4 km (1/24°) Surface Meteorological Forcing Down-scaled from NLDAS-2 and Radar/Satellite Products

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Background

Original Goal: To establish a VIC 3km near real-time simulation system over CONUS for SMAP Val/Cal purpose.

Main Target Specs:

- Variable Infiltration Capacity (VIC) model
- 4km (1/24°) resampled to SMAP 3km EASE grid
- Hourly time step, ~4 days behind real time
- Retrospective simulation from Jan 1, 2002
- 8 outputs archived @ JPL: soil moisture and temperature in 3 layers, land surface temperature, and rainfall (full set @ Princeton)
- NetCDF-4 packaged with CF standard
## Major Source Datasets

### Input Meteorological Forcing Fields

<table>
<thead>
<tr>
<th>Forcing Field</th>
<th>Source</th>
<th>Res</th>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation</td>
<td>Stage IV/II (radar/gauge)</td>
<td>4 km</td>
<td>Gap-filling, NLDAS-2 matchup</td>
</tr>
<tr>
<td>Shortwave Radiation</td>
<td>GSIP (GOES satellite)</td>
<td>0.125°</td>
<td>Solar angle adjustment, bilinear interpolation</td>
</tr>
<tr>
<td>Longwave Radiation</td>
<td>NLDAS-2 (analysis)</td>
<td>0.125°</td>
<td>Radiative temperature adjusted for elevation</td>
</tr>
<tr>
<td>2m Air Temperature</td>
<td>NLDAS-2 (analysis)</td>
<td>0.125°</td>
<td>Elevation adjustment (lapse rate -6.5° C/km)</td>
</tr>
<tr>
<td>Specific Humidity</td>
<td>NLDAS-2 (analysis)</td>
<td>0.125°</td>
<td>From interpolated relative humidity interpolation and elevation adjusted temperature/pressure</td>
</tr>
<tr>
<td>Surface Pressure</td>
<td>NLDAS-2 (analysis)</td>
<td>0.125°</td>
<td>Elevation based interpolation</td>
</tr>
<tr>
<td>10 Wind Speed</td>
<td>NLDAS-2 (analysis)</td>
<td>0.125°</td>
<td>Bilinear interpolation</td>
</tr>
</tbody>
</table>
Stage IV and Stage II

Stage IV Data Problem

Annual Precipitation 2014

[Map showing annual precipitation in the United States with a focus on the west coast.]
Stage IV and Stage II

Northwest RFC (NWRFC)

California Nevada RFC (CNRFC)
Stage IV and Stage II

1. For CNRFC and NWRFC:
   - Hourly Stage II
   - 6-hourly Stage IV (fallback: 6-hourly Stage II)
   - Merged Hourly Stage IV/II

2. Other RFCs: rescale to match 6-hourly Stage IV total

3. Match NLDAS-2 daily total at $1/8^\circ$ scale (only if daily total exceeds 0.4mm)
Stage IV and Stage II

6-hr Sum Stage II

6-hr Sum Stage IV

6-hrly Stage IV

6-hr Stage II Sum - 6-hrly Stage IV

6-hr Stage IV Sum - 6-hrly Stage IV

Hrly Stage II

Hrly Stage IV

Hrly Merged, 2015-06-11T01
GOES Solar Insolation Product (GSIP)

GSIP Downward Shortwave Radiation
1/8°, validated at 00:45

Solar Zenith Angles at 00:00, 00:45, 01:00

Solar Angle Based Correction

Mean Flux 00:00 – 01:00

Interpolation
Downscaling

2m Air Temperature (K)

12km (1/8°)

4km (1/24°)

Interpolation

- Elevation Effect

Seal Level Ta at 12km

Interpolation

+ Elevation Effect

Seal Level Ta at 4km
Downscaling

Surface Pressure (Pa)

12km (1/8°)  
4km (1/24°)

Seal Level Pa at 12km

- Elevation Effect

Interpolation

Seal Level Pa at 4km

+ Elevation Effect
Downscaling

2m Specific Humidity (kg/kg)

12km (1/8°)

4km (1/24°)

Interpolation

Ta at 12km → Pa at 12km

RH at 12km

Ta at 4km → Pa at 4km

RH at 4km

Interpolation
Downscaling

12km (1/8°)

4km (1/24°)

Stefan-Boltzmann

Trad at 12km

Elevation Effect

Stefan-Boltzmann

Trad at 4km
Data Portal @ Princeton and Archive @ JPL

http://stream.princeton.edu:8080/opendap/Forecast_Monitoring/Forcing_CONUS_4km/

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Access manipulate data from any NetCDF or OPeNDAP compatible software

**Caution:** data packed into 2-byte short integers. GrADS: sdfopen/xdfopen, ncview, Panoply, etc, will apply scale_factor/add_offset automatically, others may need it done manually.
Data Portal @ Princeton and Archive @ JPL
Data Portal @ Princeton and Archive @ JPL

http://stream.princeton.edu:8080/opendap/Forecast_Monitoring/VIC_CONUS_3km/

Contents of /Forecast_Monitoring/VIC_CONUS_3km/2015/201508
Variables Archived @ JPL

- Soil Moisture in Layer 1
- Soil Temperature in Layer 1
- Soil Moisture in Layer 2
- Soil Temperature in Layer 2
- Soil Moisture in Layer 3
- Soil Temperature in Layer 3
- Precipitation
- Land Surface Temperature
Backup Slides