Overview of Data for CREST Model

Xianwu Xue
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CREST V2.0

Real-Time Mode

Precipitation

PET

DEM, FDR, FAC, Slope

Observed Discharge

a-priori parameter

SCE-UA

Input

Hydro-Processes Module

Output

Function Module

Furture Module

Forcasting Mode

Snow Module

Canopy Interception

Infiltration

Runoff Generation

Actual ET

Runoff Cell-to-Cell Routing

Data Assimilation

Discharge

Actual ET

Soil Moisture

Surface Runoff

Subsurface Runoff, ...

SLIDE

CREST V2.0

HyDrometeorology and RemOte Sensing Laboratory (hydro.ou.edu)
Outline

• Topography Data

• Forcing Data

• Soil Texture

• Land Cover
Topography Data

(a) World of basins

(b) Global River Networks

HydroSHEDS
Amazon Basin
River network derived from SRTM elevation data at 500 m resolution

(c) Flow Direction

NASA SRTM-DEM (30m or 90m)
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)
- GTOPO30 (http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/gtopo30_info)
- ...

HyDrometeorology and RemOte Sensing Laboratory (hydro.ou.edu)
The SRTM (Shuttle Radar Topography Mission) 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.
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).

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 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 Elevation Derivative Database

North America
Now Available

South America
Now Available

Europe
Now Available

Africa
Now Available

Asia
Now Available

Australasia
Now Available
HYDRO1K Africa

- Elevation Data
- Compound Topographic Index
- Aspect
- Flow Accumulation
- Drainage Basins
- Slope
- Flow Direction
- Streams
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)
- TRMM V6 (TMPA 3B42 V6) 
  (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

http://trmm.gsfc.nasa.gov/affinity/affinity_3hrly_rain.html
TRMM V6 Data Coverage Map

- **Temporal Coverage**: Start Date: 1998-01-01
- **Geographic Coverage**: Latitude: 50° S - 50° N; Longitude: 180° W - 180° E

3-hourly 0.25° x 0.25°
1440 Columns

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
PERSIANN

- Format:
  4-byte binary float from a SUN system (big-endian).
- Units: mm/3hr
- Spatial coverage is:
  60° to -60° lat
  0° to 360° long
- Spatial Resolution:
  0.25° x 0.25° resolution
- Geometry:
  480 rows x 1440 cols
- Latest Global QPE from PERSIANN-CCS
Daily Precipitation for: 31 Dec 2011 (00Z-00Z)
Data on .25 x .25 deg grid; UNITS are mm/day
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 Mosaic and Multi-Sensor QPE (NMQ-)
Flooded Locations And Simulated Hydrographs (FLASH)
- A CONUS-wide flash-flood forecasting demonstration system

NMQ/Q2 Rainfall Observations
-1km²/2.5 min
Stormscale Rainfall Forecasts

Stormscale Distributed
Hydrologic Models

Probabilistic Forecast
Return Periods and
Estimated Impacts

Hydrograph of Simulated and
Observed Discharge

Simulated surface
water flow

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

20 fatalities

Probability of life-threatening
flash flood

40% 60% 80%

t=0100
t=0000
t=2300
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

"bibimo" global monthly mean PET

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

2012–03–21 15h
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, 19711981).

http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/
HWSD Soil Texture
# Look-up Table for HWSD Soil Texture

<table>
<thead>
<tr>
<th>Code</th>
<th>Texture</th>
<th>Abbr.</th>
<th>Field Capacity $\theta_{fc}$ ($m^3/m^3$)</th>
<th>Permanent Wilting Point $\theta_{pw}$ ($m^3/m^3$)</th>
<th>Hydraulic Conductivity $K_{sat}$ (cm/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No_Soil</td>
<td>NS</td>
<td>0</td>
<td>0</td>
<td>0.000001</td>
</tr>
<tr>
<td>1</td>
<td>Clay(heavy)</td>
<td>CH</td>
<td>0.36</td>
<td>0.21</td>
<td>0.03</td>
</tr>
<tr>
<td>2</td>
<td>Silty Clay</td>
<td>SIC</td>
<td>0.36</td>
<td>0.21</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>Clay</td>
<td>C</td>
<td>0.36</td>
<td>0.21</td>
<td>0.075</td>
</tr>
<tr>
<td>4</td>
<td>Silty Clay Loam</td>
<td>SICL</td>
<td>0.34</td>
<td>0.19</td>
<td>0.1</td>
</tr>
<tr>
<td>5</td>
<td>Clay Loam</td>
<td>CL</td>
<td>0.34</td>
<td>0.21</td>
<td>0.1</td>
</tr>
<tr>
<td>6</td>
<td>Silt</td>
<td>SI</td>
<td>0.32</td>
<td>0.165</td>
<td>0.495</td>
</tr>
<tr>
<td>7</td>
<td>Silt Loam</td>
<td>SIL</td>
<td>0.3</td>
<td>0.15</td>
<td>0.65</td>
</tr>
<tr>
<td>8</td>
<td>Sandy Clay</td>
<td>SC</td>
<td>0.31</td>
<td>0.23</td>
<td>0.15</td>
</tr>
<tr>
<td>9</td>
<td>Loam</td>
<td>L</td>
<td>0.26</td>
<td>0.12</td>
<td>0.34</td>
</tr>
<tr>
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<td>Sandy Clay Loam</td>
<td>SCL</td>
<td>0.33</td>
<td>0.175</td>
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<tr>
<td>11</td>
<td>Sandy Loam</td>
<td>SL</td>
<td>0.23</td>
<td>0.1</td>
<td>1.09</td>
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<tr>
<td>12</td>
<td>Loamy Sand</td>
<td>LS</td>
<td>0.14</td>
<td>0.06</td>
<td>2.99</td>
</tr>
<tr>
<td>13</td>
<td>Sand</td>
<td>S</td>
<td>0.12</td>
<td>0.04</td>
<td>11.78</td>
</tr>
</tbody>
</table>
Saturated Hydraulic Conductivity derived from HWSD Soil Texture based on its 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
- crop land/natural vegetation mosaic
UMD 1km Global Land Cover Map
### Look-up Table for UMD 1km Global Land Cover

<table>
<thead>
<tr>
<th>Value</th>
<th>UMD Vegetation Category</th>
<th>Rooting Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Water</td>
<td>0.001</td>
</tr>
<tr>
<td>1</td>
<td>Evergreen Needleleaf Forest</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Evergreen Broadleaf Forest</td>
<td>1.25</td>
</tr>
<tr>
<td>3</td>
<td>Deciduous Needleleaf Forest</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Deciduous Broadleaf Forest</td>
<td>1.25</td>
</tr>
<tr>
<td>5</td>
<td>Mixed Forest</td>
<td>1.125</td>
</tr>
<tr>
<td>6</td>
<td>Woodland</td>
<td>0.997</td>
</tr>
<tr>
<td>7</td>
<td>Wooded Grassland</td>
<td>0.872</td>
</tr>
<tr>
<td>8</td>
<td>Closed Shrubland</td>
<td>0.651</td>
</tr>
<tr>
<td>9</td>
<td>Open Shrubland</td>
<td>0.578</td>
</tr>
<tr>
<td>10</td>
<td>Grassland</td>
<td>0.75</td>
</tr>
<tr>
<td>11</td>
<td>Cropland</td>
<td>0.75</td>
</tr>
<tr>
<td>12</td>
<td>Bare Ground</td>
<td>0.55</td>
</tr>
<tr>
<td>13</td>
<td>Urban and Built</td>
<td>0.797</td>
</tr>
</tbody>
</table>
WM (mm) derived from UMD 1km Global Land Cover
Thank you for your attention!

Any questions and/or comments?