

Building CREST model: hydro-fabric, forcing, and settings

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Course timeline

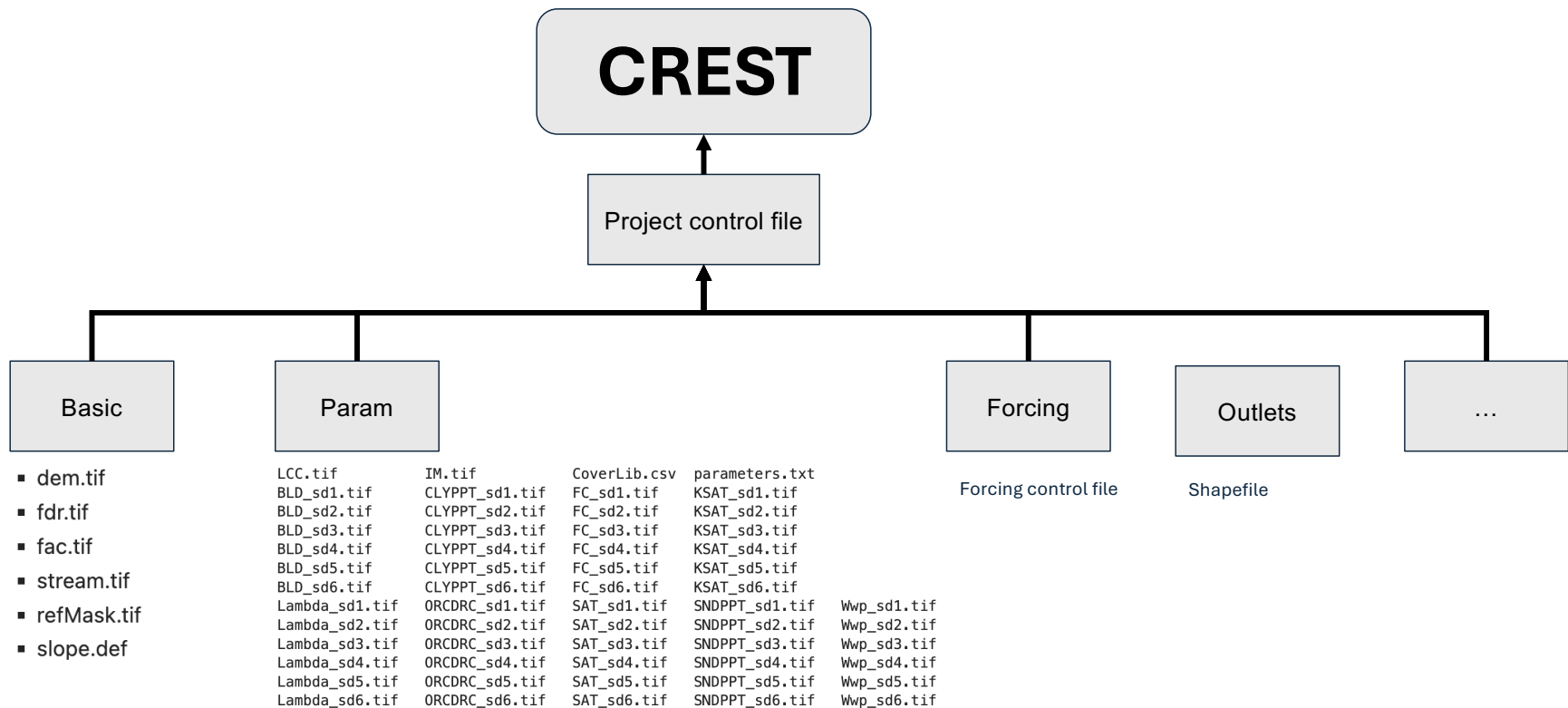
15:30 - 17:30 GMT+3

3 Sessions (30-40 mins each), 2 breaks (5-10 mins each).

Outline:

1. CREST runtime data structure.
2. Two practical options for data preparation.
3. Hydro-fabric data sources.
4. Forcing data and connection setting.
5. Model settings.

CREST runtime data and settings:



https://github.com/QingYang6/CREST_tutorial/blob/main/Files_prepare.ipynb

Hydro-fabric: static hydro data

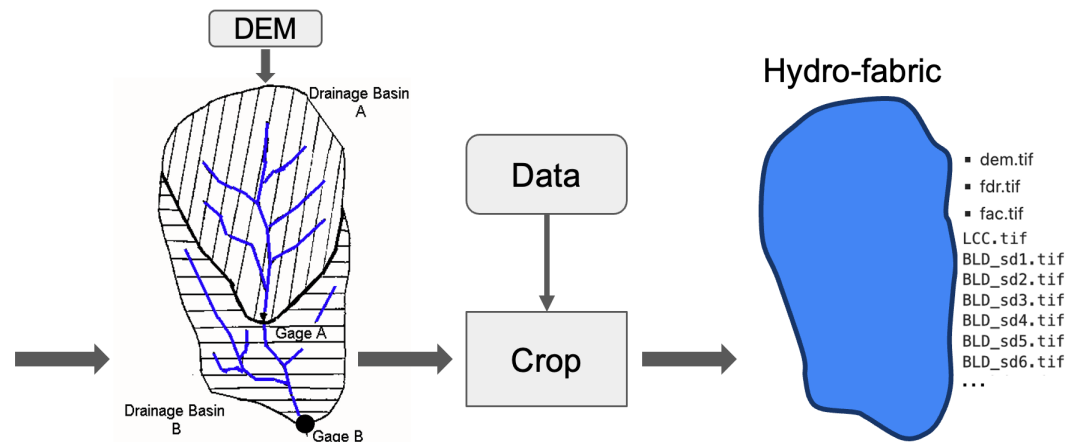
Categories	Data source	Options	Key data
Topography	HydroSHEDS https://www.hydrosheds.org/	3s (~90m) 15s (~450m) 30s (~900m)	DEM, Flow direction, Flow accumulation.
Soil Type	SoilGrids https://www.isric.org/explore/soilgrids	250m, 6 layers (0-200cm)	SNDPPT, CLYPPT, SLTPPT, ORCDRC, BLD
Land Cover	MCD12Q1 Version 061 https://lpdaac.usgs.gov/products/mcd12q1v061/	500m, yearly	Web selection.
Outlets	User defined	shapefile	Better locate on stream network

Two practical options:

Option 1

1. Specify outlet point.
2. Watershed algorithm.
3. Crop operator.
4. Hydro-fabric in basin shape.

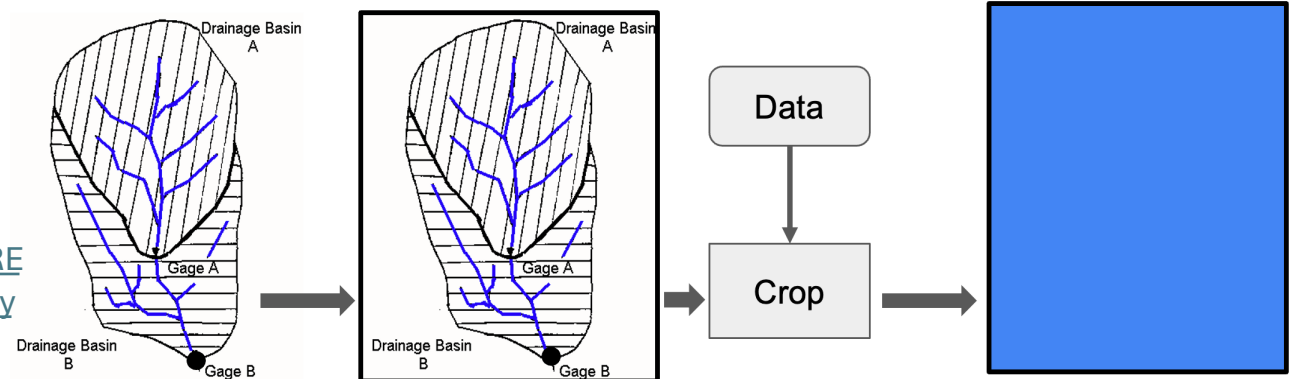
https://github.com/QingYang6/CREST_tutorial/blob/main/Files_prepare.ipynb



Option 2

1. Estimate basin bounds.
2. Crop operator.
3. Hydro-fabric in rectangle.

https://github.com/QingYang6/CREST_tutorial/blob/main/Practice_Hydrofabric.ipynb



Reproject all files to reference basin mask

1. Candidate mask: dem.tif, fdr.tif, fac.tif, stream.tif, refMask.tif.
2. Tools, QGIS, ArcGIS, or https://github.com/QingYang6/CREST_tutorial/blob/main/Files_prepare.ipynb Section 2.5

Topography

HydroSHED produced based on:

- 3s SRTM data.
- Error correction and void filling.
- Hydrological conditioning.
- Stream burning.

https://data.hydrosheds.org/file/technical-documentation/HydroSHEDS_TechDoc_v1_4.pdf

Topography

Files in basic folder:

1. dem.tif, download and crop.
2. fdr.tif, download and crop.
3. fac.tif, download and crop.
4. stream.tif, apply threshold to fac.tif.
5. refMask.tif, index mask generated based on dem.tif (fdr or fac also fine).
6. slope.def, copy from example.

https://github.com/QingYang6/CREST_tutorial/blob/main/Files_prepare.ipynb

SoilGrids

Produced based on:

1. Source data from World Soil Information Service, ancillary data from climatic, topographic, and land cover.
2. Machine learning model inference.

Soil profile to soil hydraulic properties

- What we download from SoilGrids?

SNDPPT: Sand content percentage.

CLYPPT: Clay content percentage.

SLTPPT: Silt content percentage.

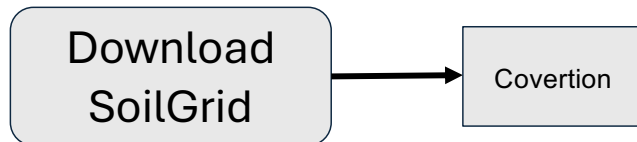
ORCDRC: Soil organic carbon density.

BLD: Bulk density.

Six layers from 0 to 200cm.

- What we need for CREST?

Saturation, Field capacity, Water wilting point, Soil saturated conductivity, Moisture-tension coefficient, etc.



https://github.com/QingYang6/CREST_tutorial/blob/main/Files_prepare.ipynb

Section 2.2

Land Cover

For LCC.tif:

1. Download data from <https://lpdaac.usgs.gov/products/mcd12q1v061/>.
2. Merge files.
3. Crop to match with reference raster in the basic folder.

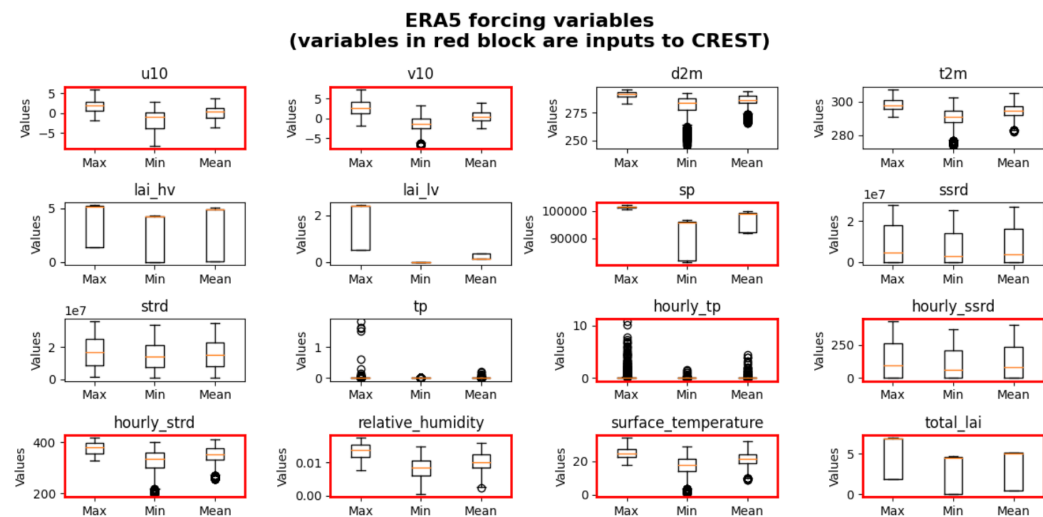
For IM.tif:

1. Derived from merged LCC file with impervious area identification.

https://github.com/QingYang6/CREST_tutorial/blob/main/Practice_Hydrofabric.ipynb

Forcing data

Variable name	Unit
total precipitation	mm
downward shortwave radiation	w/m ²
downward longwave radiation	w/m ²
ari temperature	Celsius
relative humidity	ratio
Pressure	Pa
10m u-component of wind	m/s
10m v-component of wind	m/s
leaf area index	index



https://github.com/QingYang6/CREST_tutorial/blob/main/Files_prepare.ipynb

Section 3

Model settings

Example and explain:

1. Project control file, https://github.com/QingYang6/CREST_tutorial/blob/main/control_file_template/project_file.md.
2. Parameters file (soil and lcc),
https://github.com/QingYang6/CREST_tutorial/blob/main/control_file_template/parameters_file.md.
3. Forcing control file,
https://github.com/QingYang6/CREST_tutorial/blob/main/control_file_template/forcing_control_file.md.
4. Others could directly copy the example files without modification.