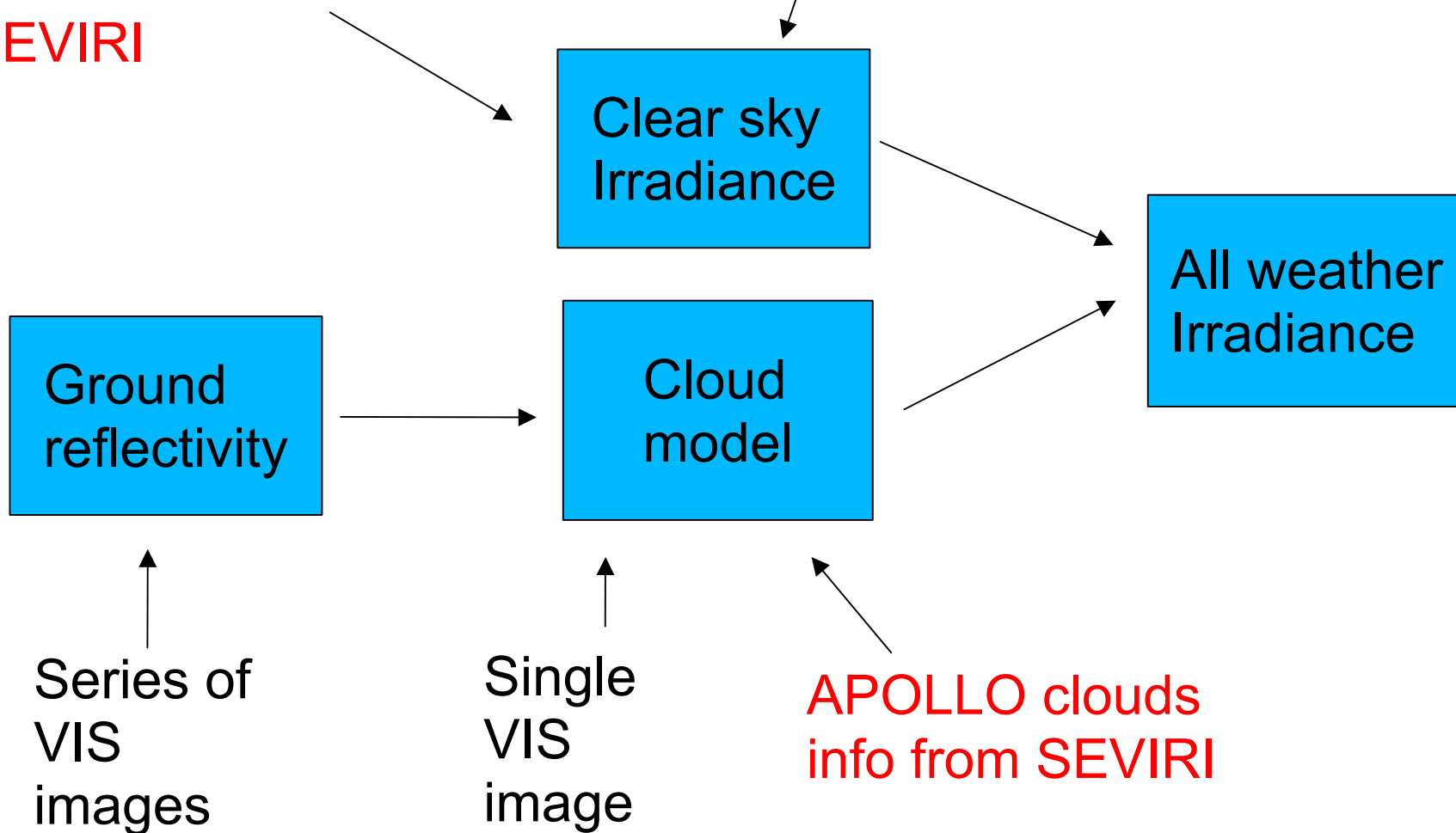


- High resolution visual channel
 - Pixel size 1 km x1 km
 - Frequency
- SEVIRI instrument with 12 channels
 - water vapour detection
 - ozone detection
 - advanced cloud products
- Geostationary Earth Radiation Budget (GERB) instrument
- Data available since March 2004 (Planned Jan 2003)

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- Aerosol and ozone information can be derived from instruments on board of polar orbiting satellites
 - Envisat -SCIAMACHY
 - ERS-2 GOMES AATRS

Semi Real Time
atmospheric data from
ENVISAT and MSG-
SEVIRI

~~Climatological
atmospheric
data~~



- Radiative Transfer Model rather than empirical method
- Possibility to use detailed near real time atmospheric data as input
- Produces global and direct clear sky irradiance
- Produces spectrally resolved data

- Benefits from higher spatial and temporal resolution
- Detection of cloud shadows
- Calculation of influence of clouds on spectrum

Products of HELIOSAT-3 (clear sky +cloudy sky)



- Global irradiance
 - highest temporal resolution 15 min
 - highest spatial resolution 1 km x1 km
- Direct and diffuse irradiance
- Spectrally resolved irradiance
 - spectral derivatives:
 - PAR
 - Luminance
 - Spectral response of PV
- *Directional dependency*

- Still ongoing
- Clear sky calculation on basis of climatological atmospheric data
- Due to late launch of MSG a complete year of data is not available yet.

- Approx 1.5 % improvement in RMSE of global irradiance due to higher spatial and temporal resolution
- Additionally up to 2% improvement for global irradiance due to new method
- Additionally up to 3% improvement for diffuse irradiance due to new method

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- Near real time atmospheric input
 - Correction on cloud index calculation for broken cloud situations
 - Improved RTM-based cloud modelling using detailed near real time cloud information

- A new solar irradiance scheme has been developed that uses detailed atmospheric data and is a good platform to integrate new developments
- The new Heliosat-3 method provides an extended range of products
- First validation results look promising
- Additional improvements are in the pipeline

Links for additional info on cloud products

- [http:// www.heliosat3.de](http://www.heliosat3.de)
- [http:// www.soda-is.com](http://www.soda-is.com)
- <http://satel-light.com>

- University of Oldenburg, Faculty of Physics, Energy- and Semiconductor Research (EHF)
- Association pour la Recherche et le Développement des Méthodes et Processus Industriels (ARMINES)
- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) - Deutsches Fernerkundungsdatenzentrum (DFD)
- Universitetet i Bergen, Geofysisk Institutt (UiB)
- Université de Genève, Groupe de Physique Appliqué - Energie (UNIGE)
- Fraunhofer-Institut für Solare Energiesysteme (FhG-ISE)
- Ecole Nationale des Travaux Publics de l'Etat (ENTPE), Centre Nationale de la Recherche Scientifique (CNRS), Département Génie Civil et Bâtiment (DGCB)
- Instituto Tecnológico de Canarias, S.A. (ITC)
- Ecole Nationale Supérieure des Mines de Paris - Centre Télédétection & Modélisation (ENSMP - T&M)

- The Heliosat-3 Project has been funded by the European Commission under Contract Nr NNK5-CT200_00322

