APEIS Capacity Building Workshop on Integrated Environmental Assessment in the Asia Pacific Region
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Demonstrative presentation of AIM/Impact model

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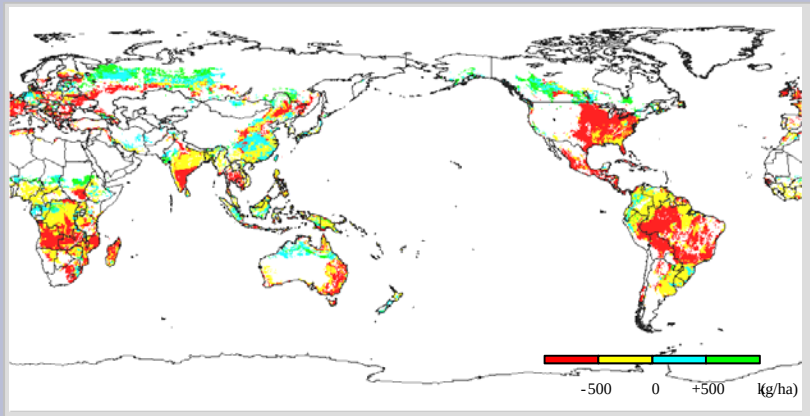
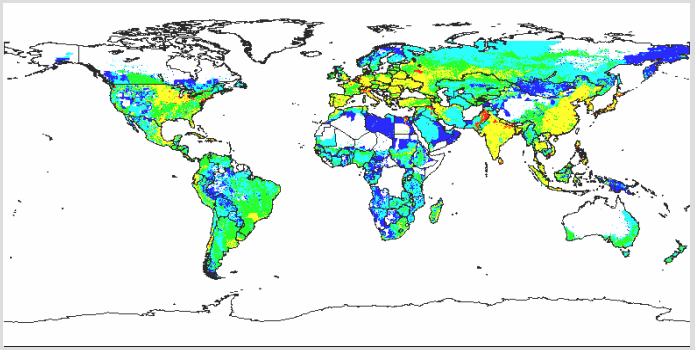
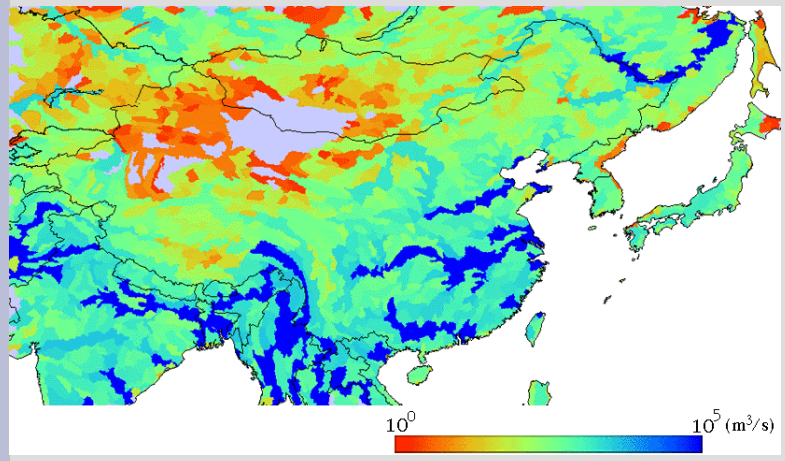
Outputs of AIM/Impact



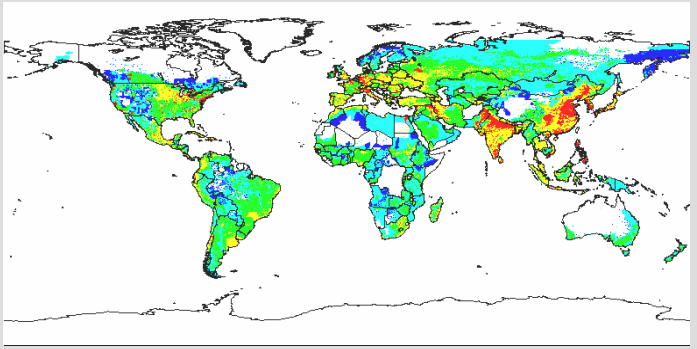
Change of crop productivity



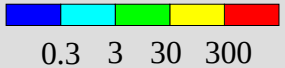
1990



Change of river discharge



2050



Water withdrawal

Objective of the course

- Introduction of standard procedures of impact assessment using AIM/Impact.
- Demonstration of specific procedures of assessment of potential crop productivity under anticipated climate change.
  - STEP1: Collection of input data
  - STEP2: Scenario development
  - STEP3: Parameter setting and simulation
  - STEP4: Display and analysis of the results
- Brief introduction of AIM/Impact [Country]

Standard work flow of impact assessment in AIM/Impact

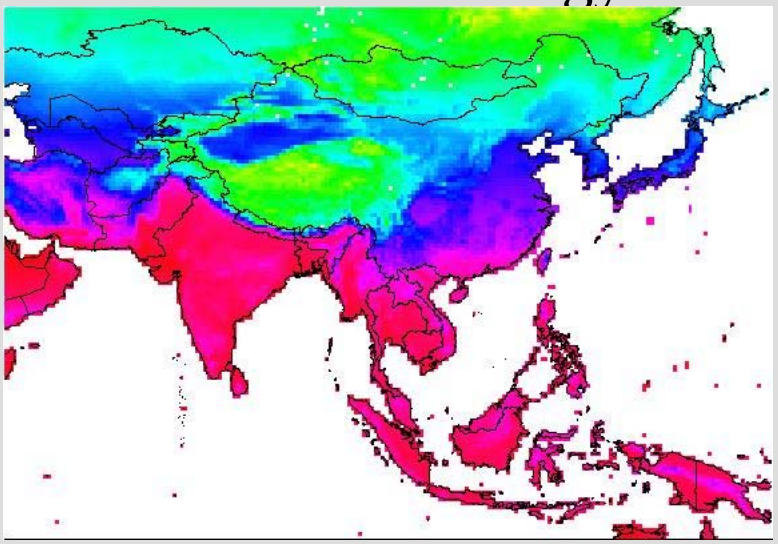
- 1. Collection of input data and importing them into GIS database
  - GRASS GIS
- 2. Future scenario development
  - Interpolation
  - Simple climate model and Pattern scaling
- 3. Simulation
  - Parameter setting
- 4. Display and analysis of the results
  - Visualization
  - Aggregation
  - Feedback or higher impact

GRASS (Geographic Reseoucres Analysis Support System)

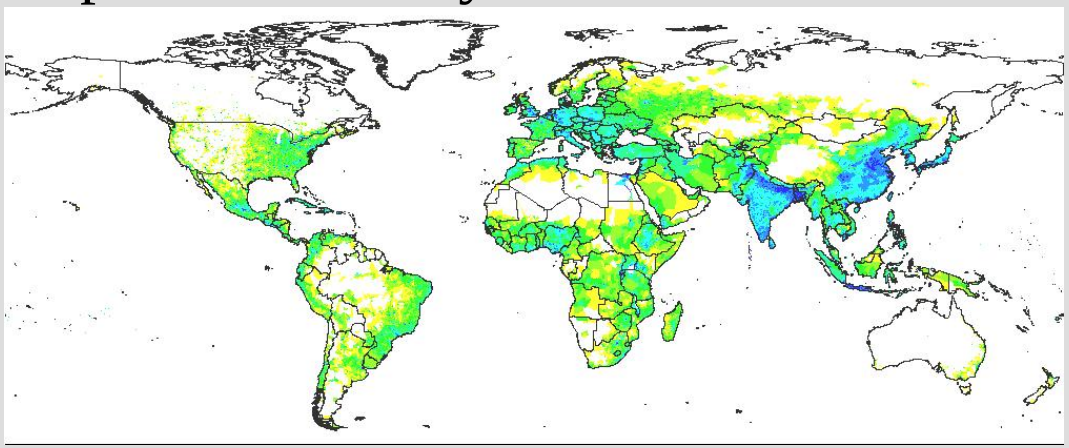
- Gegraphical Information System Software
- Run on unix oprating systems (Solaris, Linux, etc.)
- Advantage
  - Distributed on internet (Free)
  - Raster (gridded) data
  - Source codes available (C language)
  - Modules can be developed by users with the GRASS developers' library.
- Disadvantage
  - Unix
  - Inexcelent graphical user interface

Example of spatial data managed in GRASS GIS

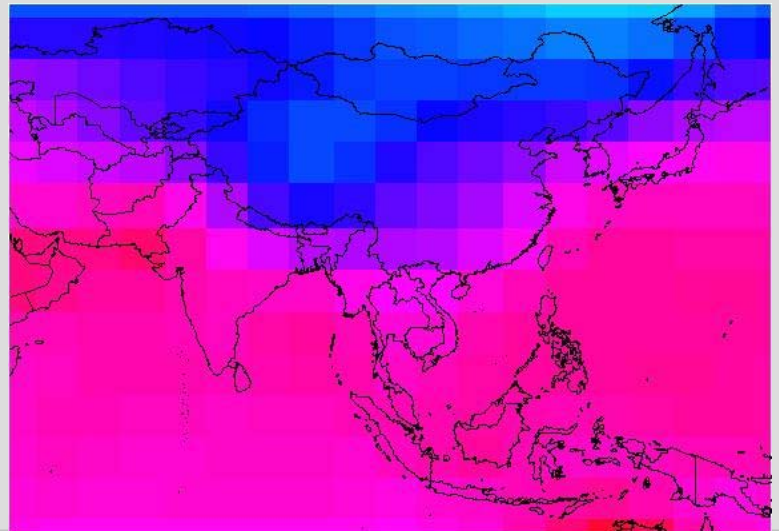
Obserbation climatology



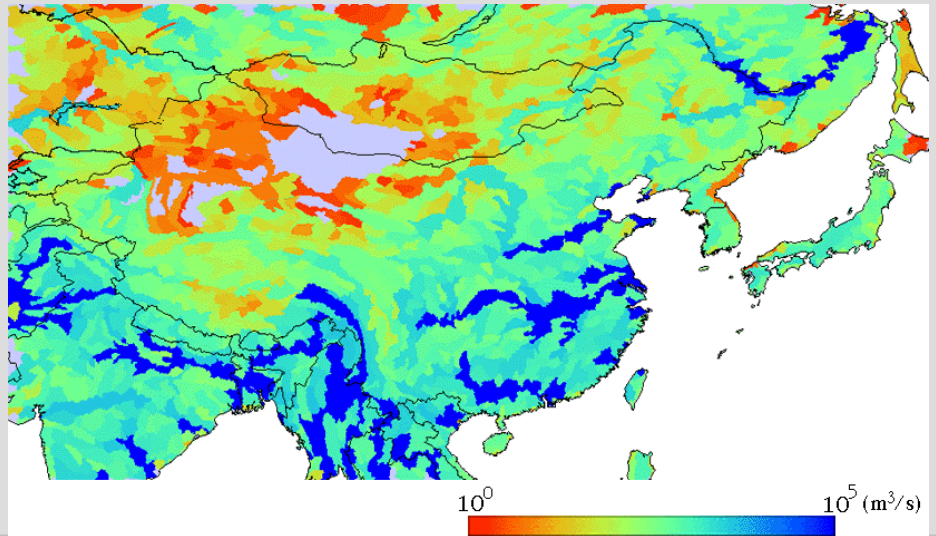
Population density



GCM results



Assessment results



Data collection

- Current climate
  - Monthly or daily mean climatology
    - CRU/UEA LINK climatology (1901-1996, 0.5x0.5, monthly)
    - GEWEX/NASA ISLSCP (1987 and 1988, 1.0x1.0, monthly, daily or 6-hourly)
- Future climate projection
  - Output of General Circulation Models (GCMs)
    - IS92a simulations (IPCC-DDC)
    - SRES simulations (IPCC-DDC)
    - Simulation by CCSR/NIES
  - Output of Regional Climate Models (RCM)
    - Not available yet

Data collection

- Soil
  - Chemical and physical character of soil
    - FAO Soil Map of the World
- Landuse
  - Landuse classification derived from remote-sensing data
    - 1km x 1km GLCC (EDC/EROS/USGS)
- Population
  - Gridded population density
    - GPW2 (CIESIN/Colombia University, 2.5min)
    - LandScan2000 (1km x 1km)

Climate scenario

- Future changes of climate (temperature, rain, radiation, wind etc.) are deduced from GCMs results distributed at IPCC-DDC or provided by NIES/CCSR.
- In order to compromise with the very low resolution of GCM results, the results of GCMs are interpolated and current observed climatology is used for expressing spatial detail.
- For assessing various future path of GHG emission, "pattern scaling method" is employed to develop climate scenario.

Simulation

- Simulation models in AIM/Impact are Unix shell files which consist of GRASS commands originally developed using GRASS-GIS library and standard GRASS commands included in the GRASS distribution.
- Some models refer to the model parameter files for reading assumption or information other than spatial input data managed in GIS.

Models in AIM/Impact

- Water balance model
  - Penman PET
  - Thornthwaite PET
  - Surface runoff
- River discharge model
- Potential crop productivity model
- Water demand model
- Malaria potential model
- Vegetation classification model
- Vegetation move possibility model

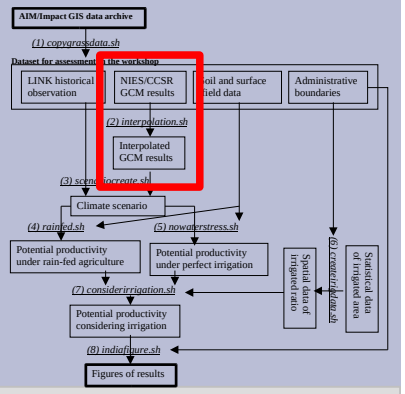
Visualization and analysis

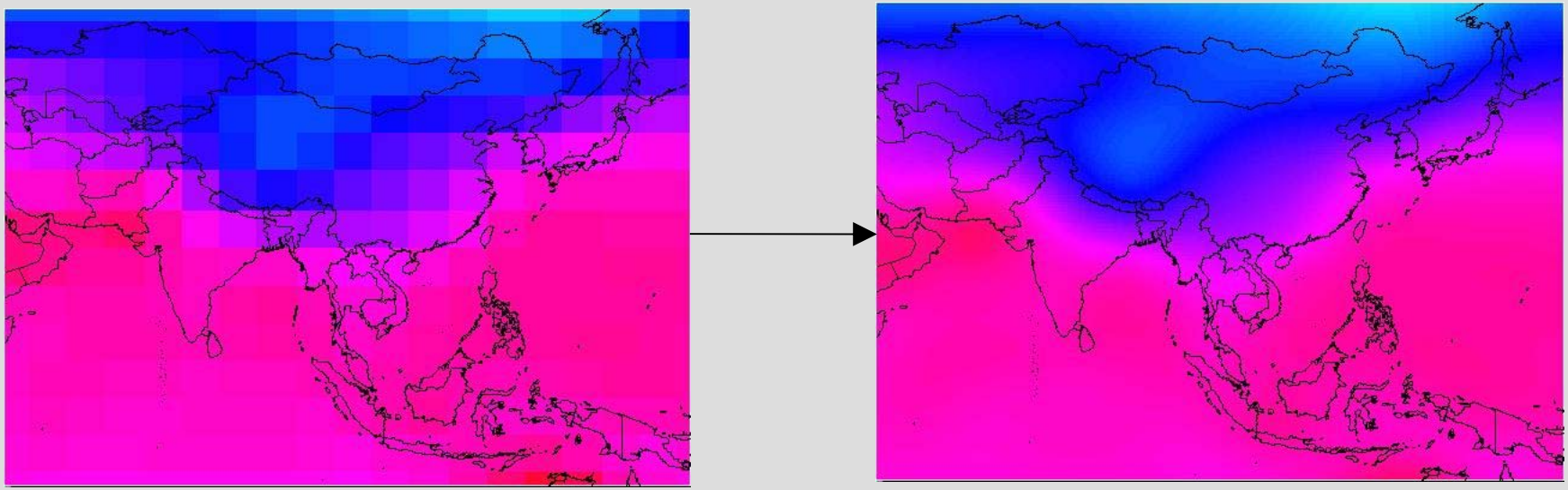
- Grasping spatial pattern of impact through visualization
  - Detection of critically damaged region
  - Time series analysis based on animation
- Spatial aggregation
  - Aggregation (spatial average) based on administrative boundaries
  - Time series trend
  - Linkage with the other assessment frameworks (ex. Economic model)

Demonstration of assessment of agricultural impact

- What will be done in the demonstration
  - Calculate potential crop productivity of rice and winter wheat in Asia.
  - Display some figures of the results focusing India.
- Objective
  - Demonstrate the procedure to assess climate change impact using AIM/Impact with going through simplified assessment processes step by step.

Interpolation (interpolation.sh)

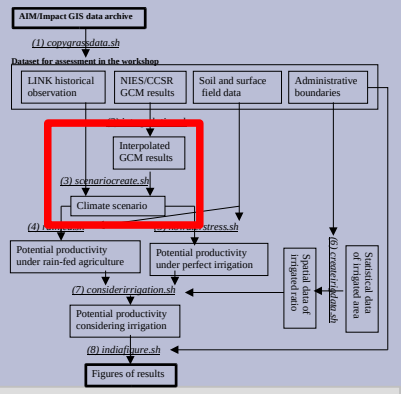


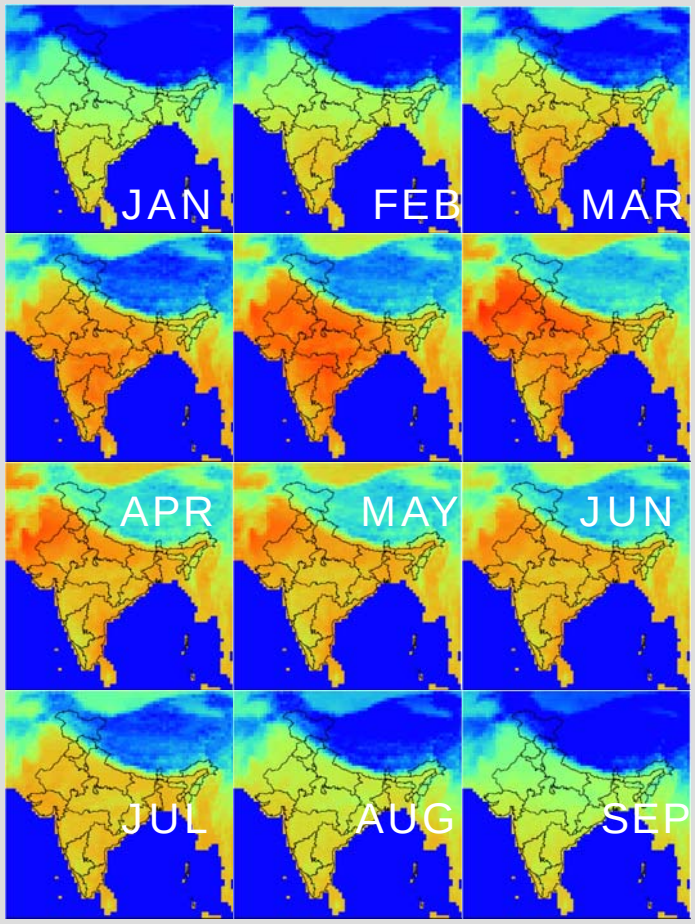


NIES/CCSR GCM (5.6 x 5.6)
Monthly mean temperature in 2050s under IS92a scenrio.

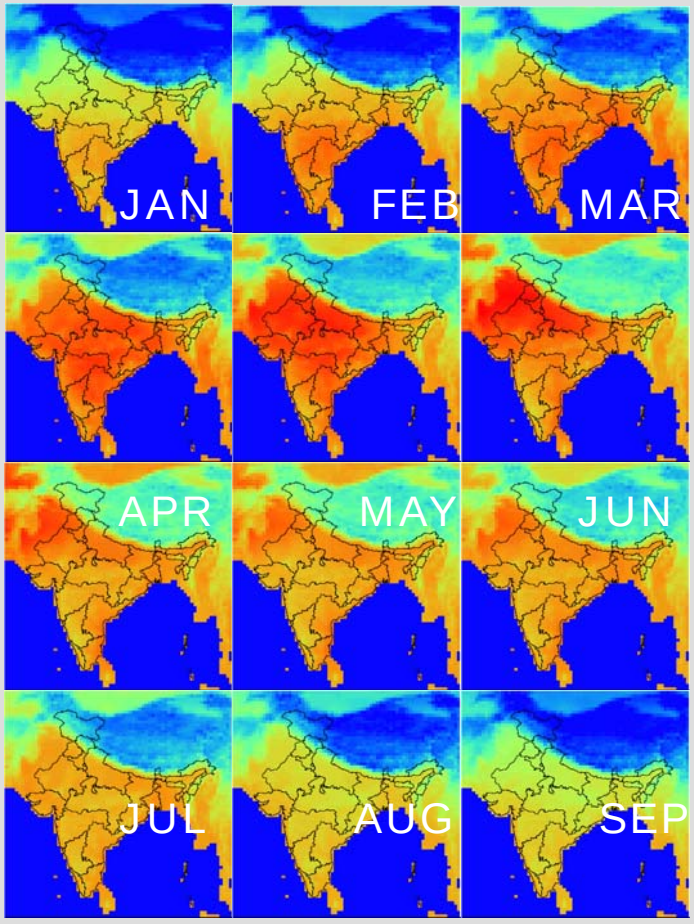
Spline interpolation
0.5 x 0.5

Temperature scenario (scenariocreate.sh)

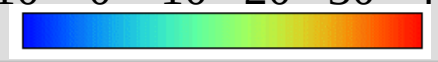




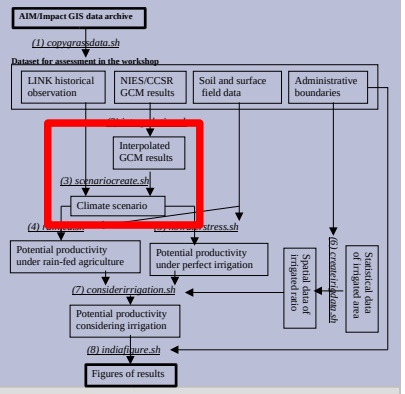
LINK historical temperature (1961-1990)

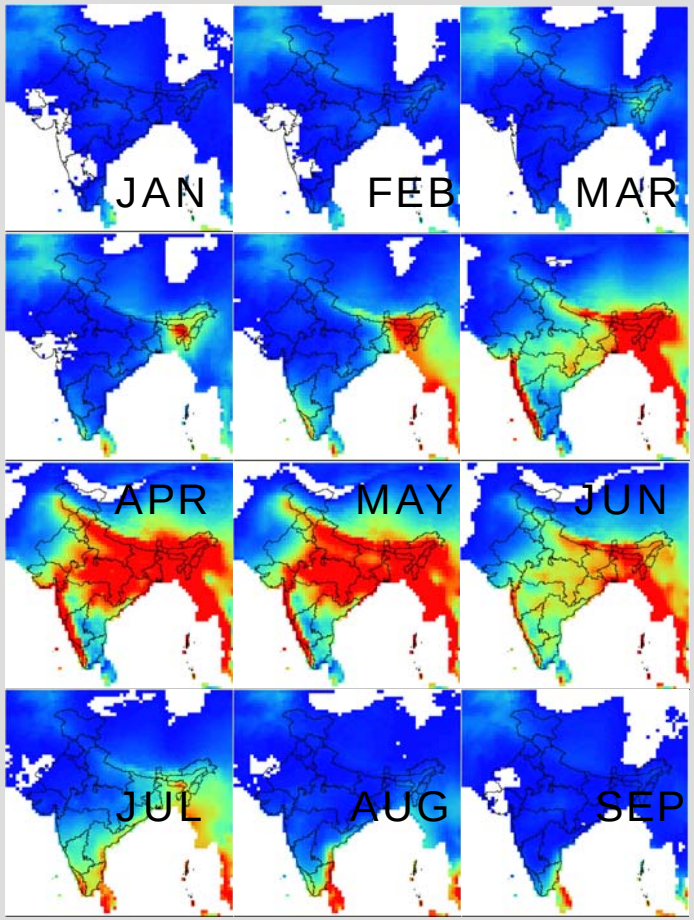


Temperature scenario (2050s, CCSR/NIES model)

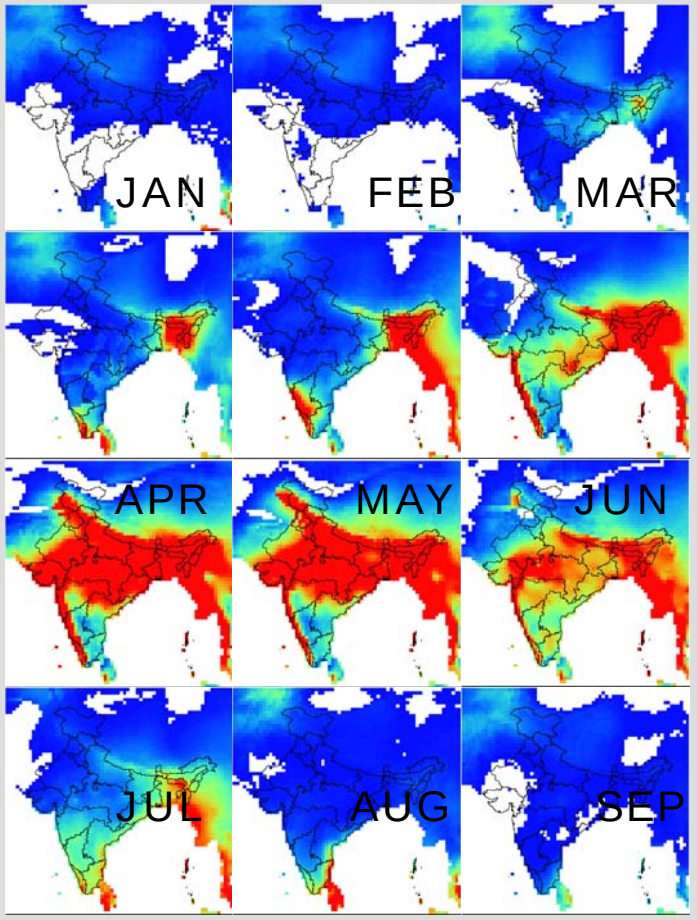


Precipitation scenario (scenariocreate.sh)

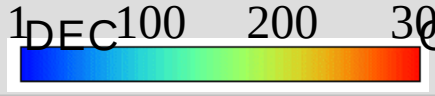




LINK historical precipitation (1961-1990)



Precipitation scenario (2050s, CCSR/NIES model)

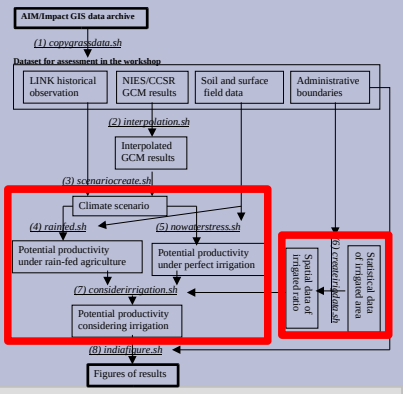


Example of parameter

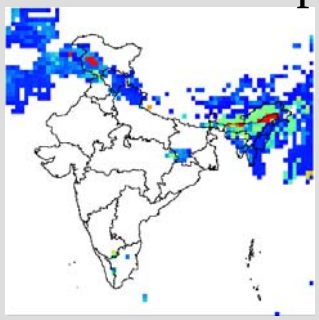
Characteristics of crop growth

cropname	WheatSC	WheatWC	Whitepotato	PhaseolusbeanTEC	PhaseolusbeanTRC	Soybean	Rice	Cotton	Sweetpotato	Cassava	Pearlmillet	SorghumTRC	MaizeTRC	SorghumTEC	MaizeTEC
crop_kind	1	1	1	1	2	2	2	2	2	2	3	3	3	4	4
m_gp	100	200	150	90	120	120	130	160	150	330	90	120	120	110	110
min_gp	90	90	90	50	50	75	80	150	90	180	55	90	70	90	70
m_lai	5	5	5	4	4	4	5	3	4.5	3	4	4	4	3	4
m_hi	0.4	0.4	0.6	0.3	0.3	0.35	0.3	0.07	0.55	0.55	0.25	0.25	0.35	0.25	0.35
bean	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
hi_kind	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
gp_kind	1	0	0	1	0	0	0	0	0	0	0	0	0	2	2
thres_l	5	5	7	7	7	13	12	15	10	10	15	15	12	15	12
thres_u	25	25	30	32	32	38	36	38	40	35	45	38	40	38	40

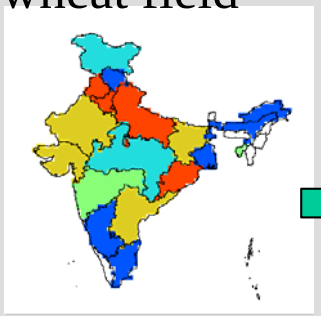
Potential productivity of winter wheat



Rain-fed assumption

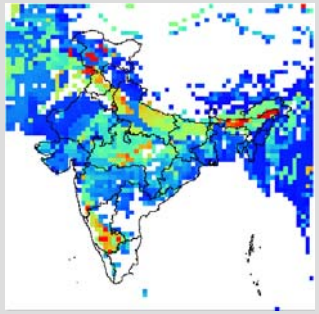


Irrigated ratio of wheat field

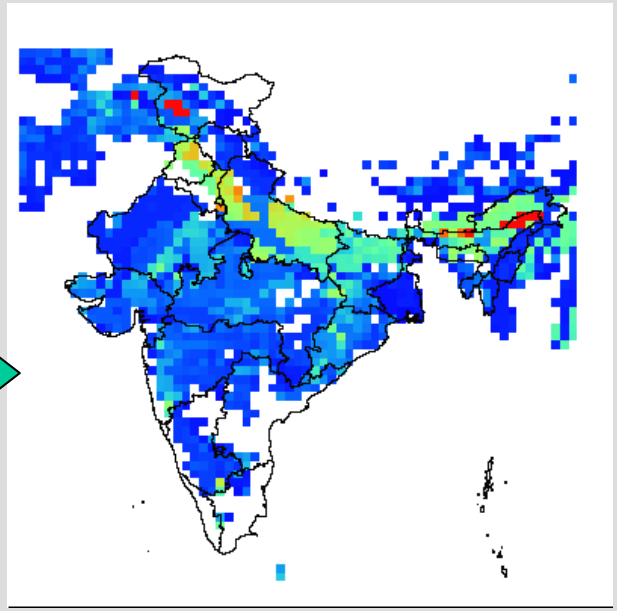


0 50 100 (%)

Perfect irrigation (No water stress)



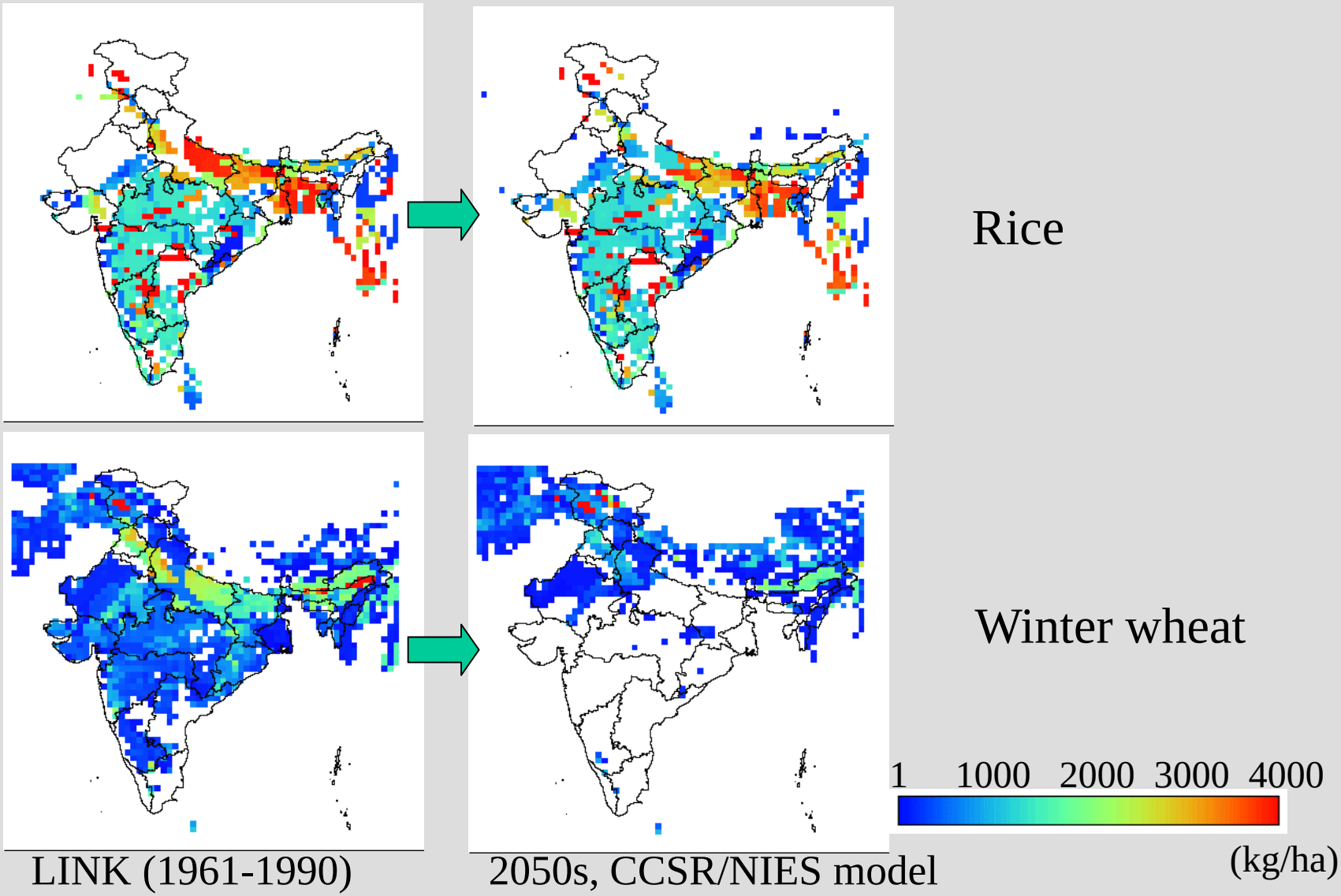
Combined (weighted average)



Estimated winter wheat potential productivity under current climate

1 1000 2000 3000 4000 (kg/ha)

Change of potential productivity of rice and wheat



Features of AIM/Impact [Country]

- Package of models, tools and data for scenario analysis of national-scale climate change impact assessment
- Executable on PC-Windows (no need to learn UNIX & GRASS)
- Bundled datasets for basic assessment
- Readily achievement of spatial analysis
- Detailed manual documents