

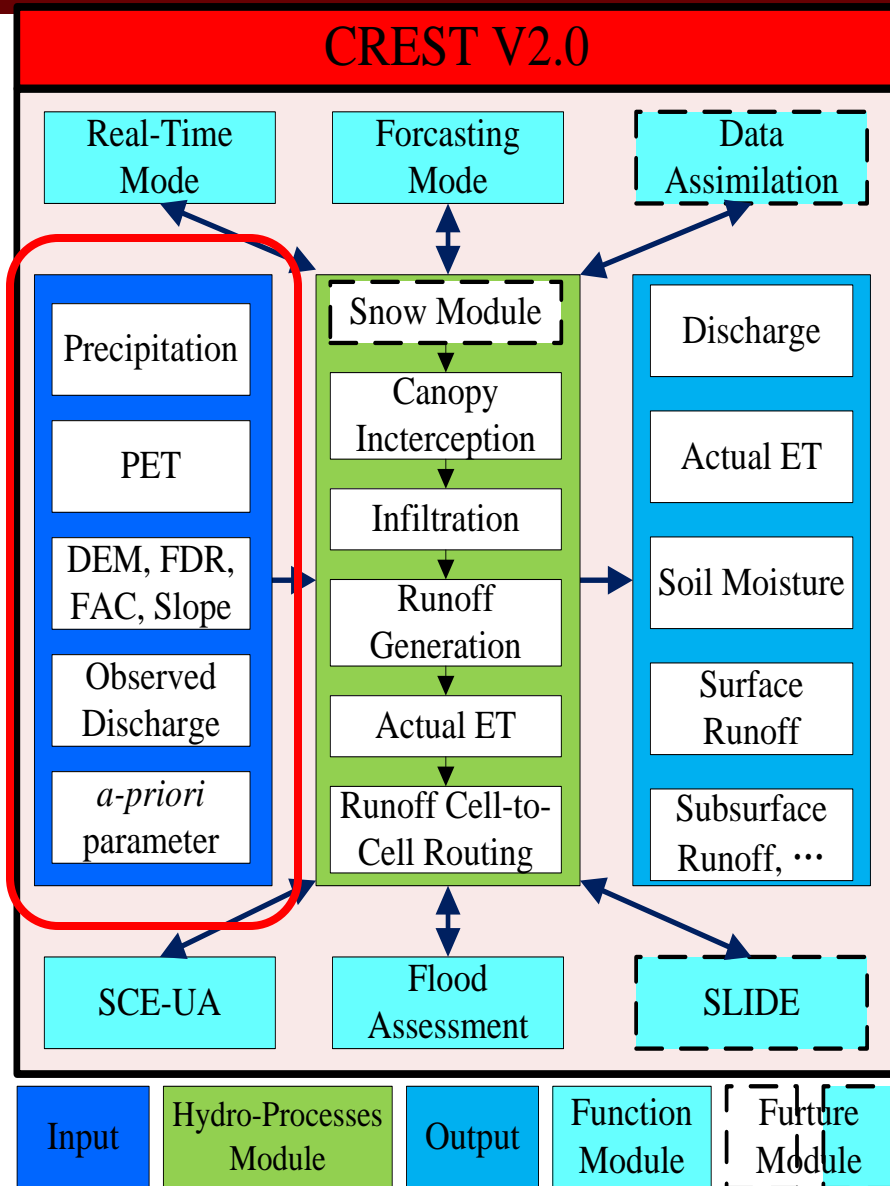


# Overview of Data for CREST Model

Xianwu Xue  
April 2<sup>nd</sup> 2012



# CREST V2.0

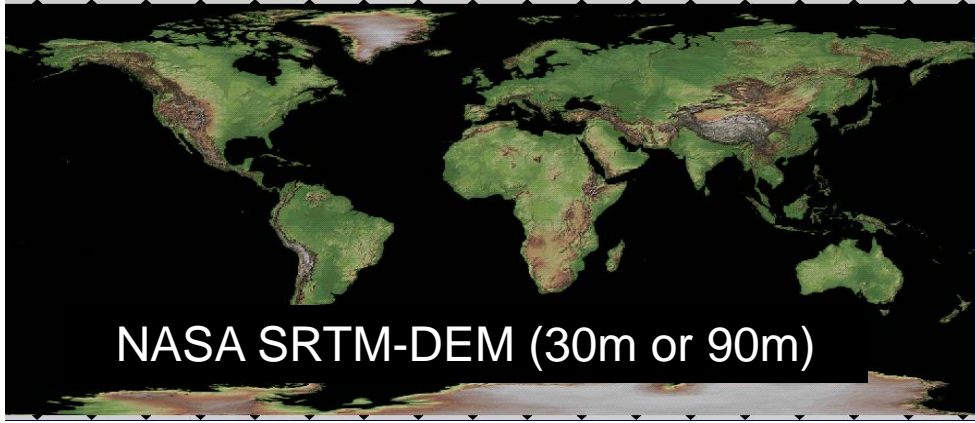


# Outline

- Topography Data
- Forcing Data
- Soil Texture
- Land Cover



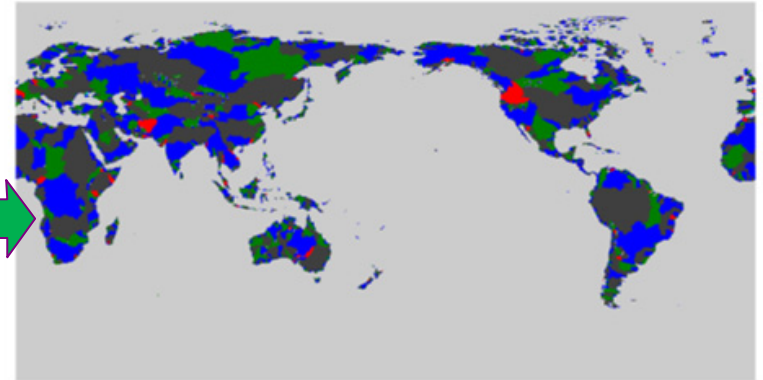
# Topography Data



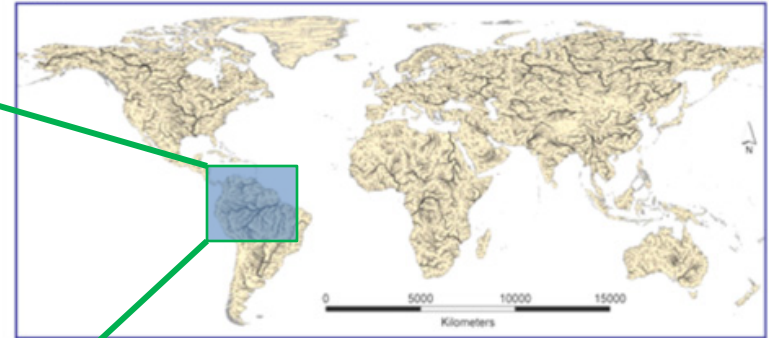
Topography Data  
Slope



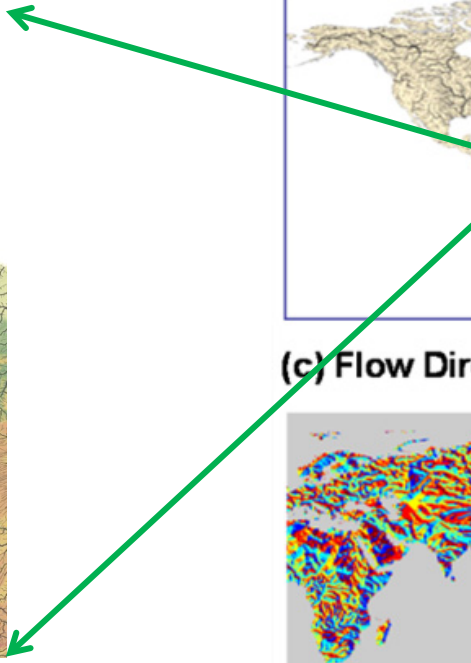
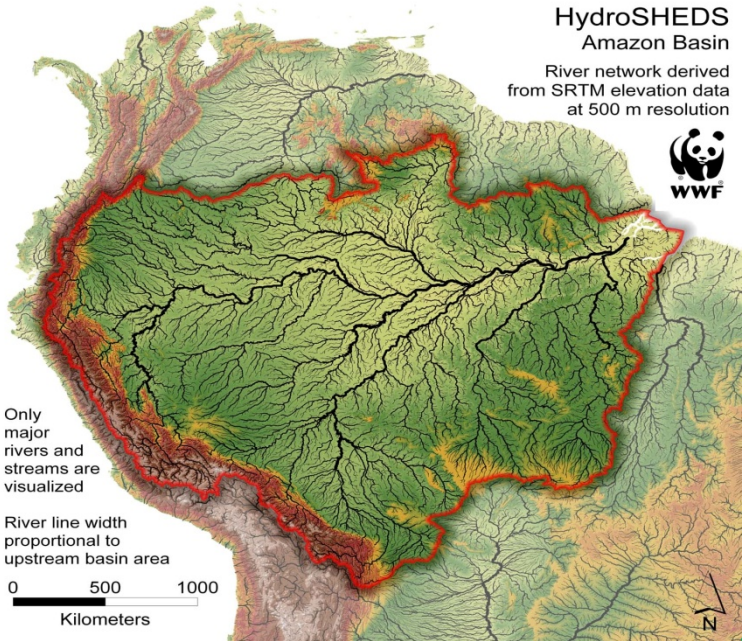
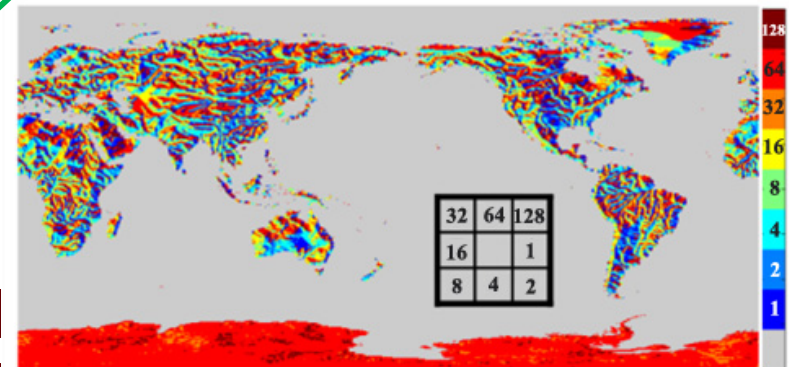
(a) World of basins



(b) Global River Networks



(c) Flow Direction



# Topography Data Products

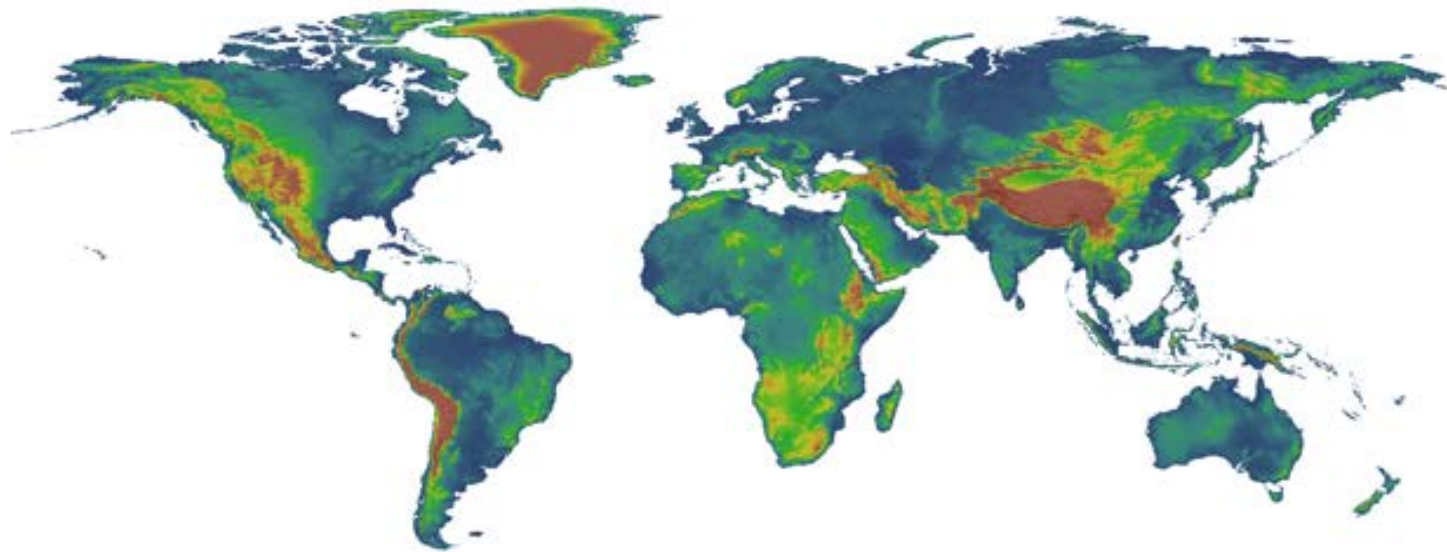
- SRTM 90m Digital Elevation Database v4.1  
(<http://www.cgiar-csi.org/data/elevation/item/45-srtm-90m-digital-elevation-database-v41>)
- HydroSHEDS (<http://hydrosheds.cr.usgs.gov/>)
- HYDRO1k ([http://eros.usgs.gov/#/Find\\_Data/Products\\_and\\_Data\\_Available/gtopo30/hydro](http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/gtopo30/hydro))
- GTOPO30 ([http://eros.usgs.gov/#/Find\\_Data/Products\\_and\\_Data\\_Available/gtopo30\\_info](http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/gtopo30_info))
- ...



# SRTM 90m Digital Elevation Database v4.1

- The SRTM (**S**huttle **R**adar **T**opography **M**ission) digital elevation data, produced by NASA originally, is a major breakthrough in digital mapping of the world, and provides a major advance in the accessibility of high quality elevation data for large portions of the tropics and other areas of the developing world.

## SRTM 90m Digital Elevation Database v4.1



# HydroSHEDS Data

- HydroSHEDS is a mapping product that provides hydrographic information for regional and global-scale applications in a consistent format.
- It offers a suite of geo-referenced data sets (vector and raster) at various scales, including **river networks, watershed boundaries, drainage directions (FDR), and flow accumulations (FAC)**.
- HydroSHEDS is based on **high-resolution elevation data (DEM, 3s, 15s and 30s)** obtained during a Space Shuttle flight for NASA's Shuttle Radar Topography Mission (SRTM).

<http://hydrosheds.cr.usgs.gov/index.php>



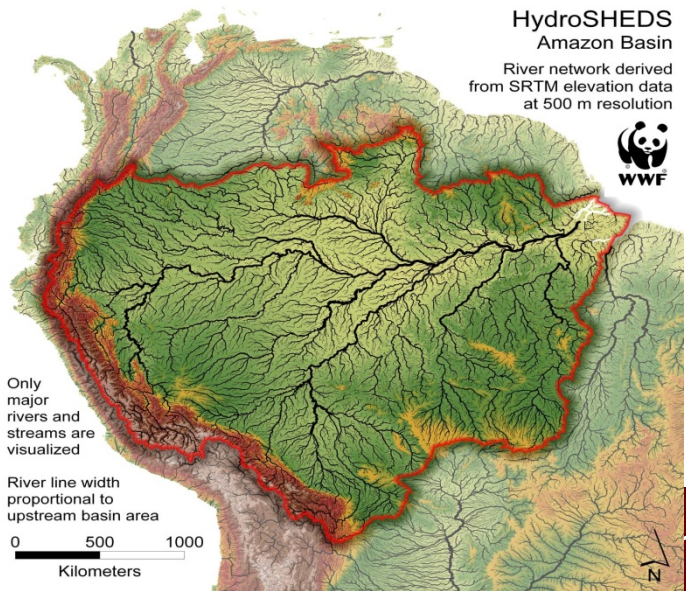
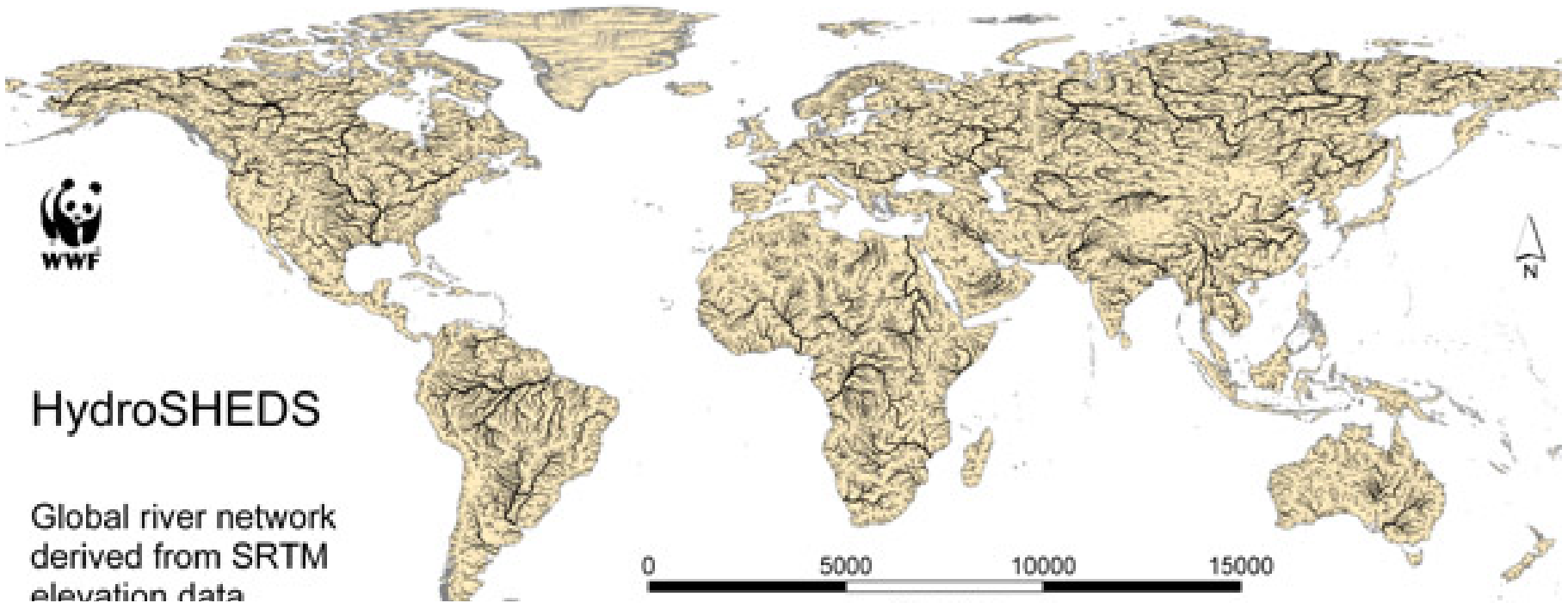
# Data Layers and Availability

- HydroSHEDS is produced on a continental basis. The drainage direction maps represent the core data layer from which users can derive their own products by applying standard GIS functionality. All other data layers are produced as time permits. Drainage direction maps are currently scheduled for completion as follows:
  - South America Complete (May 2006)
  - Asia Complete (March 2007)
  - Central America Complete (March 2007)
  - Africa Complete (October 2007)
  - Australia Complete (March 2008)
  - Europe Complete (October 2008)
  - North America Complete (January 2009 )





# HydroSHEDS used in Global CREST Model



HydroSHEDS provides global river basins at

3s ---90-m

15s--500-m

30s--1000-m



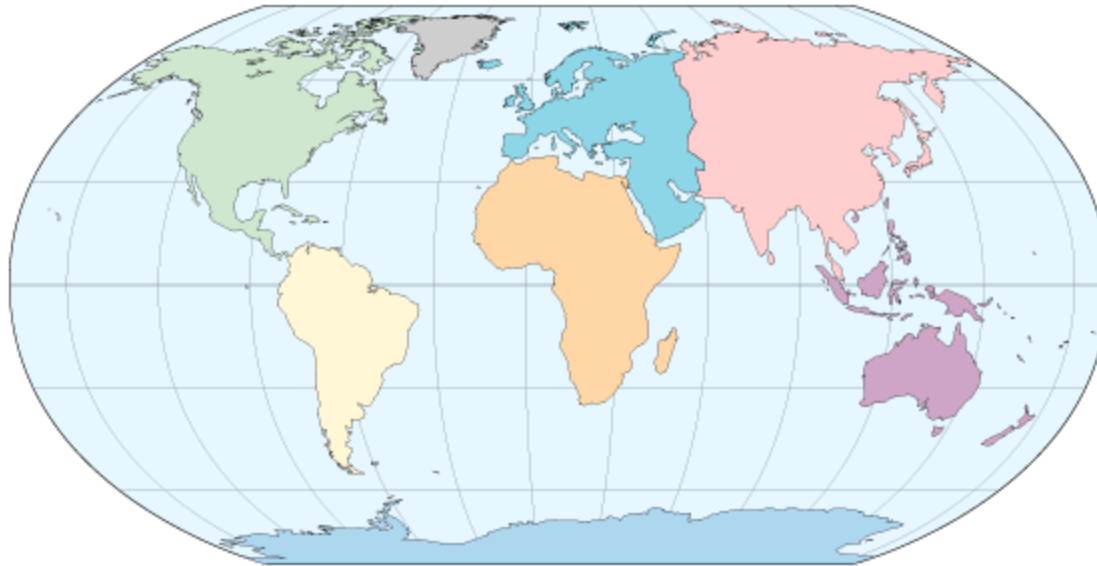
# HYDRO1K

- HYDRO1k is a geographic database developed to provide comprehensive and consistent global coverage of topographically derived data sets, including streams, drainage basins and ancillary layers derived from the USGS' 30 arc-second digital elevation model of the world (GTOPO30).
- HYDRO1k provides a suite of geo-referenced data sets, both raster and vector, which will be of value for all users who need to organize, evaluate, or process hydrologic information on a continental scale.



# HYDRO1K (contd.)

## HYDRO1k Elevation Derivative Database



**North America**  
*Now Available*

**Africa**  
*Now Available*

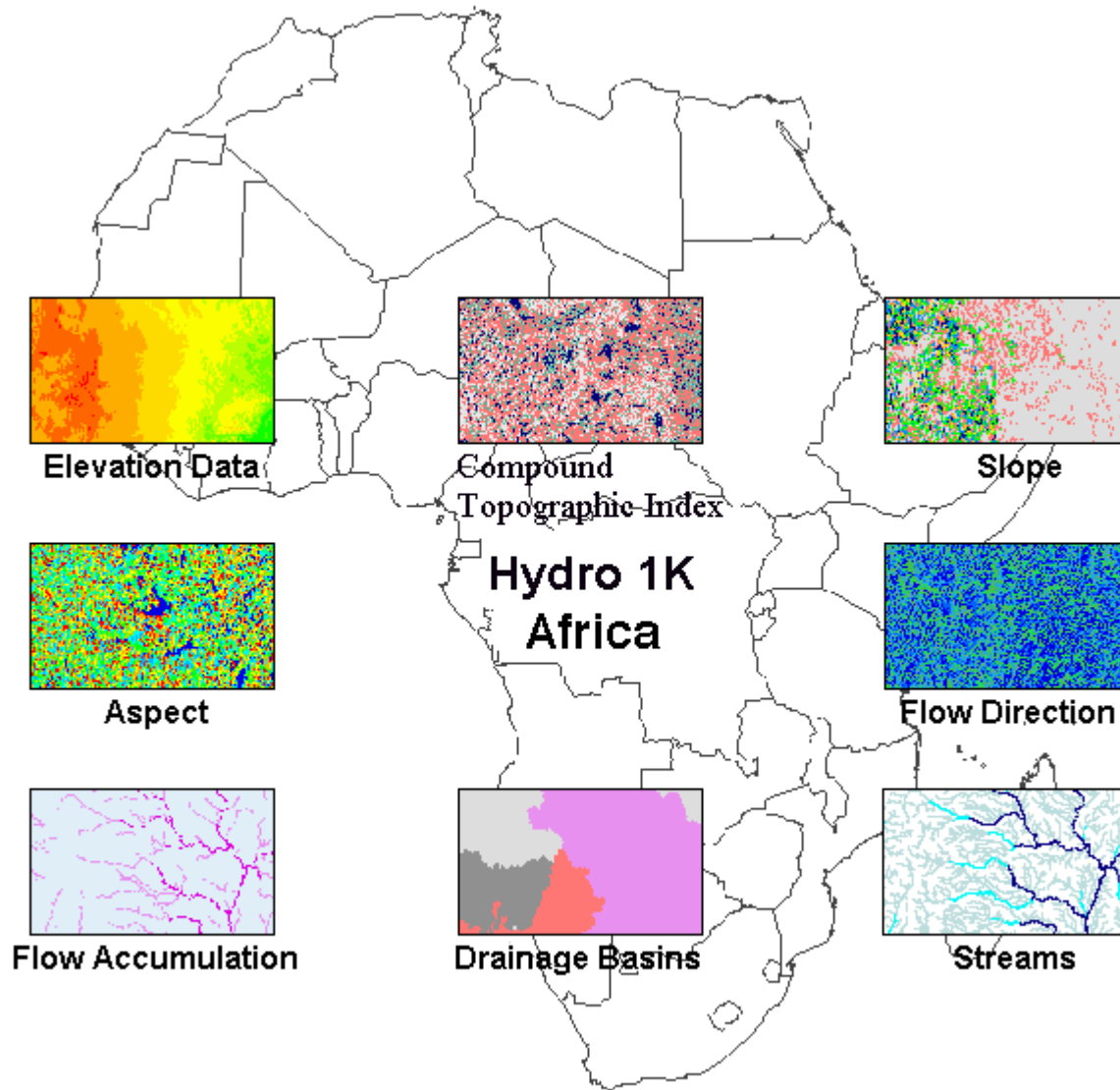
**South America**  
*Now Available*

**Asia**  
*Now Available*

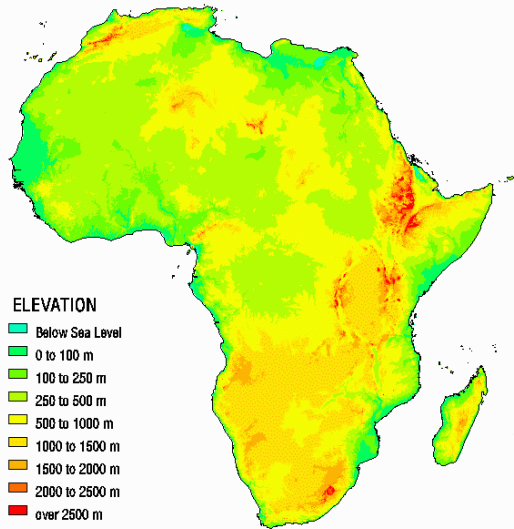
**Europe**  
*Now Available*

**Australasia**  
*Now Available*

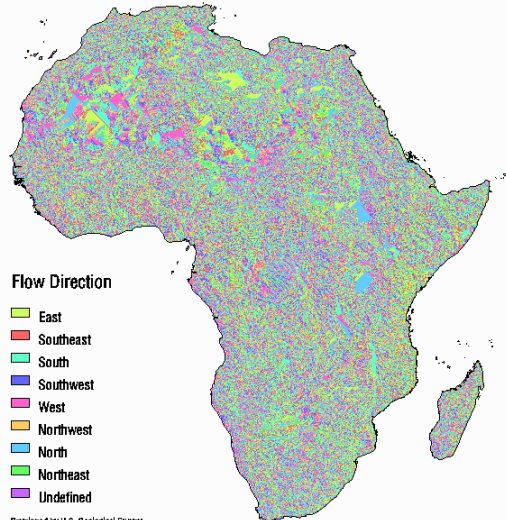
# HYDRO1K Africa



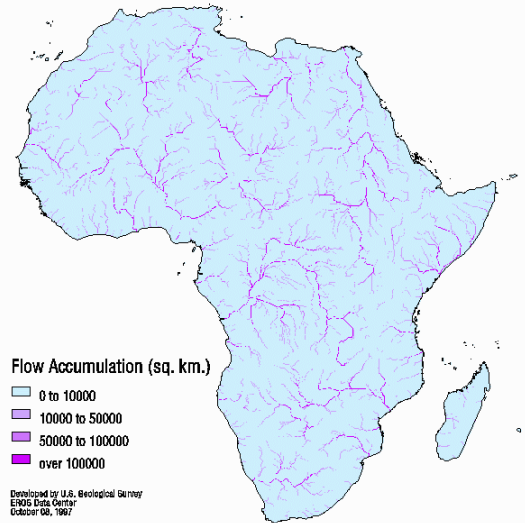
# HYDRO1K Africa



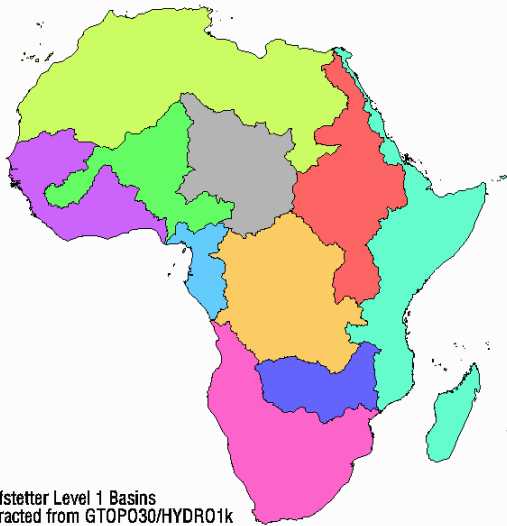
Developed by U.S. Geological Survey  
EROS Data Center  
October 08, 1997



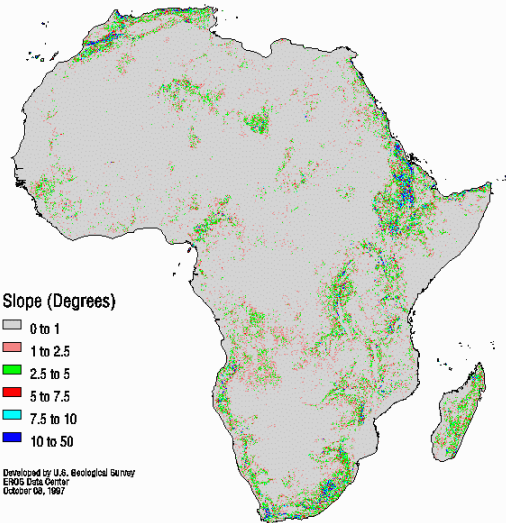
Developed by U.S. Geological Survey  
EROS Data Center  
October 08, 1997



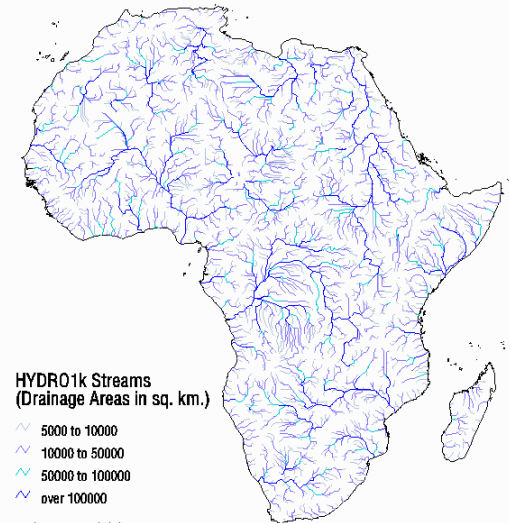
Developed by U.S. Geological Survey  
EROS Data Center  
October 08, 1997



Developed by U.S. Geological Survey  
EROS Data Center  
October 08, 1997



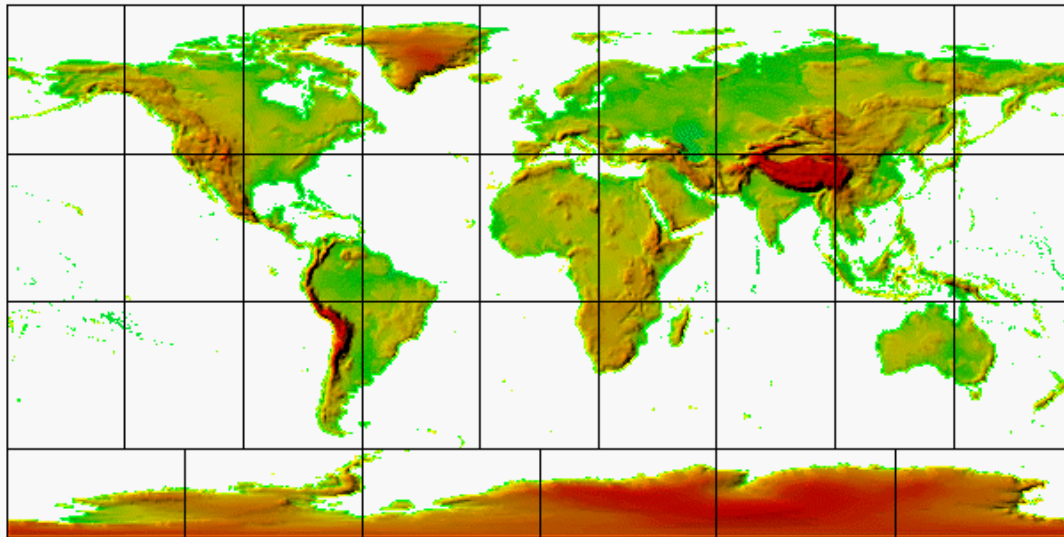
Developed by U.S. Geological Survey  
EROS Data Center  
October 08, 1997



Developed by U.S. Geological Survey  
EROS Data Center  
October 08, 1997

# GTOPO30

- GTOPO30 is a global digital elevation model (DEM) with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometer).
- GTOPO30 was derived from several raster and vector sources of topographic information.
- GTOPO30 has been **divided into tiles** which can be selected from the map shown above.



# Forcing Data

- TRMM RT (TMPA 3B42RT)  
([http://trmm.gsfc.nasa.gov/affinity/affinity\\_3hrly\\_rain.html](http://trmm.gsfc.nasa.gov/affinity/affinity_3hrly_rain.html))
- TRMM V6 (TMPA 3B42 V6)  
([http://disc.sci.gsfc.nasa.gov/precipitation/documentation/TRMM\\_README/TRMM\\_3B42\\_readme.shtml](http://disc.sci.gsfc.nasa.gov/precipitation/documentation/TRMM_README/TRMM_3B42_readme.shtml))
- PERSIANN
- CMORPH
- Stage IV or Q2
- Ground Radar or rain gauge
  
- FEWS NET PET
- “bibimo” global monthly mean PET that is provided

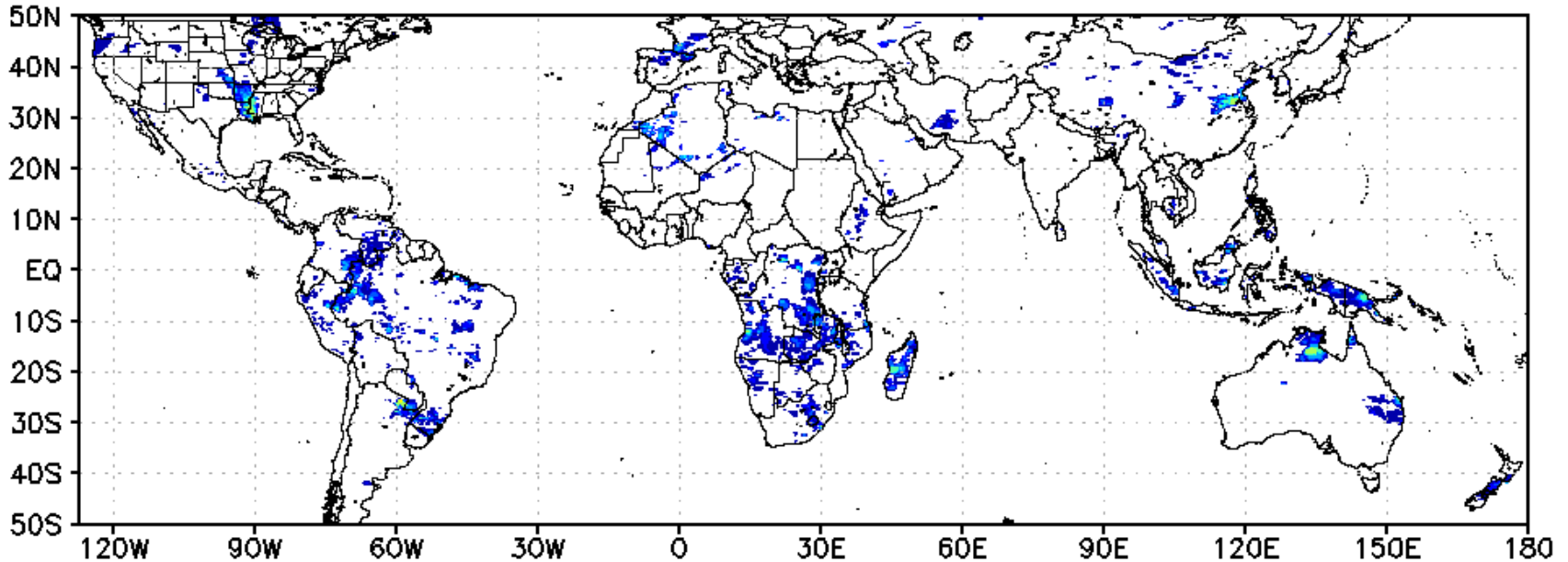


# TRMM RT

- 3 hourly 0.25 degree resolution

Latest 24h/3h Precipitation (mm/h)

2012-03-21 15h

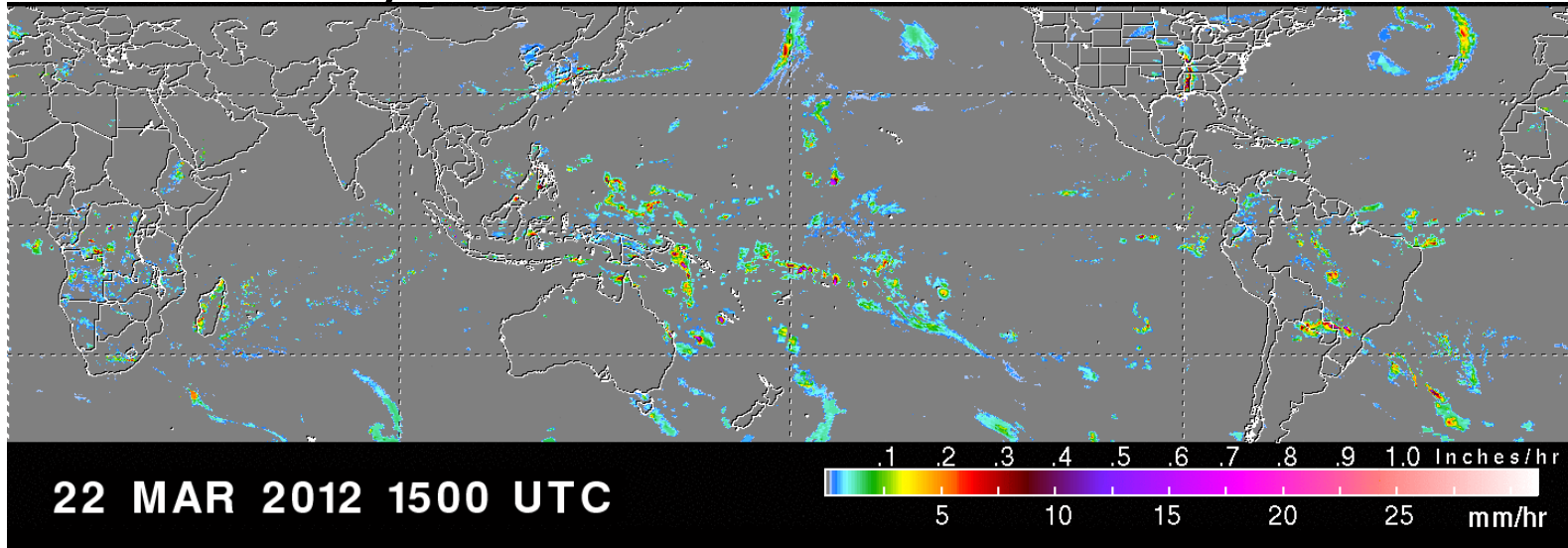


<http://eos.ou.edu>

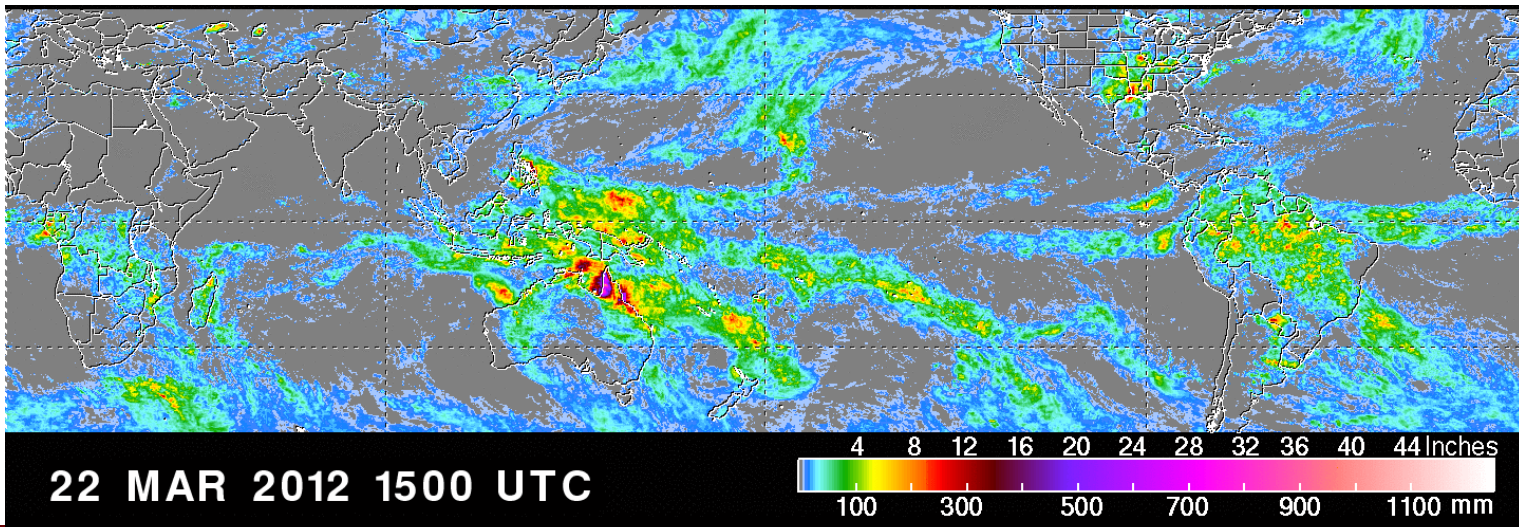


# TRMM RT Latest Hourly and Week Data

- Latest 3 Hourly Global Rainfall



- Latest Week of Global Rainfall Accumulation



Hy

[http://trmm.gsfc.nasa.gov/affinity/affinity\\_3hrly\\_rain.html](http://trmm.gsfc.nasa.gov/affinity/affinity_3hrly_rain.html)

ou.edu)



# TRMM V6 Data Coverage Map

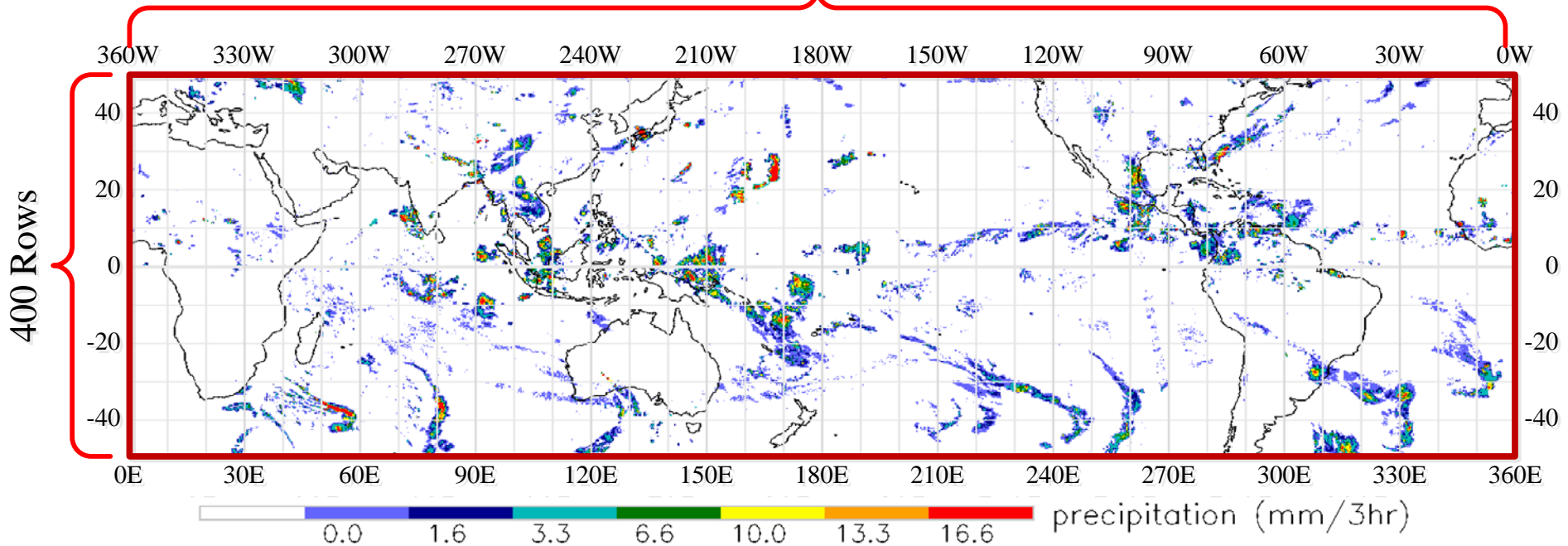
- Temporal Coverage: Start Date: 1998-01-01
- Geographic Coverage Latitude:  $50^{\circ}$  S -  $50^{\circ}$  N;  
Longitude:  $180^{\circ}$  W -  $180^{\circ}$  E

3B42.100630.21.6A.HDF

3B42 TRMM and Others Combined 3 Hour Surface Precipitation Accumulation  
2011/06/30 19:30:00 UT to 2011/06/30 22:30:00 UT

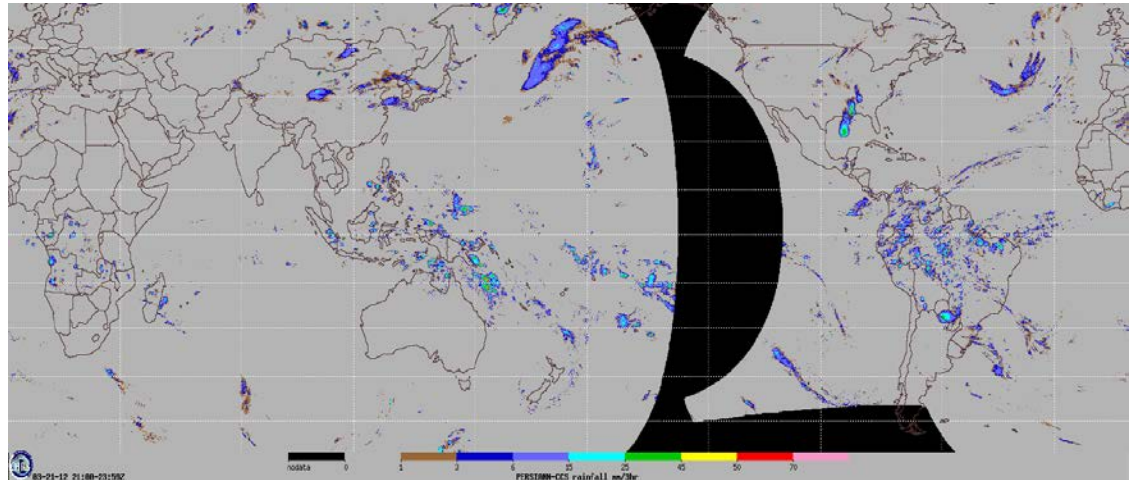
3-hourly  $0.25^{\circ} \times 0.25^{\circ}$

1440 Cols



# PERSIANN

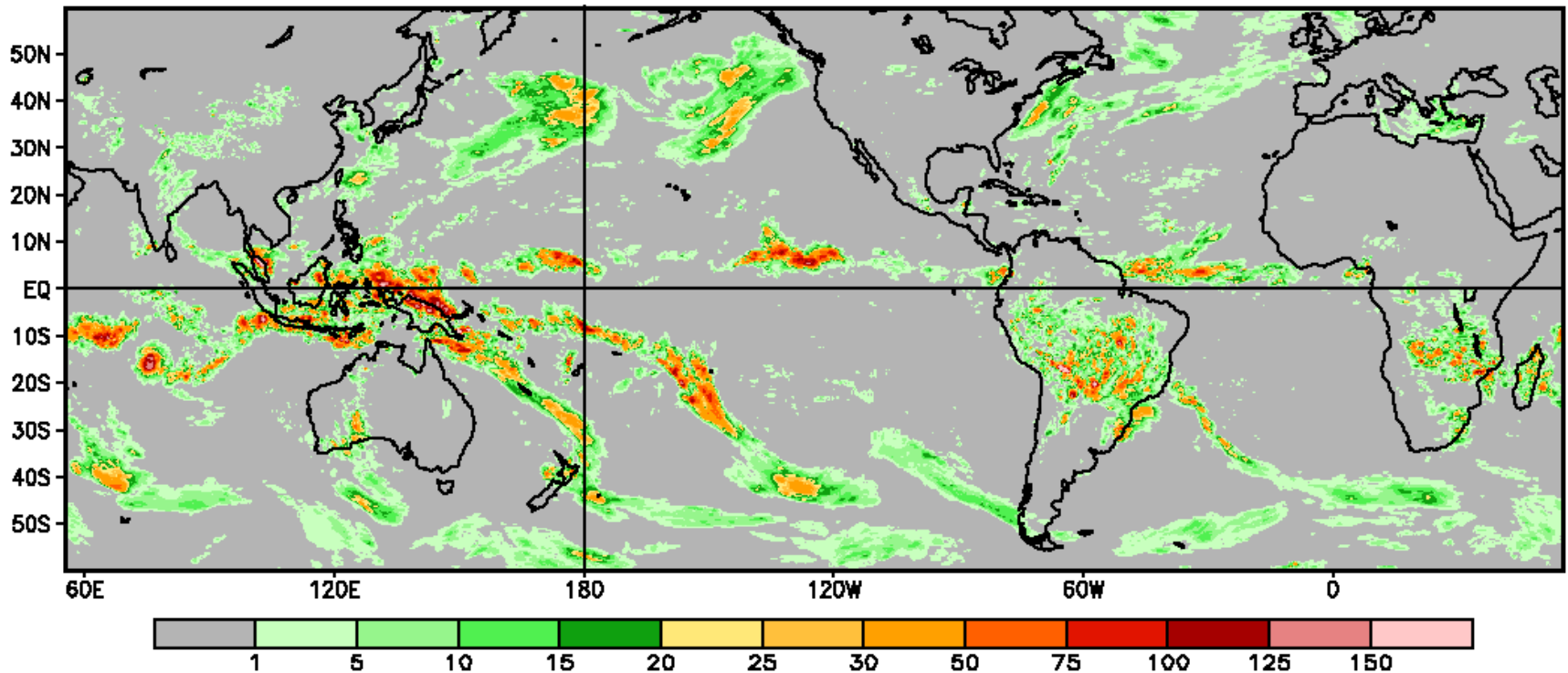
- Format:
  - 4-byte binary float from a SUN system (big-endian).
- Units: mm/3hr
- Spatial coverage is:
  - $60^{\circ}$  to  $-60^{\circ}$  lat
  - $0^{\circ}$  to  $360^{\circ}$  long
- Spatial Resolution:
  - $0.25^{\circ}$  x  $0.25^{\circ}$  resolution
- Geometry:
  - 480 rows x 1440 cols
- Latest Global QPE from PERSIANN-CCS



# CMORPH

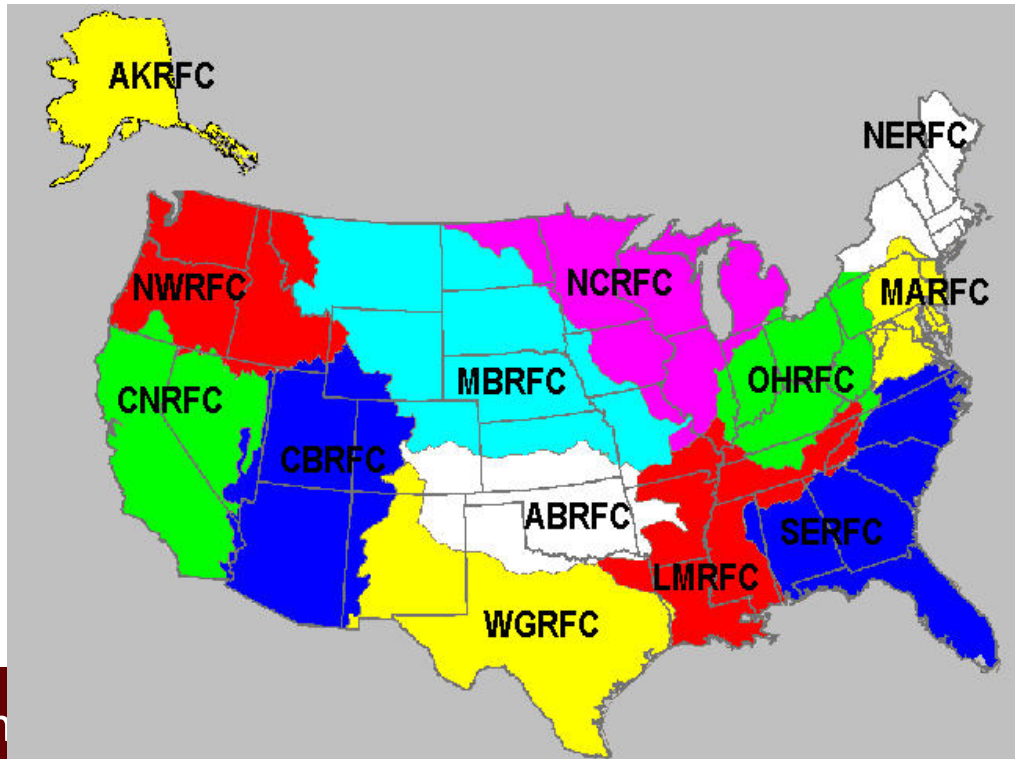
Daily Precipitation for: 31 Dec 2011 (00Z-00Z)  
Data on .25 x .25 deg grid; UNITS are mm/day

## CMORPH Precipitation Estimates

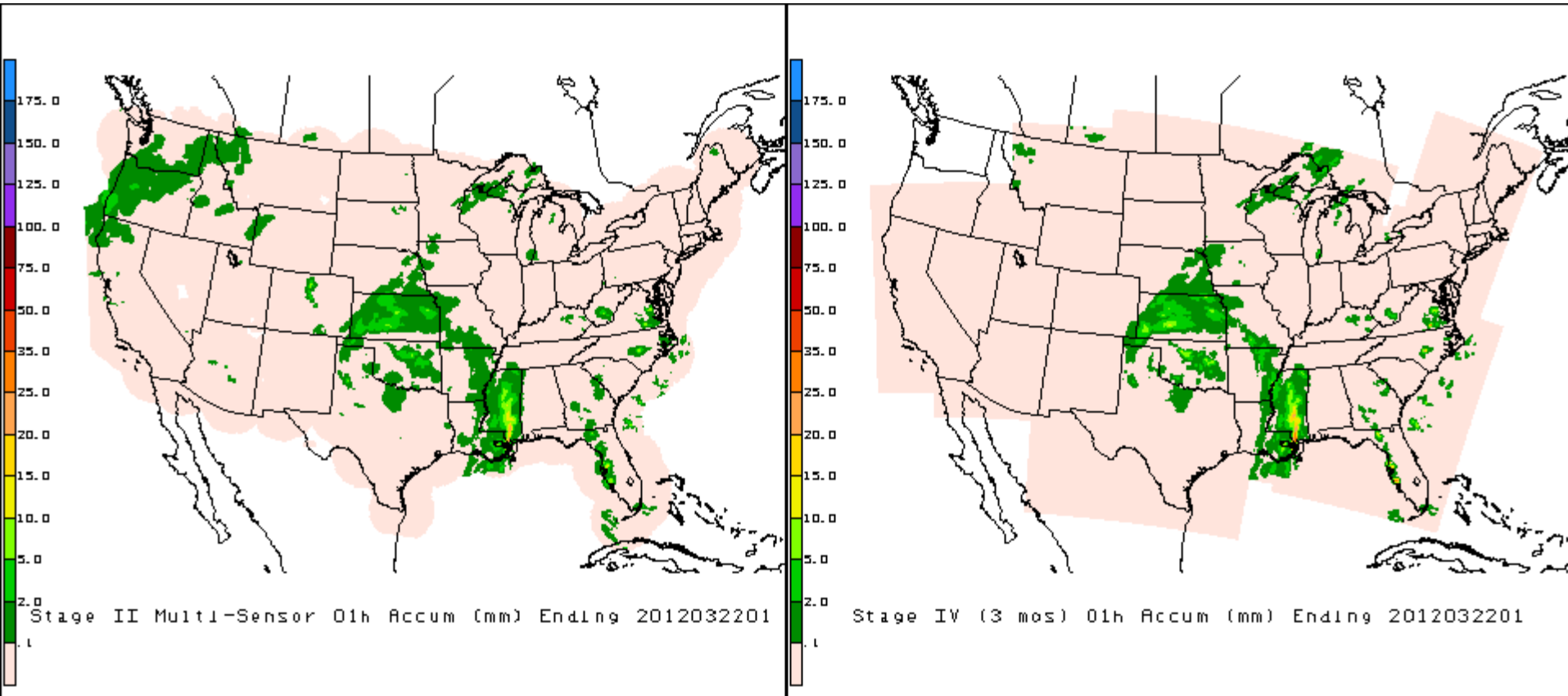


# National Stage IV QPE Product

- Mosaicked into a national product at NCEP, from the regional hourly/6-hourly multi-sensor (radar+gauges) precipitation analyses (MPEs) produced by the 12 River Forecast Centers over CONUS. Some manual QC done at the RFCs. Mosaic done at NCEP within an hour of receiving any new hourly/6-hourly data from one or more RFC.



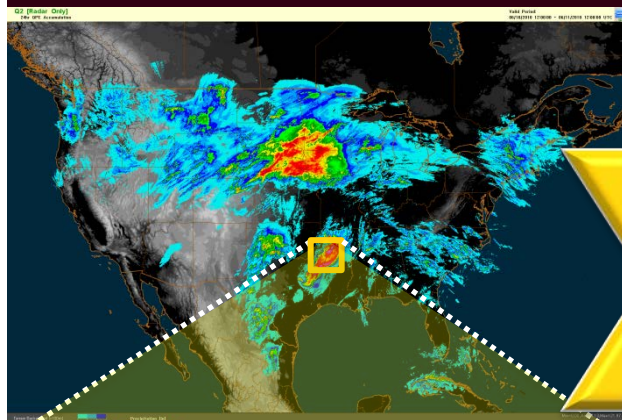
# National Stage IV QPE Product



# National Mosaic and Multi-Sensor QPE (NMQ-) Flooded Locations And Simulated Hydrographs (FLASH)

- A CONUS-wide flash-flood forecasting demonstration system

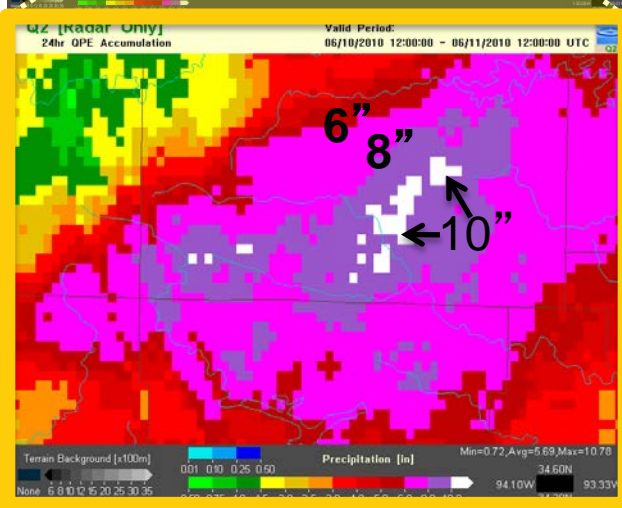
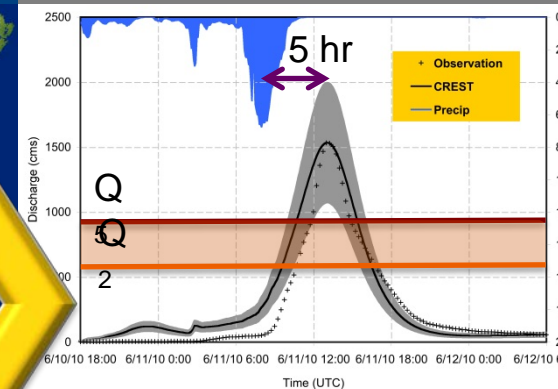
NMQ/Q2 Rainfall Observations  
- 1km<sup>2</sup>/2.5 min  
Stormscale Rainfall Forecasts



Stormscale Distributed Hydrologic Models



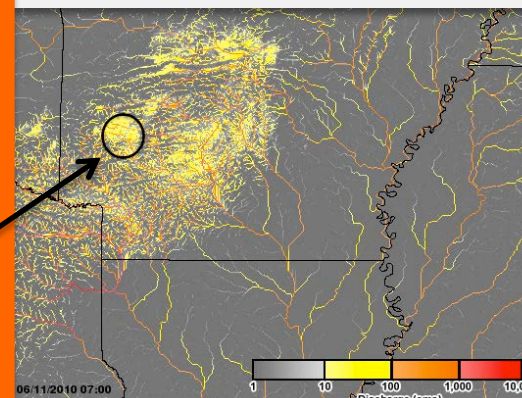
Probabilistic Forecast Return Periods and Estimated Impacts



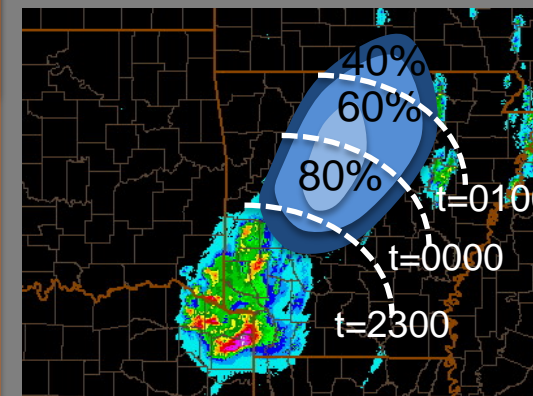
10-11 June 2010, Albert Pike Rec Area, Arkansas

20 fatalities

Simulated surface water flow



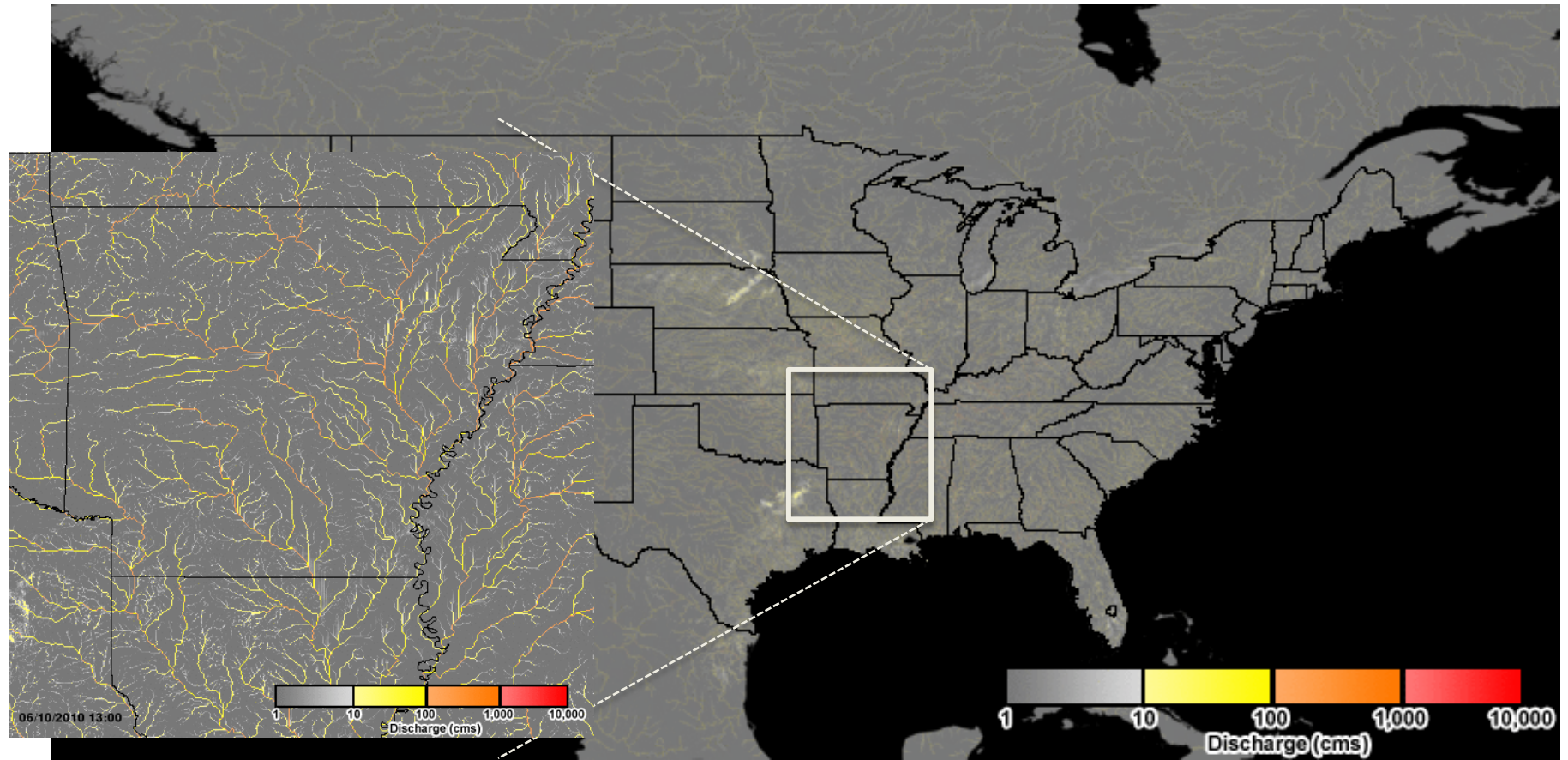
Hydrograph of Simulated and Observed Discharge



Probability of life-threatening flash flood

# CONUS Flash Flood Demo System

## Arkansas Flash Flood Simulation





# FEWS NET PET

- The daily PET is calculated on a spatial basis using the Penman-Monteith equation (the formulation of Shuttleworth (1992) for reference crop evaporation is used). These equations were standardized in accordance with the FAO publication 56 for the 6-hourly calculations (Allen et al, 1998).
- -180 to +180 longitude by -90 to +90 latitude
- <http://earlywarning.usgs.gov/fews/global/web/dwnglobalpet.php>

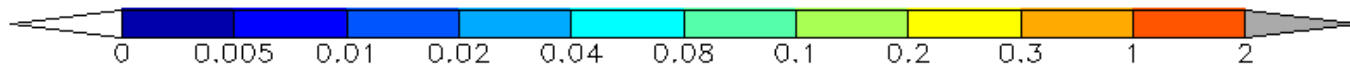
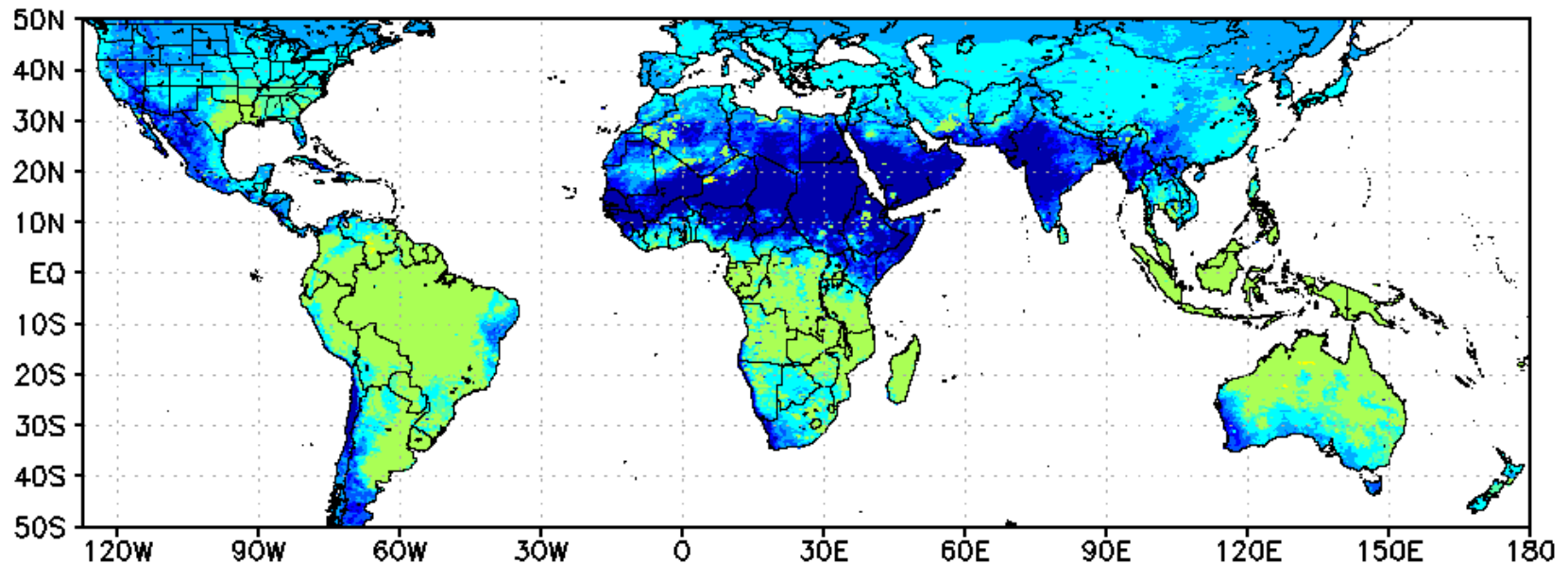


# “bibimo” global monthly mean PET

al

Latest 24h/3h Actual ET (mm/h)

2012-03-21 15h



# Soil Texture

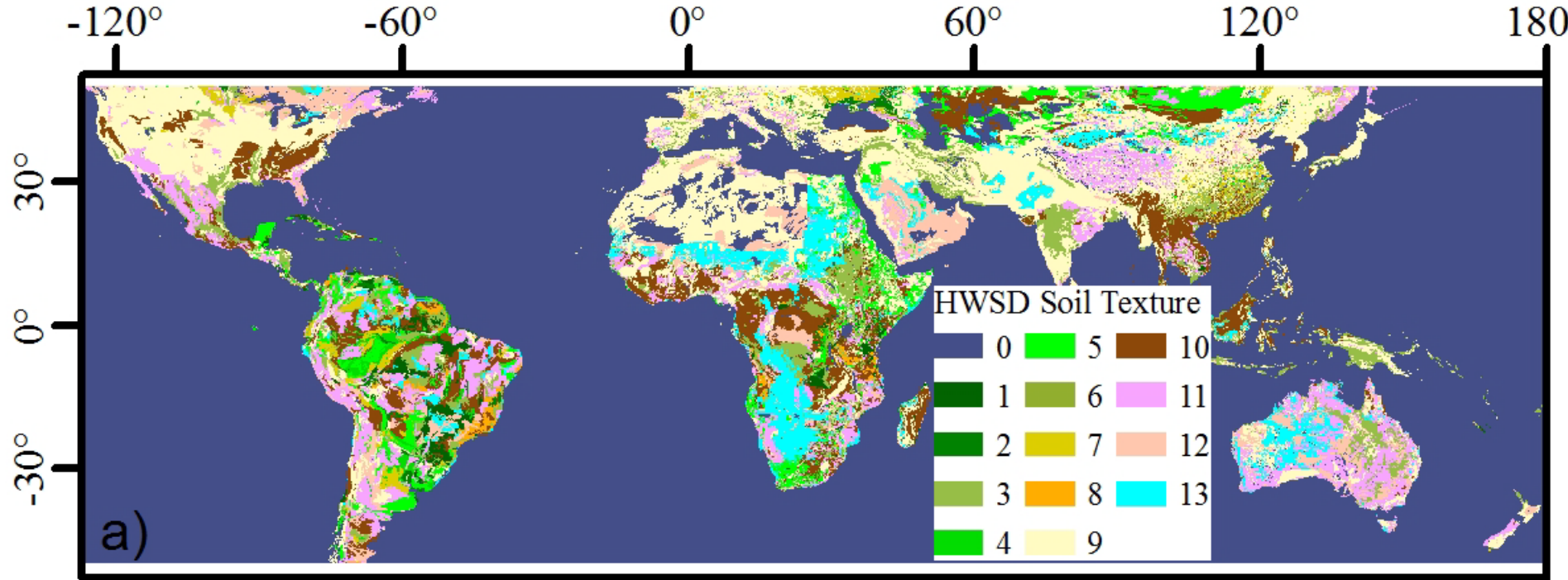
## Harmonized World Soil Database (HWSD) v 1.2

- The Land Use Change and Agriculture Program of IIASA (LUC) and the Food and Agriculture Organization of the United Nations (FAO) have developed a new comprehensive Harmonized World Soil Database (HWSD). Vast volumes of recently collected regional and national updates of soil information were used for **this state-of-the-art database**.
- The HWSD is a **30 arc-second** raster database with over 16000 different soil mapping units that combines existing regional and national updates of soil information worldwide (SOTER, ESD, Soil Map of China, WISE) with the information contained within the 1:5 000 000 scale FAO-UNESCO Soil Map of the World (FAO, 1971/1981).

<http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/>



# HWSD Soil Texture



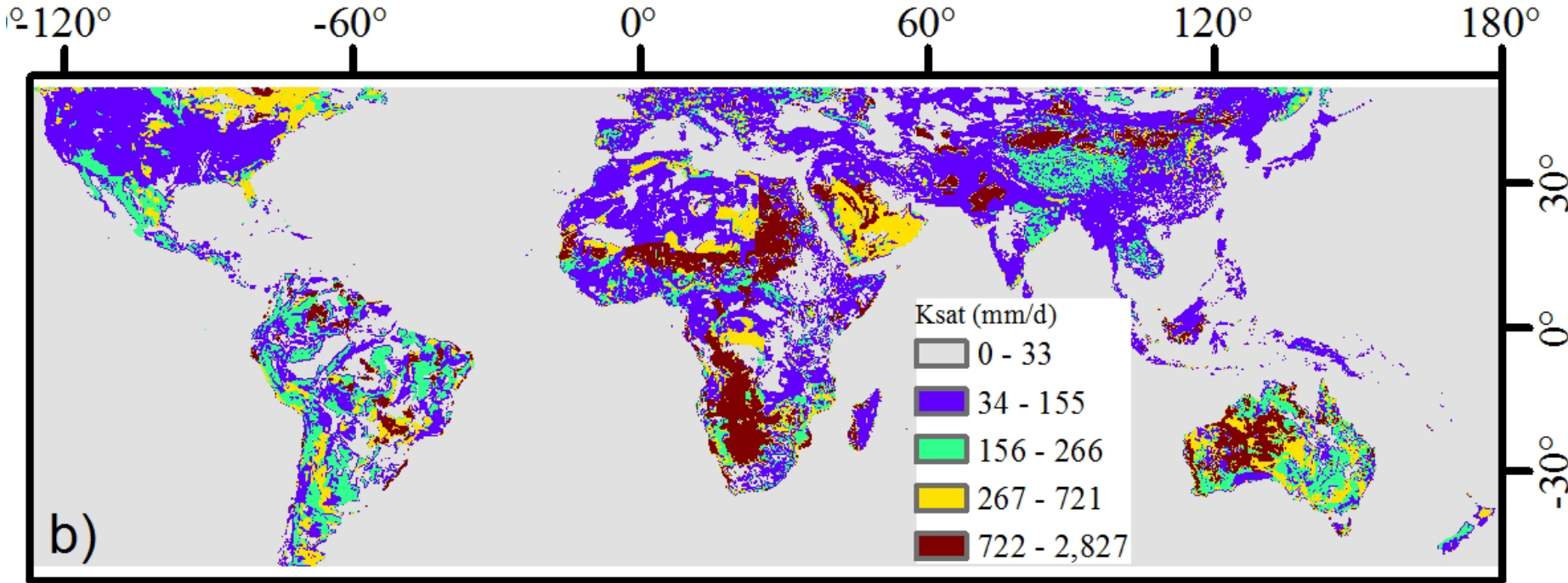
# look-up Table for HWSD Soil Texture

Table 10-2 Look-up Table for HWSD Soil Texture

Code	Texture	Abbr.	Fild Capacity $\theta_{fc}(m^3/m^3)$	Permanent Wilting Point $\theta_{pw}(m^3/m^3)$	Hydraulic conductivity $K_{sat} (cm/h)$
0	No_Soil	NS	0	0	0.00001
1	Clay(heavy)	CH	0.36	0.21	0.03
2	Silty Clay	SIC	0.36	0.21	0.05
3	Clay	C	0.36	0.21	0.075
4	Silty Clay Loam	SICL	0.34	0.19	0.1
5	Clay Loam	CL	0.34	0.21	0.1
6	Silt	SI	0.32	0.165	0.495
7	Silt Loam	SIL	0.3	0.15	0.65
8	Sandy Clay	SC	0.31	0.23	0.15
9	Loam	L	0.26	0.12	0.34
10	Sandy Clay Loam	SCL	0.33	0.175	0.15
11	Sandy Loam	SL	0.23	0.1	1.09
12	Loamy Sand	LS	0.14	0.06	2.99
13	Sand	S	0.12	0.04	11.78

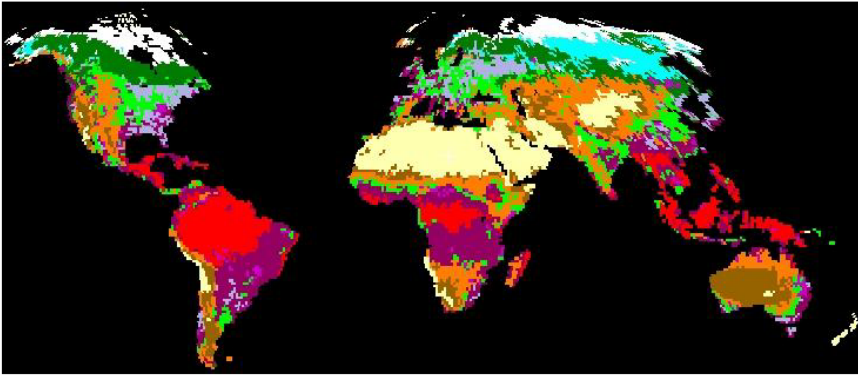


# Saturated Hydraulic Conductivity derived from HWSO Soil Texture based on it's look-up Table

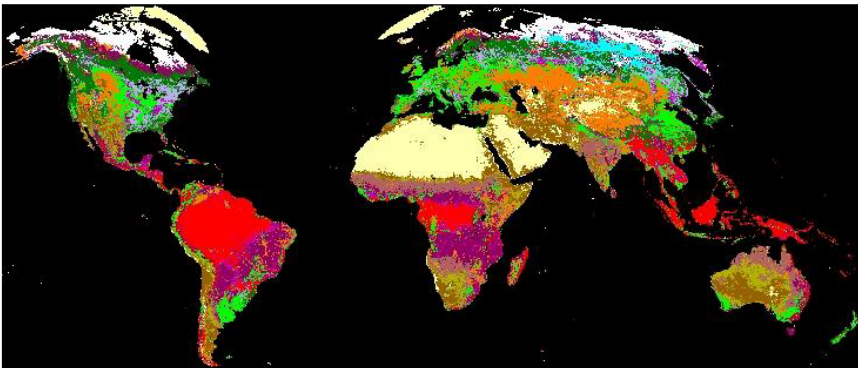


# Land Cover

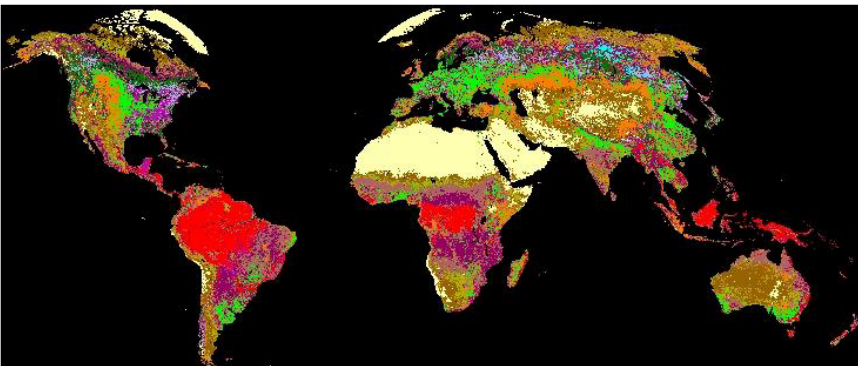
1 degree



8 km

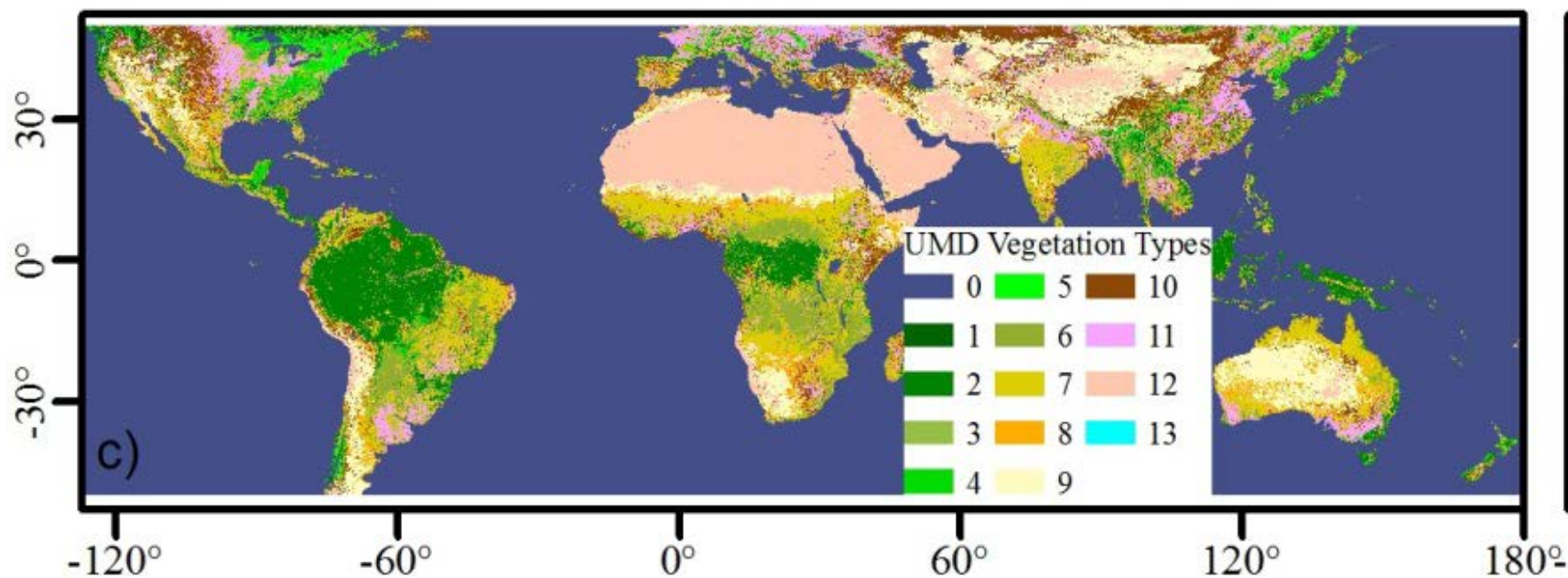


1 km



- water
- evergreen needleleaf forest
- evergreen broadleaf forest
- deciduous needleleaf forest
- deciduous broadleaf forest
- mixed forest
- woody savanna / woodland
- savanna / wooded grassland
- closed shrubland
- open shrubland
- grassland
- cropland
- bare ground
- urban and built-up
- cropland/natural vegetation mosaic

# UMD 1km Global Land Cover Map





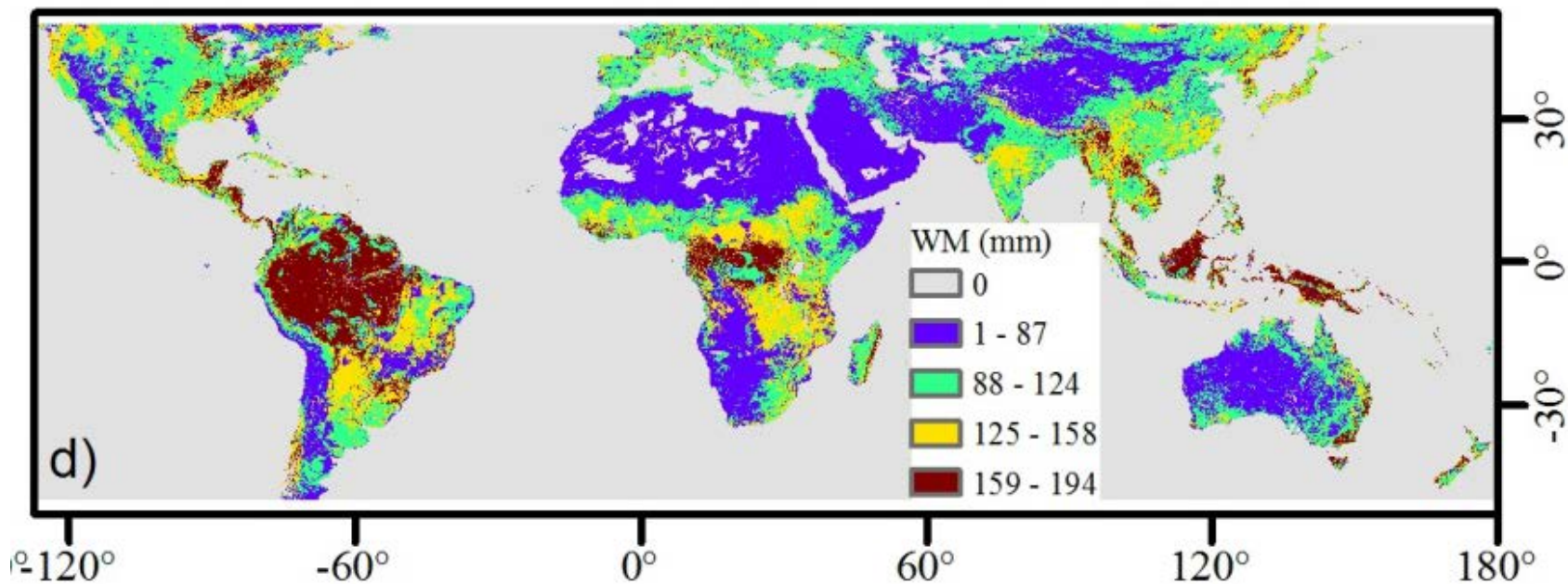
# Look-up Table for UMD 1km Global Land Cover

Table 10-1 Look-up Table for UMD Vegetation Types

Value	UMD Vegetation Category	Rooting Depth (m)
0	Water	0.001
1	Evergreen Needleleaf Forest	1
2	Evergreen Broadleaf Forest	1.25
3	Deciduous Needleleaf Forest	1
4	Deciduous Broadleaf Forest	1.25
5	Mixed Forest	1.125
6	Woodland	0.997
7	Wooded Grassland	0.872
8	Closed Shrubland	0.651
9	Open Shrubland	0.578
10	Grassland	0.75
11	Cropland	0.75
12	Bare Ground	0.55
13	Urban and Built	0.797



# WM (mm) derived from UMD 1km Global Land Cover



Thank you for your attention!

Any questions and/ or comments?

