International Water Management Institute

CGIAR

Water Accounting +

Rapid WA using WAPORWA

October 27, 2022 – Session I

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Data for Water Accounting

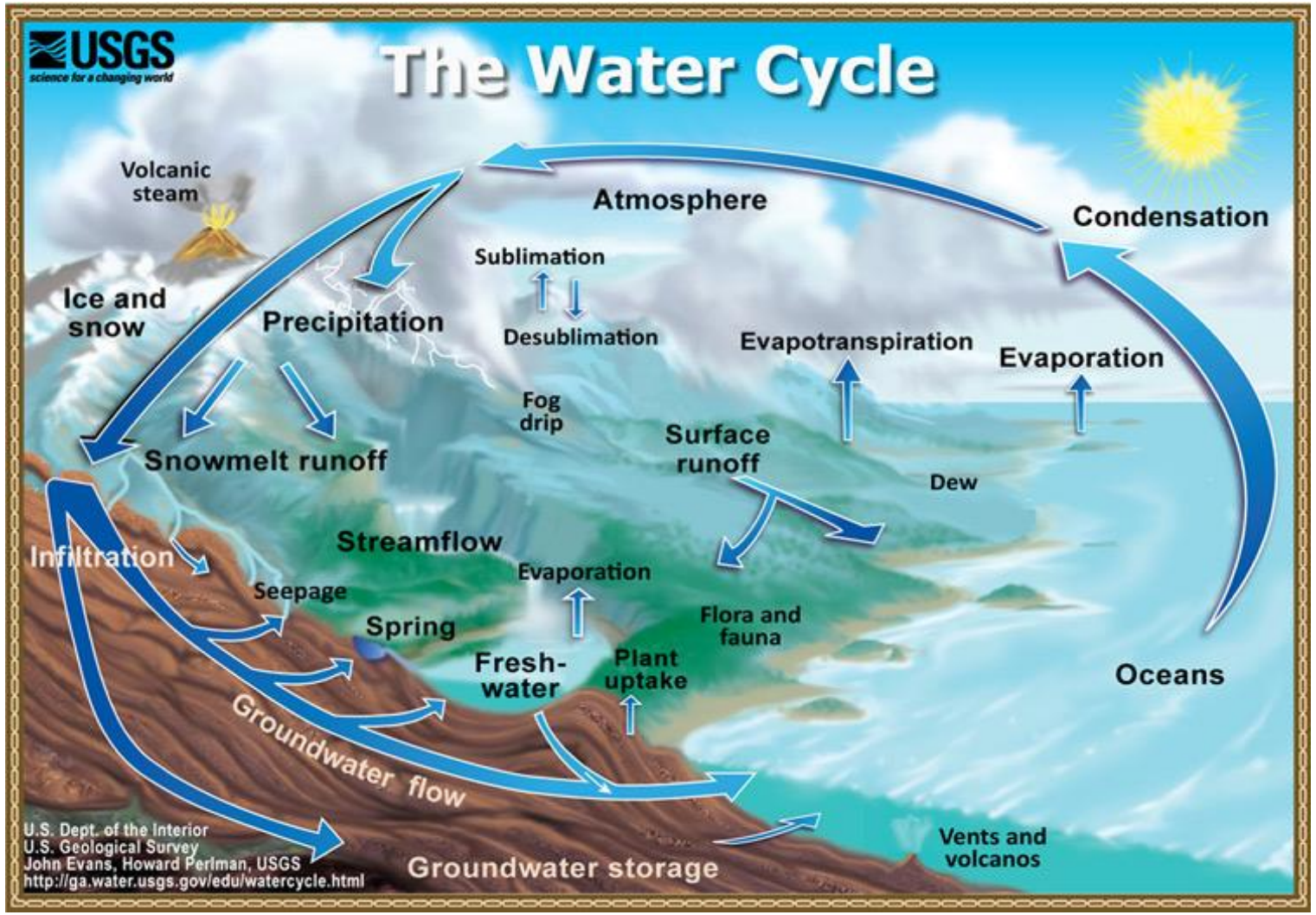
RS data directly downloadable	More modelling needed (indirectly available)	GIS data	Hydrological data
Land Use Land Cover (LULC) - GlobCover	Actual Transpiration (T)	Protected areas (A)	Ratio Fast/Slow runoff
Precipitation (P) - CHIRPS	Actual soil Evaporation (E)	Bathemetry	Surface runoff
Actual EvapoTranspiration (ET) - ETEns	ET green water consumption (ET_green)	Weather data (meteo)	Baseflow
Soil moisture (SM) - ASCAT	ET blue water consumption (ET_blue)	Terrain elevation (DEM)	Storage changes
Surface temperature (LST) - MODIS	Water withdrawals (Q)	Soil physical data	Outflow from basins
Surface albedo (alpha) - MODIS	Beneficial / non-beneficial water consumption	Population density	Ratio SW/GW withdrawals
Water levels (l) - Jason	Reference EvapoTranspiration (ET0)	Livestock density	Lateral groundwater flow
Change in gravity (delta S) - GRACE	Interception (I)	Grey water consumption	Groundwater recharge
Snow cover (cl) - MSG	Soil erosion (Ero)	Environmental flow requirements	
Cloud cover (sn) - MODIS	Dry matter production (Bio)	Depth of root zone	
Leaf Area Index (LAI) - MODIS	Crop yield (Y)		
Vegetation Cover (Vc) - MODIS	Crop Yield due to rainfall (Y_P)		
Net Primary Production (NPP) - MODIS	Crop yield due to irrigation (Y_IRR)		
Total Dissolved Solids	Crop water productivity (WP)		
Chlorophyll	Water productivity due to rainfall (WP_P)		
Water body area	Water productivity due to irrigation (WP_IRR)		
	Carbon sequestration (C)		
	Lifestock feed production (LiveS)		
	Fuelwood production (Fuel)		

Hydrologic Data

- Quantitative representation of the Water Cycle
- Variable
  - Time
  - Space

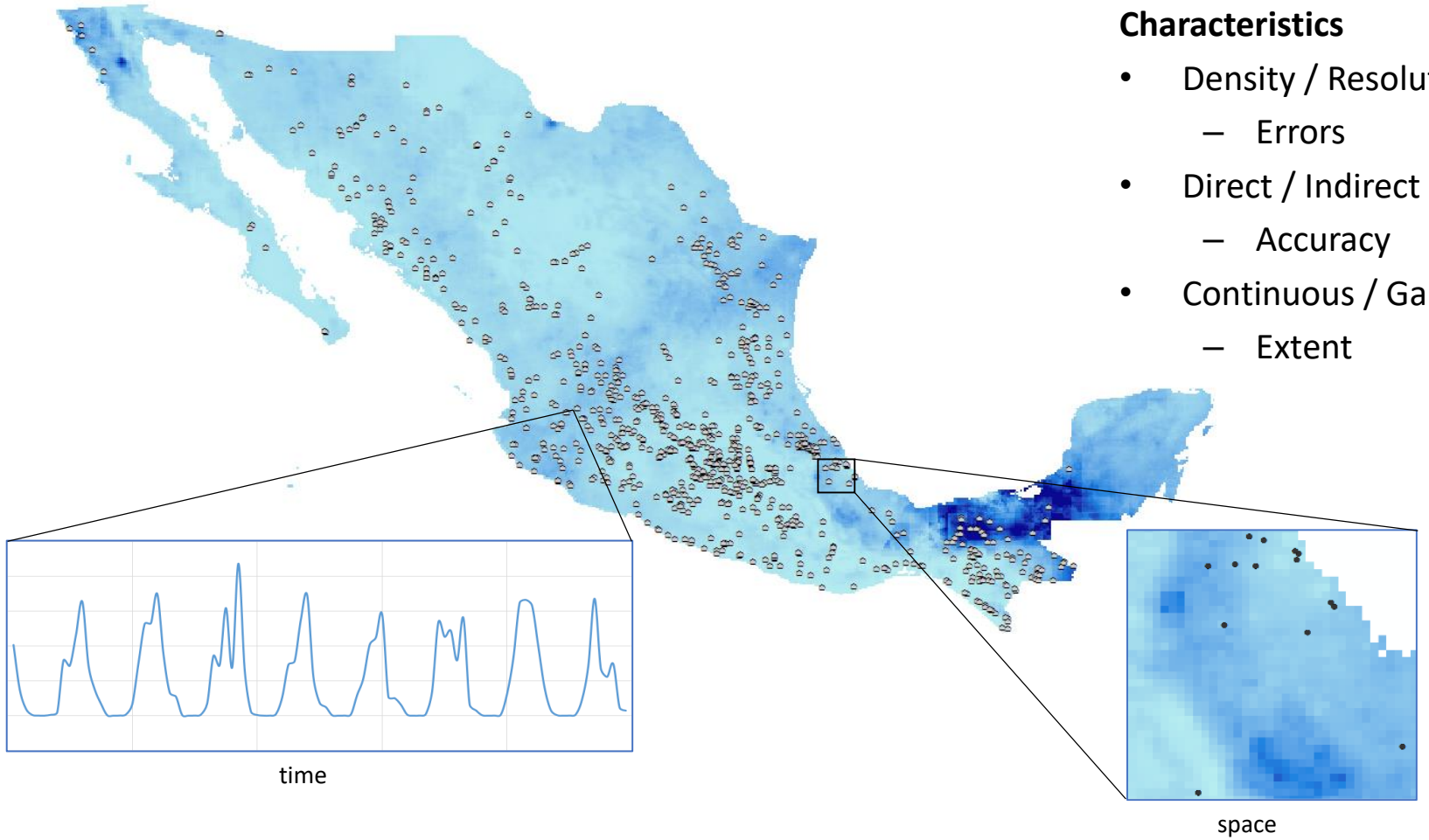
Build knowledge based on existing information

Focus on the meaning of the information



Hydrologic Measurements

- In-situ stations
- Remote sensing
- Model output
  - Re-analysis
  - Forcing parameters



Characteristics

- Density / Resolution
  - Errors
- Direct / Indirect
  - Accuracy
- Continuous / Gaps
  - Extent

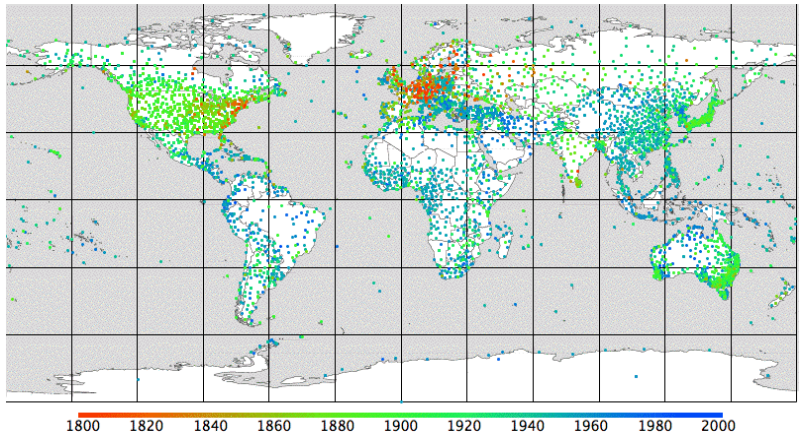
Hydrologic Measurements (cont.)

Insitu Advantage:

- Accurate at point level

Disadvantages:

- Spatial Accuracy
- Spatial Coverage

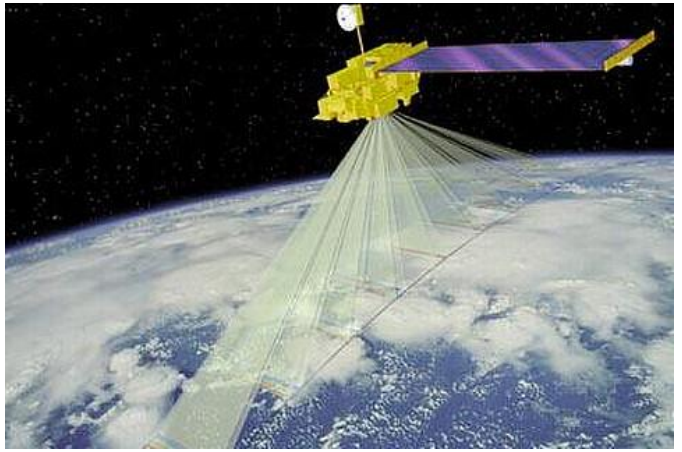


Remote Sensing Advantage:

- Spatial coverage

Disadvantages

- In some areas less accurate (mountainous areas and higher latitudes)



Terminology

- Resolution
  - Space: Grid size (e.g. 30m, 1/8°)
  - Time: Interval (e.g. hourly, monthly)

High resolution

Low Resolution

Temporal resolution

>>> Daily >>> 5 Daily >>> Weekly >>> 10 Daily >>> 2 weekly >>>

Terminology

- Extent
  - Space: Coverage (e.g. Global, [-180, 180, -50, 50])
  - Time: Start and end Dates

    (e.g. Data since 1970-01-01, from 2000 to 2005)
- Range of values

  (e.g. 0,255; -1,1)
- Scale factor and offset
  - Save storage space - integer vs float

    (e.g. scale factor: 0.01, offset: 0)

50 → 0.5

Terminology

- Resolution
  - Space: Grid size (e.g. 30m, 1/8°)
  - Time: Interval (e.g. hourly, monthly)
- Extent
  - Space: Coverage (e.g. Global, [-180, 180, -50, 50])
  - Time: Start and end Dates
    (e.g. Data since 1970-01-01, from 2000 to 2005)
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  (e.g. 0,255; -1,1)
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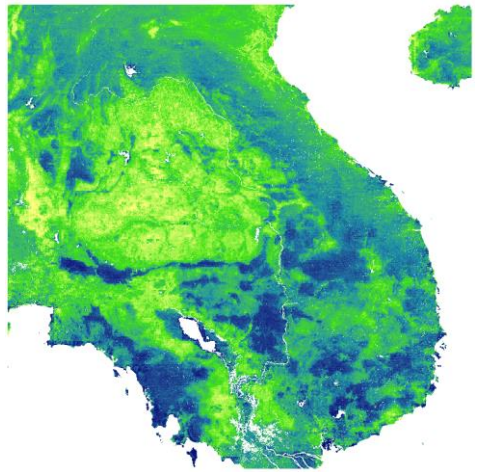
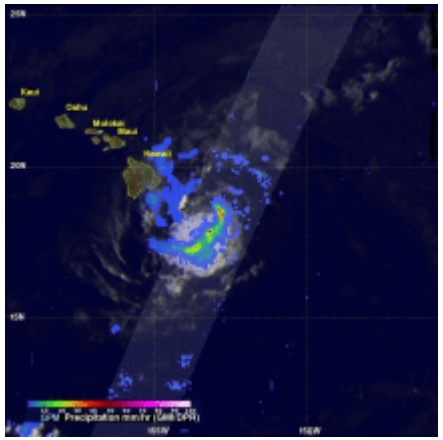
Metadata

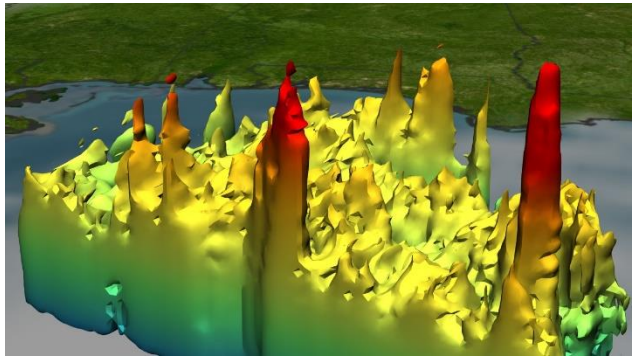


Precipitation: TRMM

- Tropical Rainfall Measuring Mission (TRMM)
- NASA & JAXA mission
- Spatial resolution: 0.25° ~27 km
- Temporal resolution: 3-hourly, daily, monthly
- From 1998 to 2015

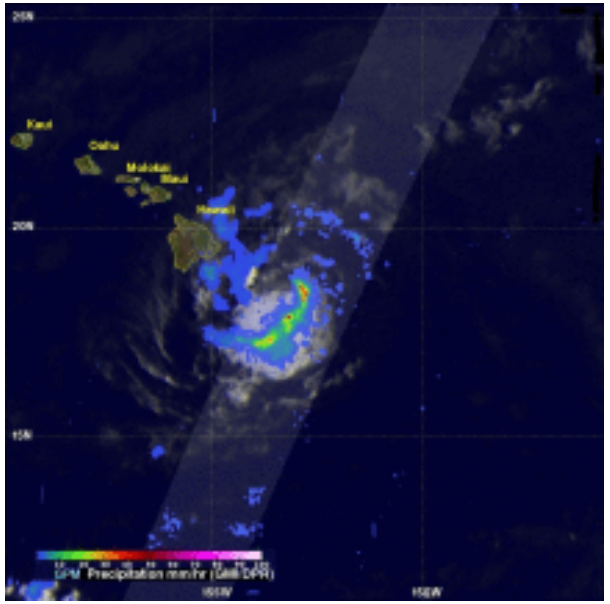


- Instruments
  - Precipitation radar
  - Microwave imager
  - Visible and Infrared Scanner (VIRS)
  - Lightning Image Sensor (LIS)



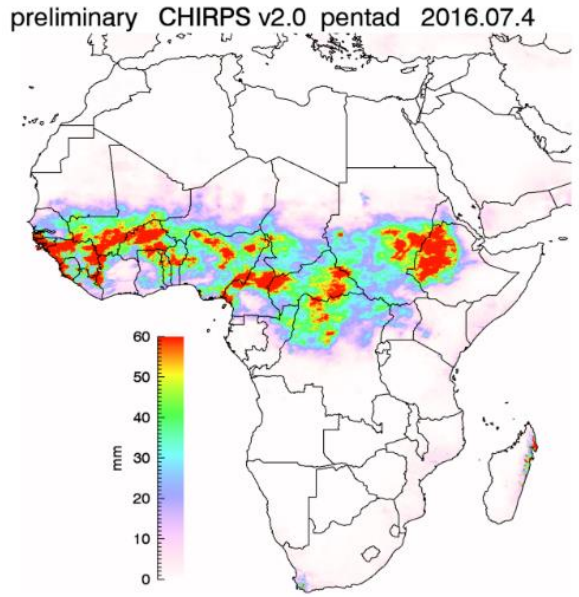
Precipitation: GPM IMERG

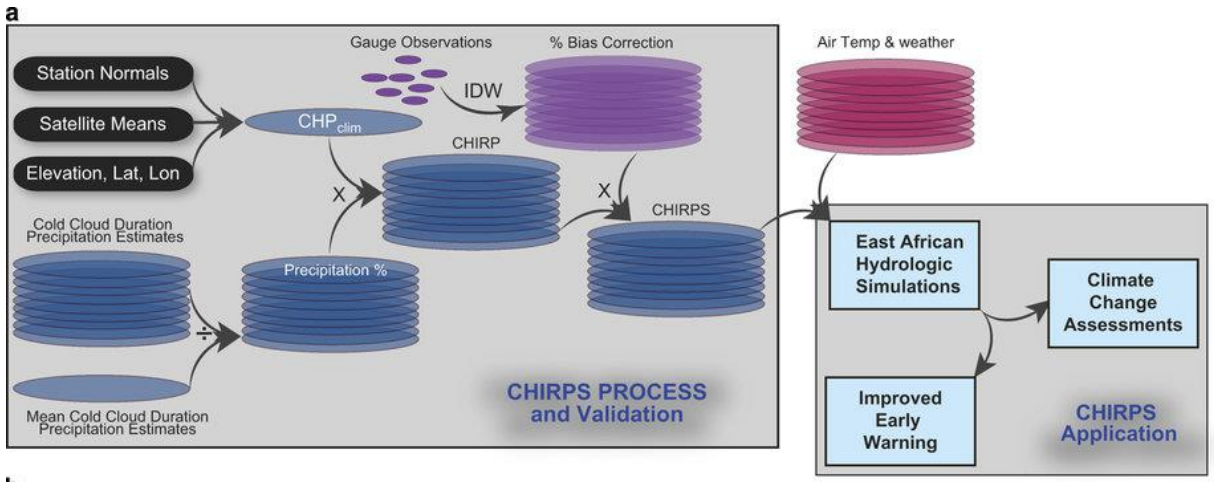
- Integrated Multi-satellite Retrieval for GPM (Global Precipitation Measurement)
- Merges measurements from network of satellites
- Contains TRMM
- Spatial resolution: 0.1° ~11 km
- Temporal resolution: 30 mins, daily, monthly
- From 2000 to present
  - Microwave and Radar



Precipitation: CHIRPS

- Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS)
- Funded by USGS and USAID
- Spatial Extent: -180, 180, -50, 50°
- Spatial resolution: 0.05° ~5 km
- Temporal resolution: daily, monthly
- Initial date: 1981



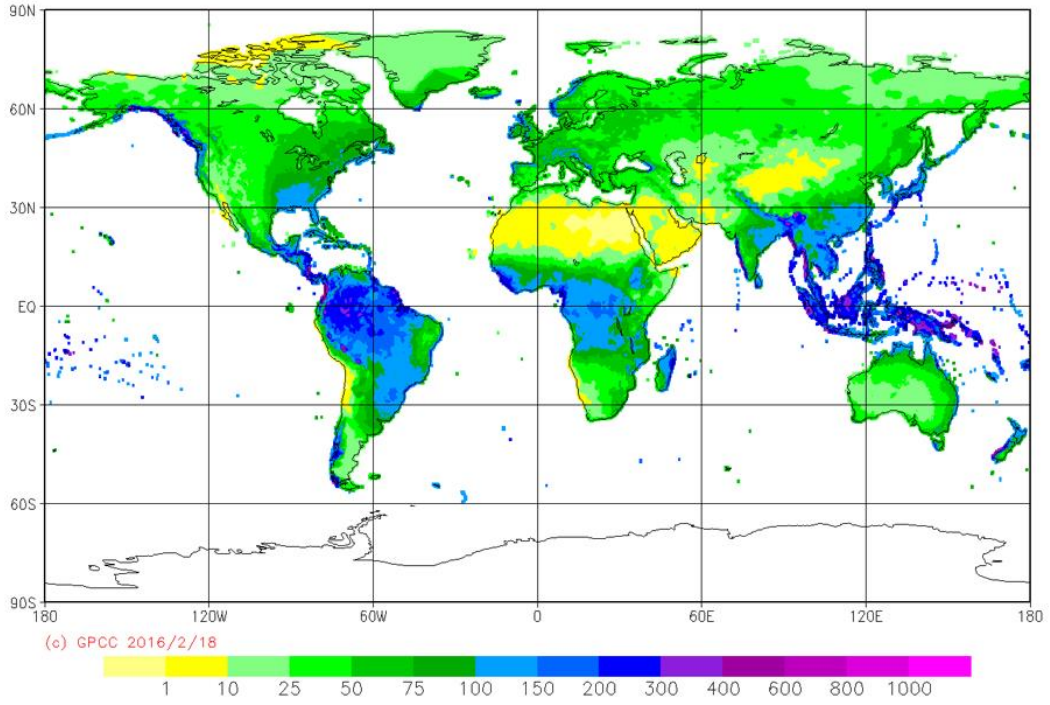


Source: http://chg.geog.ucsb.edu/data/chirps/ and http://www.nature.com/articles/sdata201566

Precipitation: GPCC

- Global Precipitation Climatology Centre (GPCC)
- German Meteorological Office (Deutscher Wetterdienst)
- Spatial resolution: 0.5° ~55km
- Temporal resolution: monthly
- From 1901 to 2013

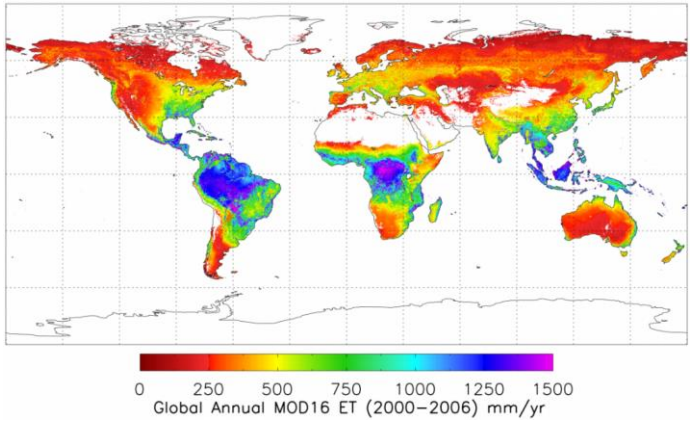
- Based on station data
  - Quality control
  - Interpolation (terrain)

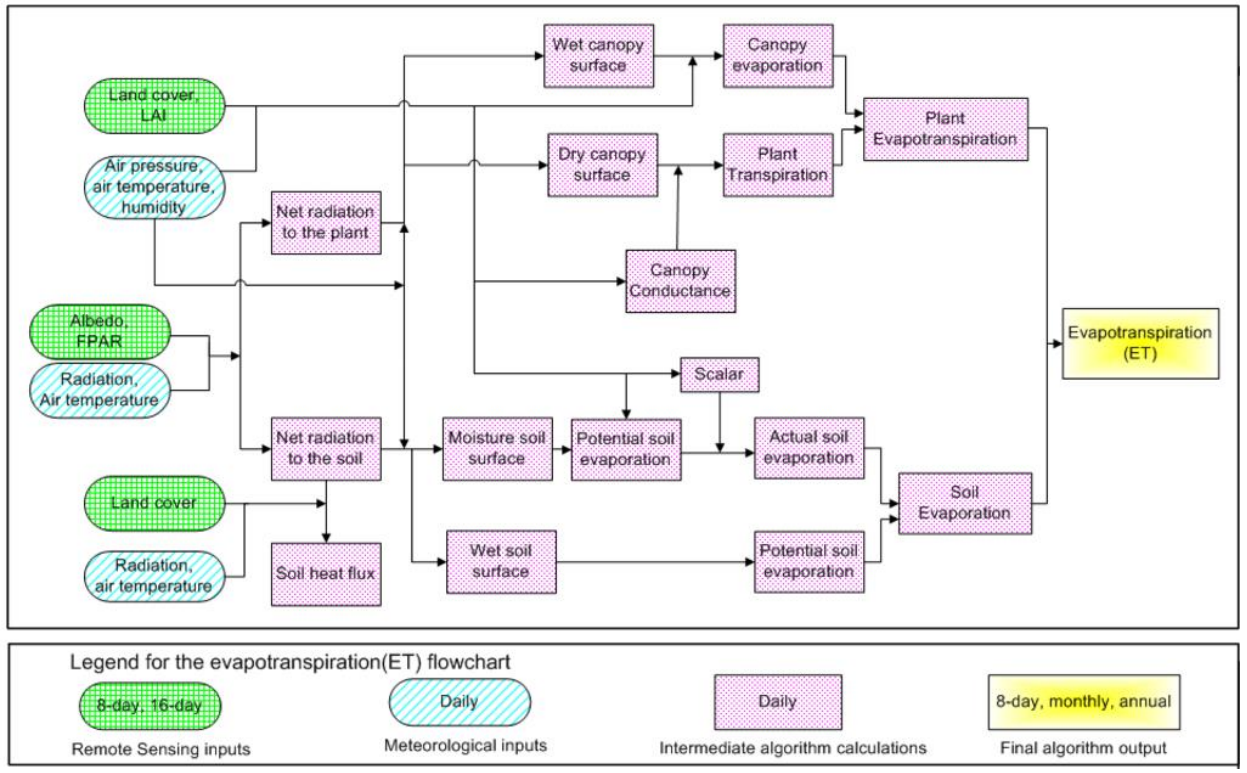


Evapotranspiration: MOD16

- Moderate Resolution Imaging Spectroradiometer (MODIS)
- Two satellites / 36 bands
- Spatial Resolution: 1km
- Temporal resolution:

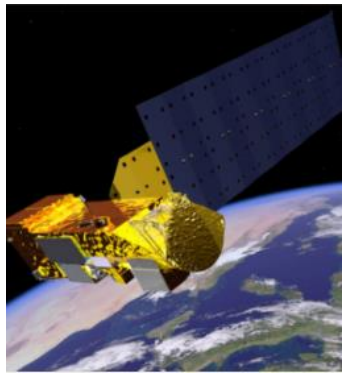
  8-day, monthly
- Initial date: 2000

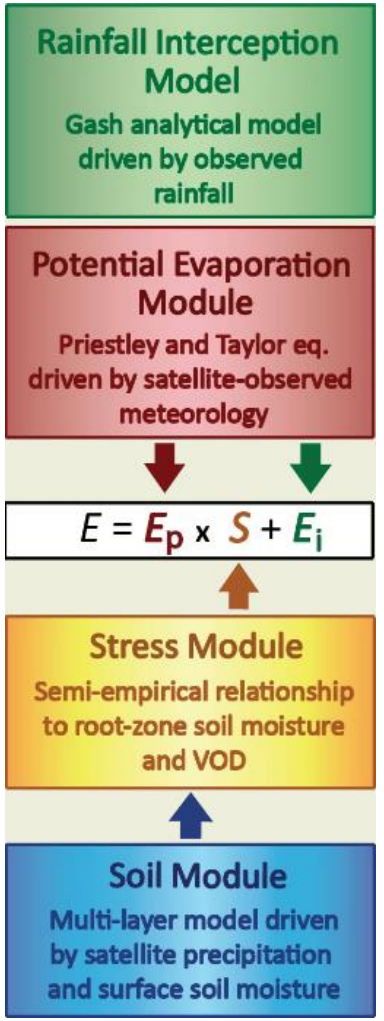




Evapotranspiration: GLEAM

- Global Land Evaporation Amsterdam Model (GLEAM)
- VU - ESA
- Global, 0.25° ~27km
- Temporal resolution: daily, monthly
- From 1980–2018



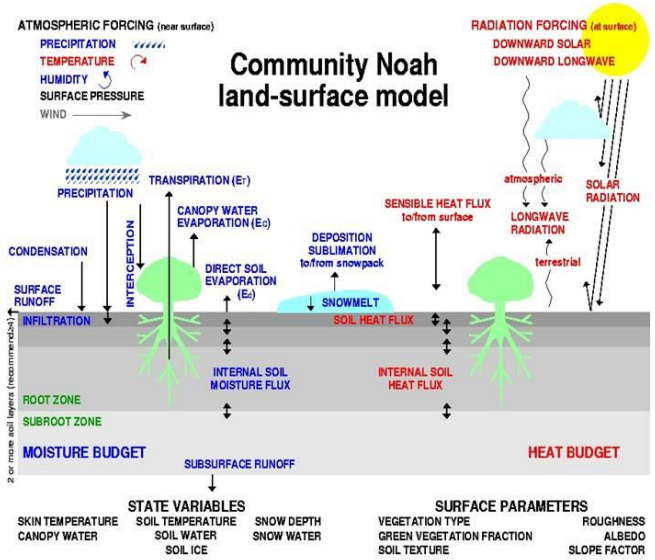


Meteorological: GLDAS

- Global Land Data Assimilation System (GLDAS)
- Models: VIC and Noah
- Spatial resolution:

  1° ~110km
- Temporal resolution:

  3-hourly, monthly
- Initial date:1948



ftp://ftp.emc.ncep.noaa.gov/mmb/gcp/ldas/noahlsm

Variables

- Temperature
  - Surface
  - Soil
  - Air
- Albedo
- Surface Pressure etc.

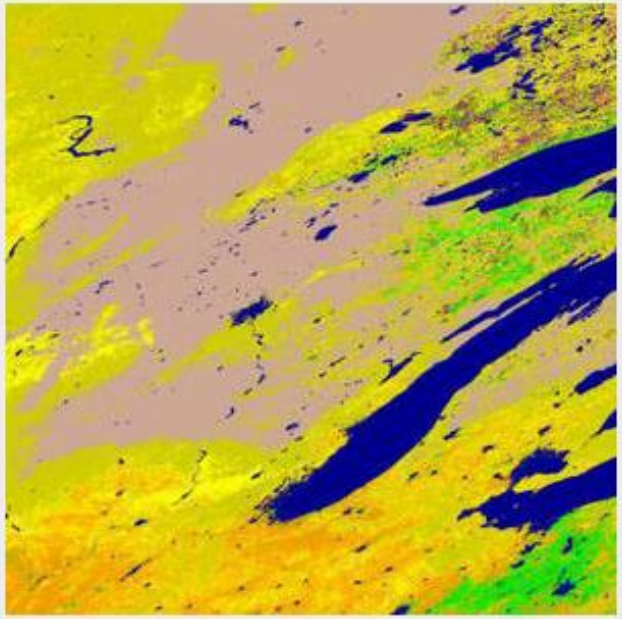
Source: http://ldas.gsfc.nasa.gov/gldas/ and http://ldas.gsfc.nasa.gov/nldas/NLDAS2model.php

Vegetation: MODIS

- Moderate Resolution Imaging Spectroradiometer (MODIS)
- Two satellites / 36 bands
- Spatial Resolution: 1km
- Temporal resolution:

  8-day, monthly
- Initial date: 2000
- NDVI
- LAI

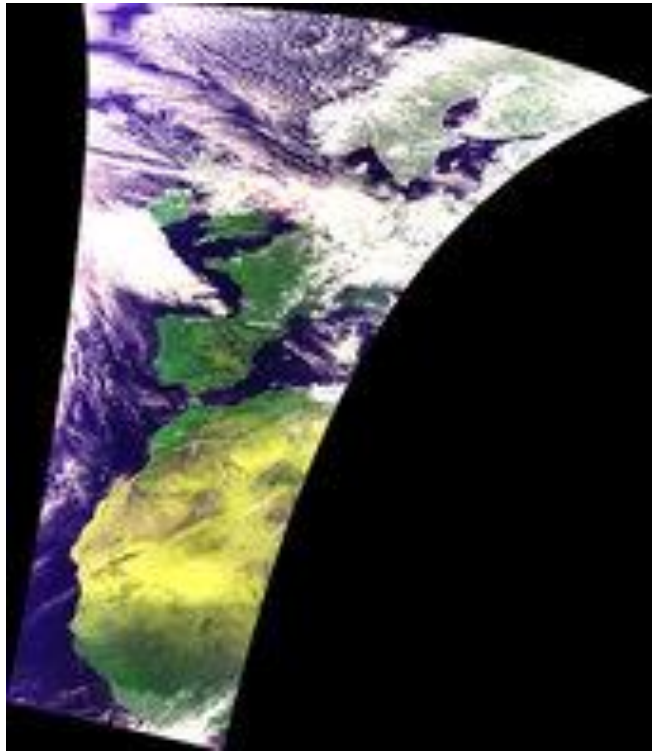
Short Name: MOD15A2



This image is pseudo-colored to display the Fraction of Photosynthetically Active Radiation (FPAR) calculated over north-central U.S., from the Great Lakes westward across the Northern Great Plains. These data collected between March 6 13, 2007 indicate more vegetation growing furthest to the East, as expected during this time of the year.

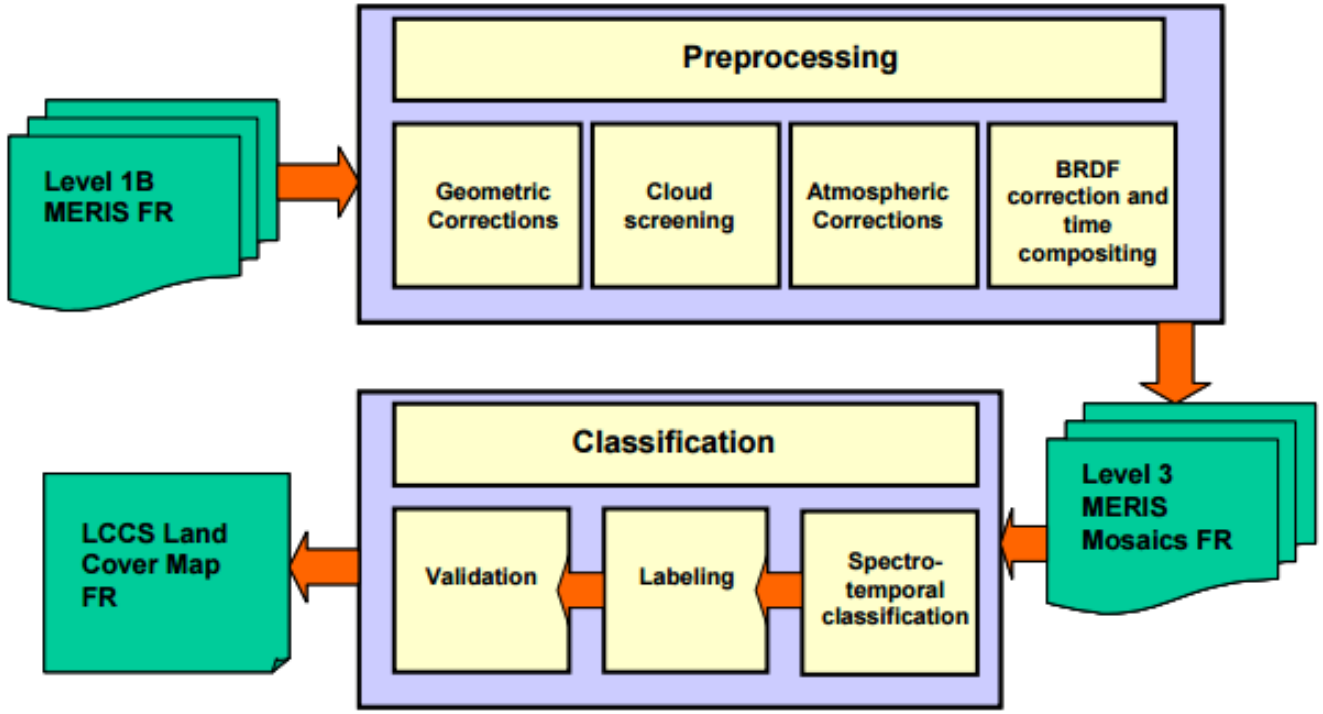
Vegetation: VITO

- Flemish Institute of Technology (VITO)
- Spatial resolution: 100m
- Spatial extent: -180, 180,
- -56, 75°
- Temporal resolution: daily
- satellite passes
- Initial date: 16-10-2013
- NDVI
- LAI



Land Use / Land Cover: Global Cropland Extend

- ESA – land cover
- Spatial resolution 300m
- Yearly from 2000 to 2015
- Meris mission
- Land surface reflectance
- Classification

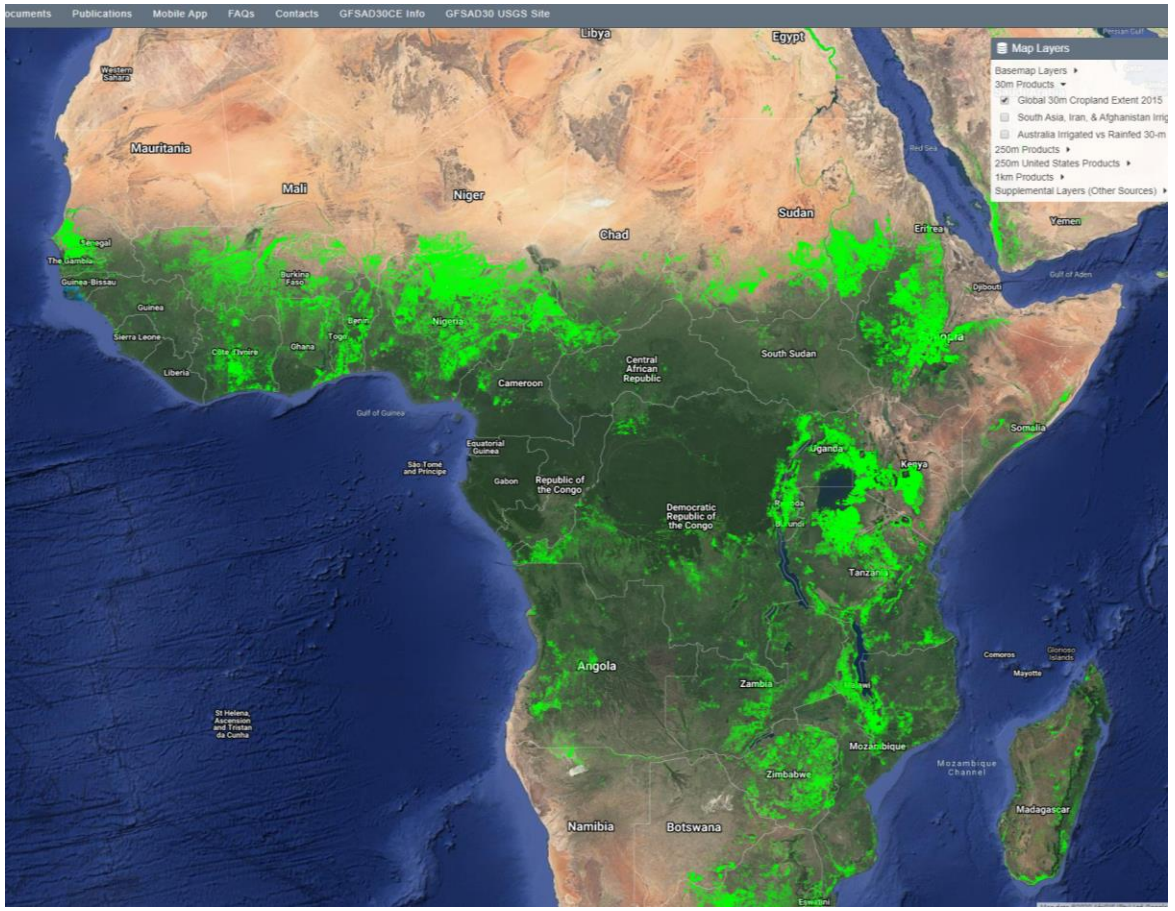


Land Use / Land Cover: Global Cropland Extend

- Global Agriculture Monitoring Program (GLAM)
- MODIS
- Spatial resolution: 250m data
- Period: 2000 – 2008
- Pixel classification
- Cropland probability per-pixel
- Cropland/non-cropland
- indicator map

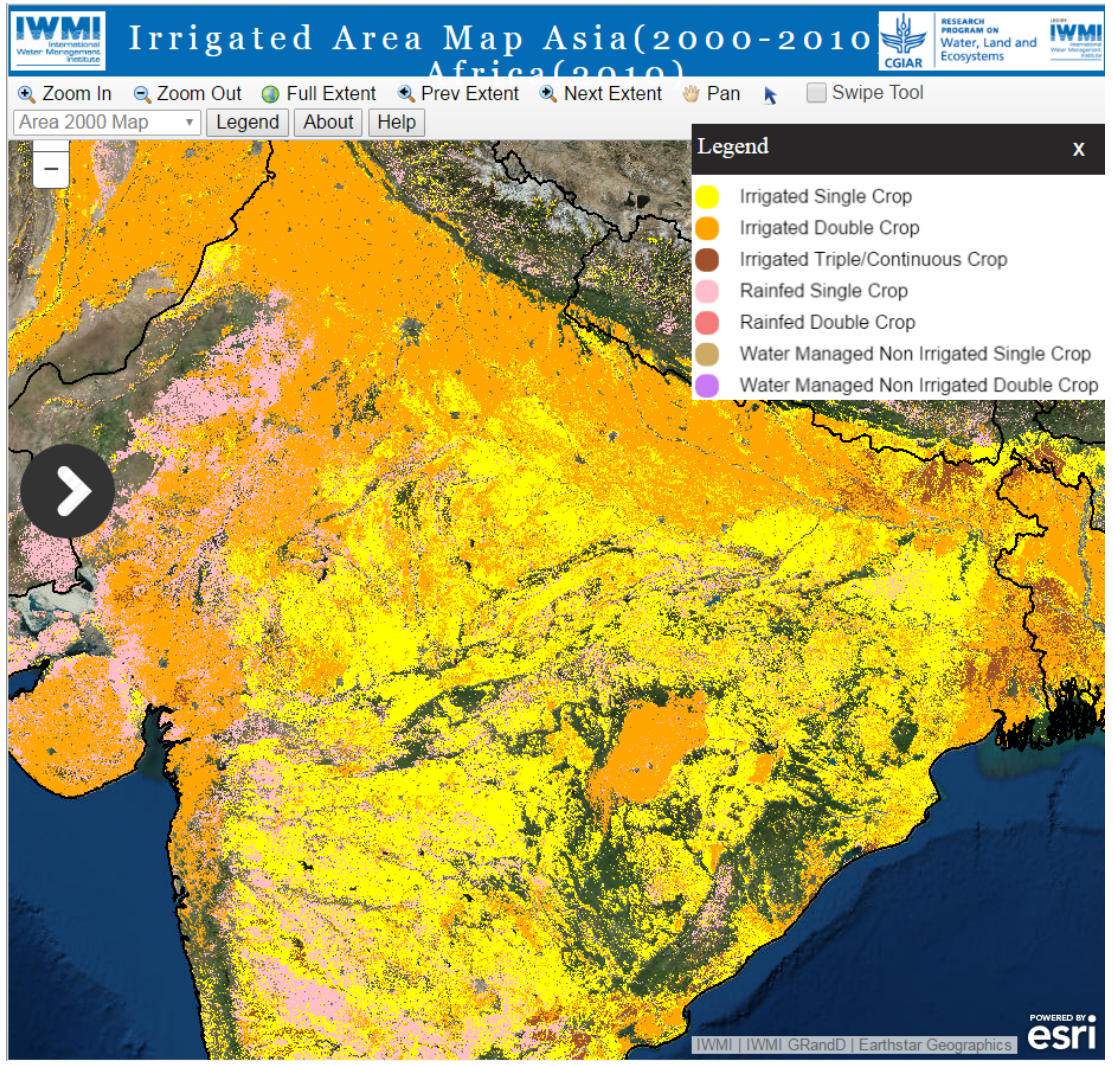
Land Use / Land Cover: Global Cropland Extend

- Global Cropland extent
- Landsat
- Spatial resolution: 30m data
- Period: 2015
- Pixel classification
- Cropland probability per-pixel
- Cropland/non-cropland



Land Use / Land Cover: IWMI Irrigated Area Map

- Agricultural Areas
- Irrigated
- Rainfed
- Period: 2000 and 2010
- Spatial resolution: 250m
- Spatial extent: Africa and Asia
- Based on MODIS NDVI data



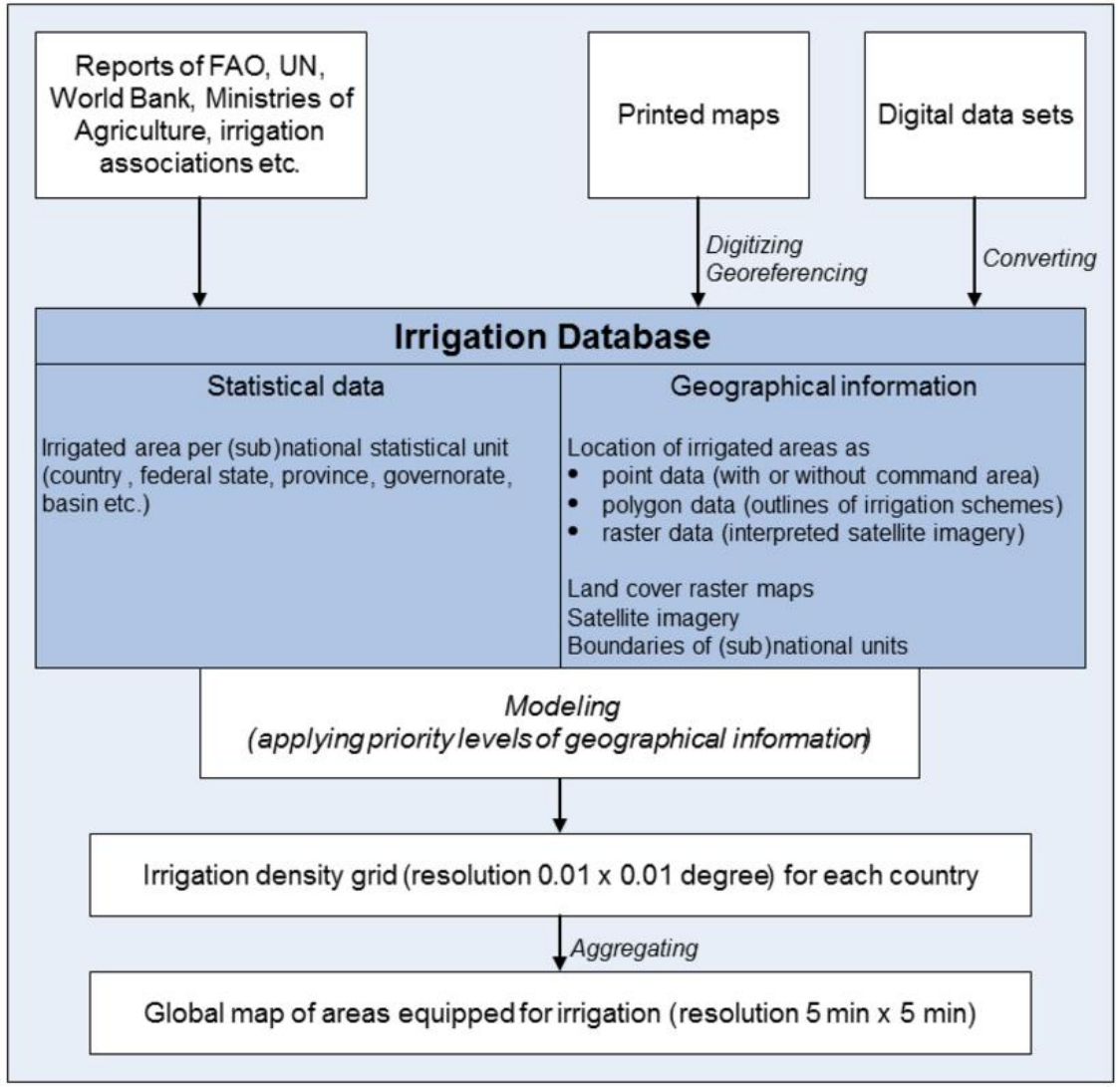
Land Use / Land Cover: FAO Global Irrigated Areas

- Map of irrigated areas
- Spatial resolution 5’ ~9km
- % or Ha per pixel

Equipped

Groundwater

Surface water



Soil Moisture: ASCAT

Advanced SCATterometer (ASCAT)

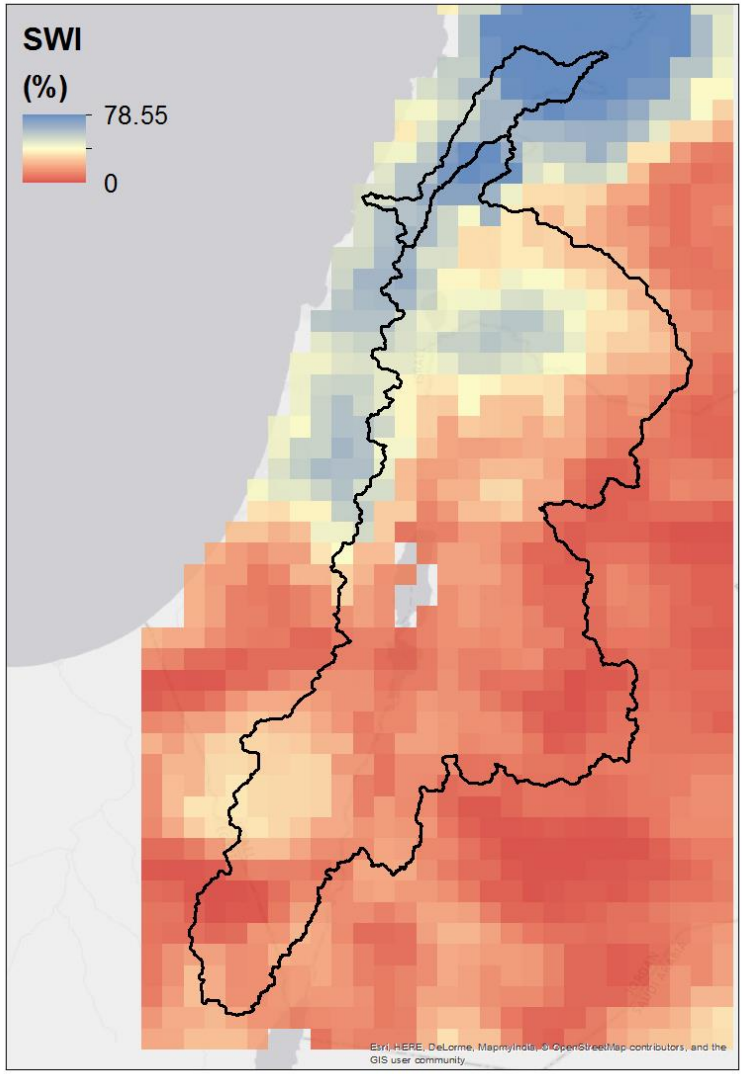
EUMETSAT

Spatial resolution: 12.5km

Temporal resolution: daily

Initial date: 2007

SWI (Soil Water Index) at different depths



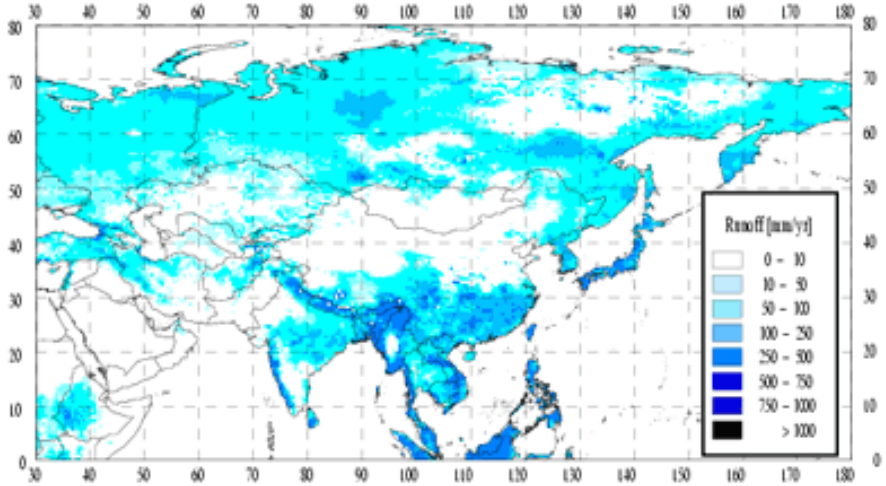
Source: http://www.eumetsat.int/website/home/News/DAT_2633340.html and http://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Home

River Flow: GRDC

Global Runoff Data Centre (GRDC)

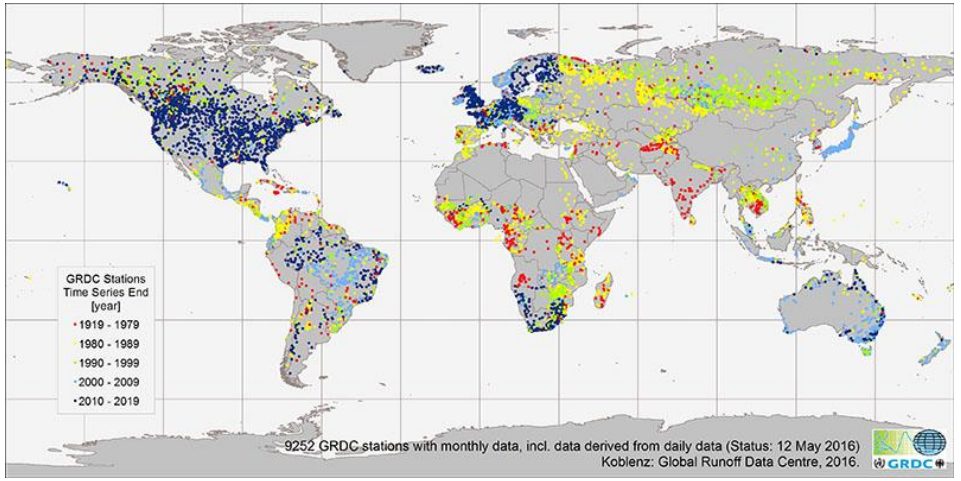
German Federal Institute of Hydrology (BfG)

Spatial resolution: 0.5° ~55km



Stations archive

- Monthly stats per station
- Normals (monthly averages)
- Grid composite



Source: http://www.bafg.de/GRDC/EN/Home/homepage_node.html

Elevation: HydroSHEDS

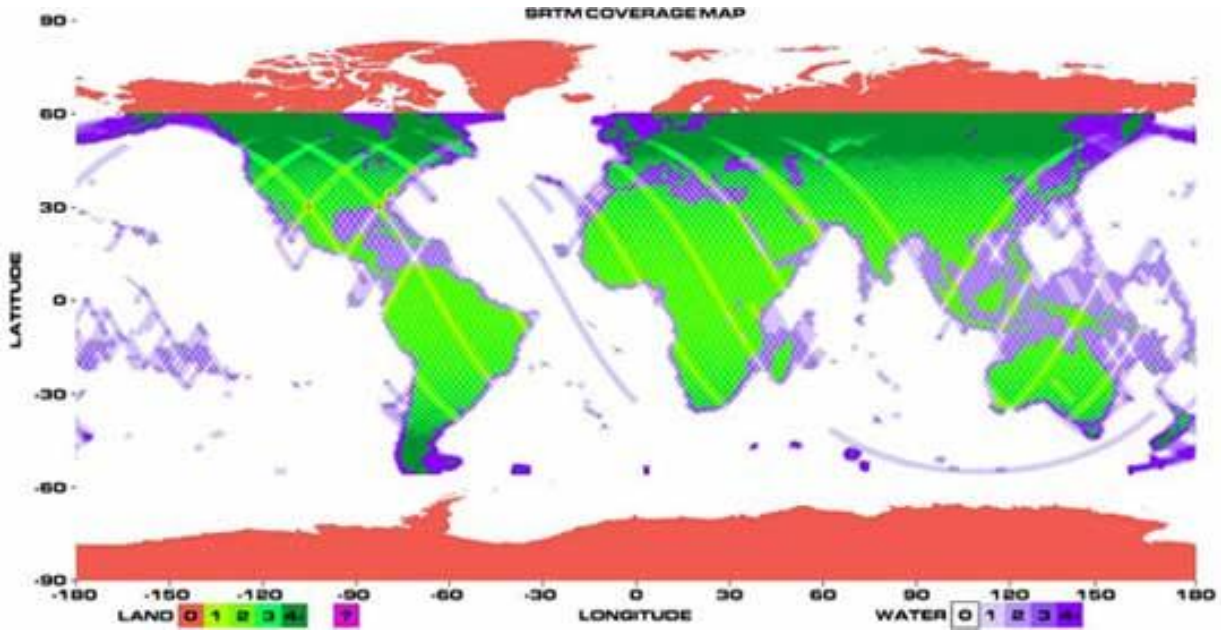
Hydrological data and maps based on Shuttle Elevation Derivatives at multiple Scales (HydroSHEDS)

- Based on SRTM
- Spatial resolution: 90m
- Conditioned DEMs
- Flow direction and
- Flow accumulation
- grids

Elevation: SRTM

Shuttle Radar Topography Mission (SRTM)

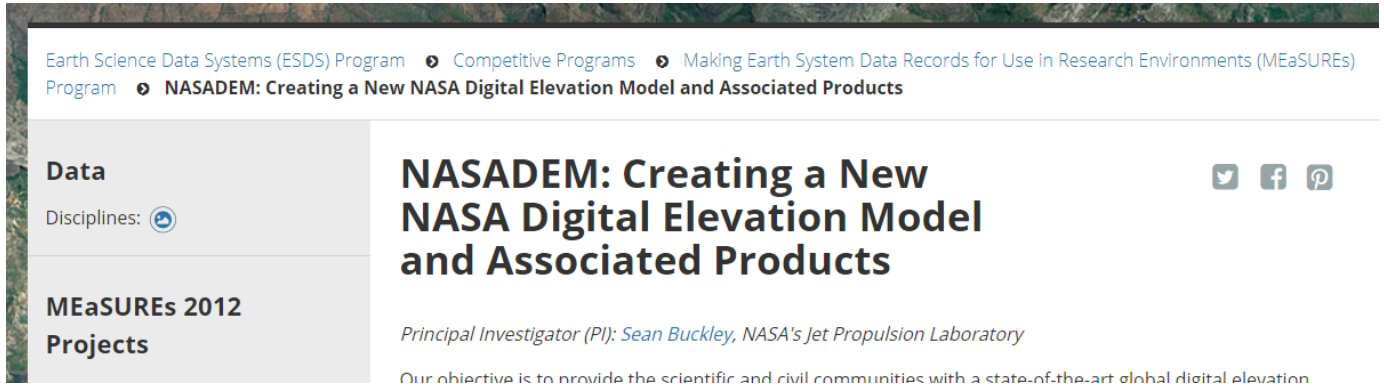
- NASA – JPL
- Spatial resolution: 90m
- Spatial extent: -180, 180
- -60, 60°
- Digital Elevation Model (DEM)



Elevation: NASADEM

Reprocessing of the SRTM

- NASA – JPL
- Spatial resolution: 30m
- Spatial extent: -180, 180,
- -60, 60°
- Digital Elevation Model (DEM)



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Thank you

Innovative water solutions for sustainable development

Food · Climate · Growth

CGIAR