I INTRODUCTION

FLOOD RISK AT BASIN & MICRO SCALE?

Local Agency for Disaster Management (BPBD) of Jambi Province
Local Agency for River Basin Management (BPDAS) of Jambi Province

LIPI

Requested to make Quantitave Flood Risk Map (in Damage Cost Unit) at Basin Scale and Considering More Physical Process & Climate Change Issue in Delineating the Map

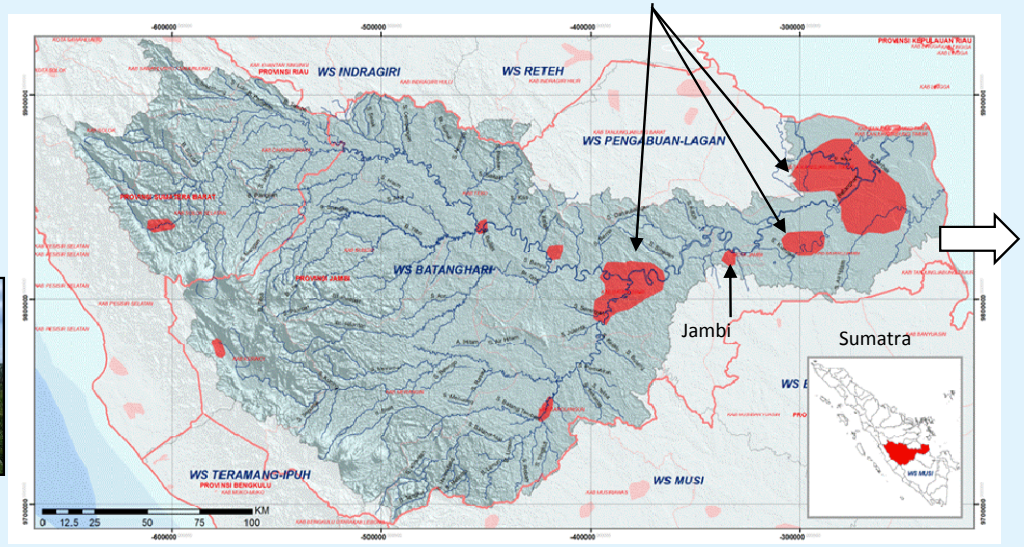
To Produce High Resolution & Precission of Flood Hazard & Risk Map

Upstream

Natural Forest

Deforestation Plantation

Frequent flooding areas, Wetland

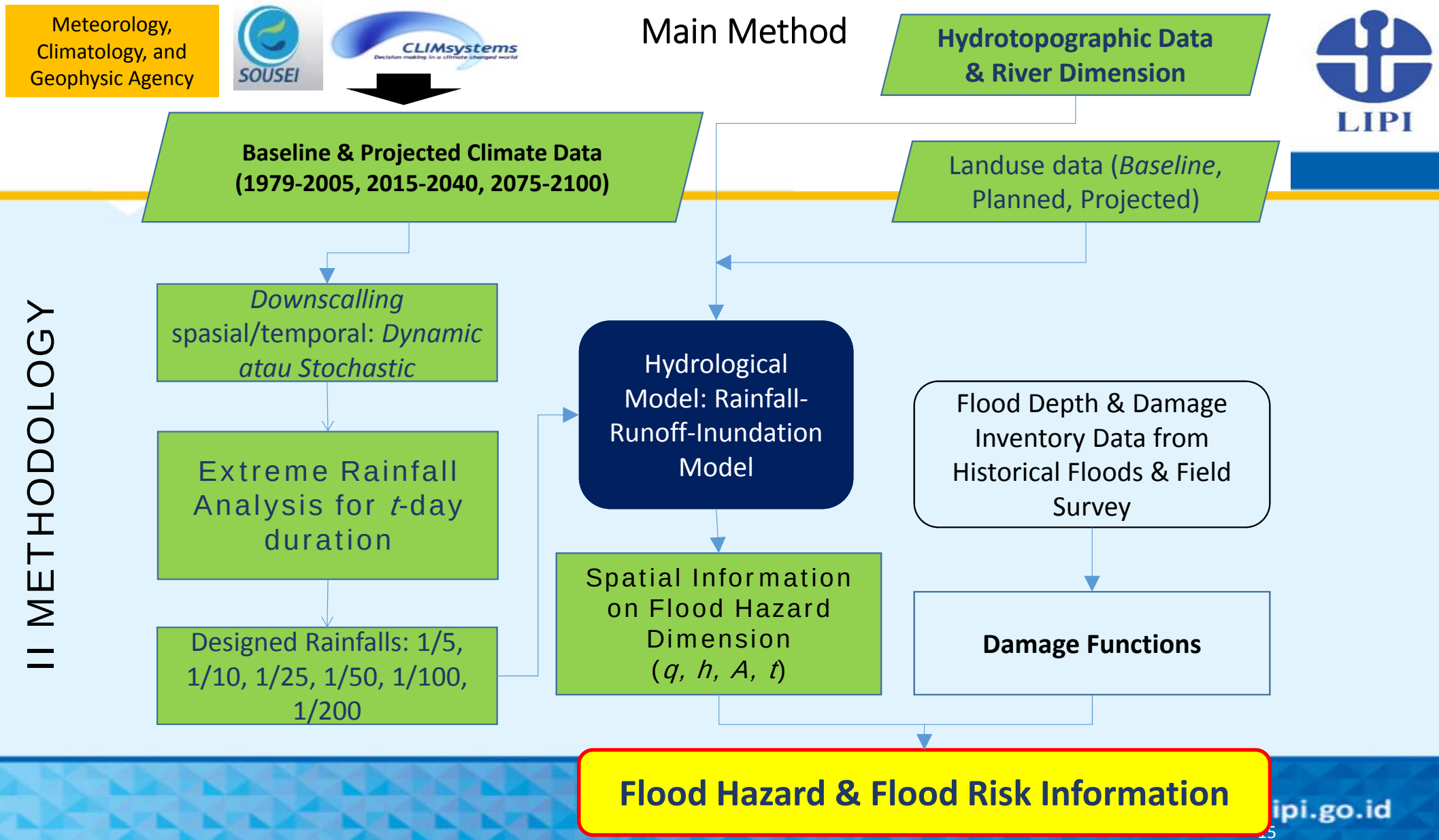


Downstream

Peatland Area

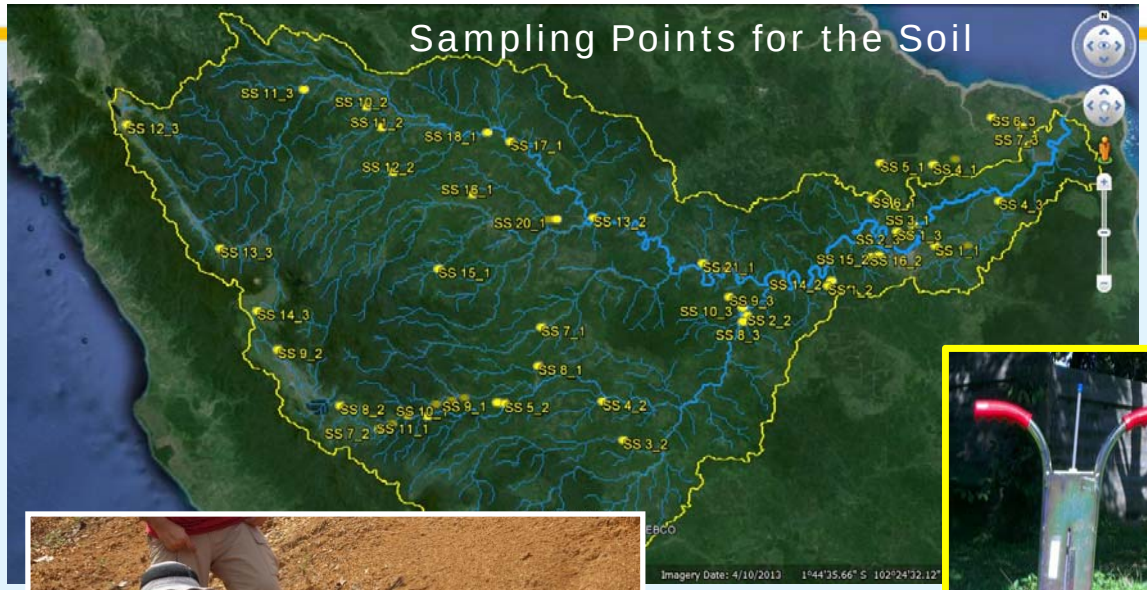
II METHODOLOGY

Main Method

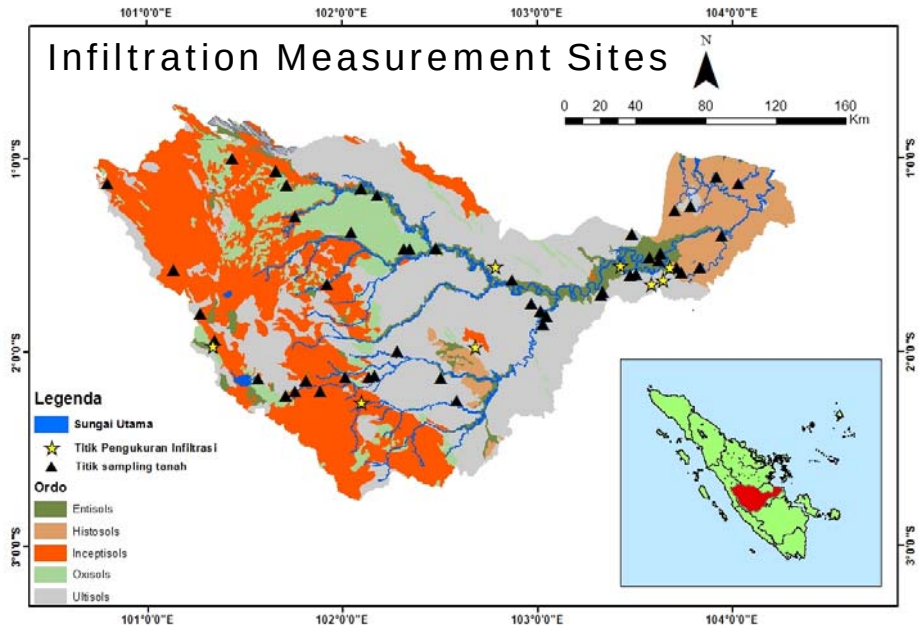


II. METHODOLOGY

Field Data Collections for Database, Understanding the Process, Hydrologic Modeling



Turf – tec infiltrometer



Primary Data of Soil Properties

✓Soil Properties Analysis: permeability, texture, organic matter, bulk density, porosity

✓Infiltration measurement

Method

1. Soil permeability, texture, organic matter, bulk density, porosity

- Collection and analysis of soil samples→ regression analysis
- Spatial analysis using GIS with 30 m resolution

2. Infiltration measurement

Analysis of infiltration rate using Horton model

$$f_p = f_c + (f_0 - f_c)e^{-kt}$$

f_p = the infiltration capacity (depth/time) at some time t

k = a constant representing the rate of decrease in f capacity

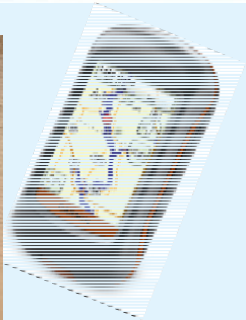
f_c = a final or equilibrium capacity

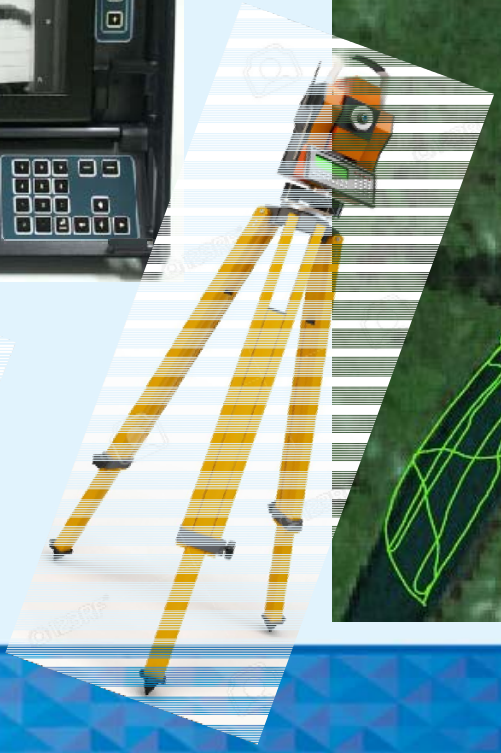
f_0 = the initial infiltration capacity

II. METHODOLOGY

Field Data Collections for Database & Hydrologic Modeling

Cross Section and River's Bathymetric Measurments





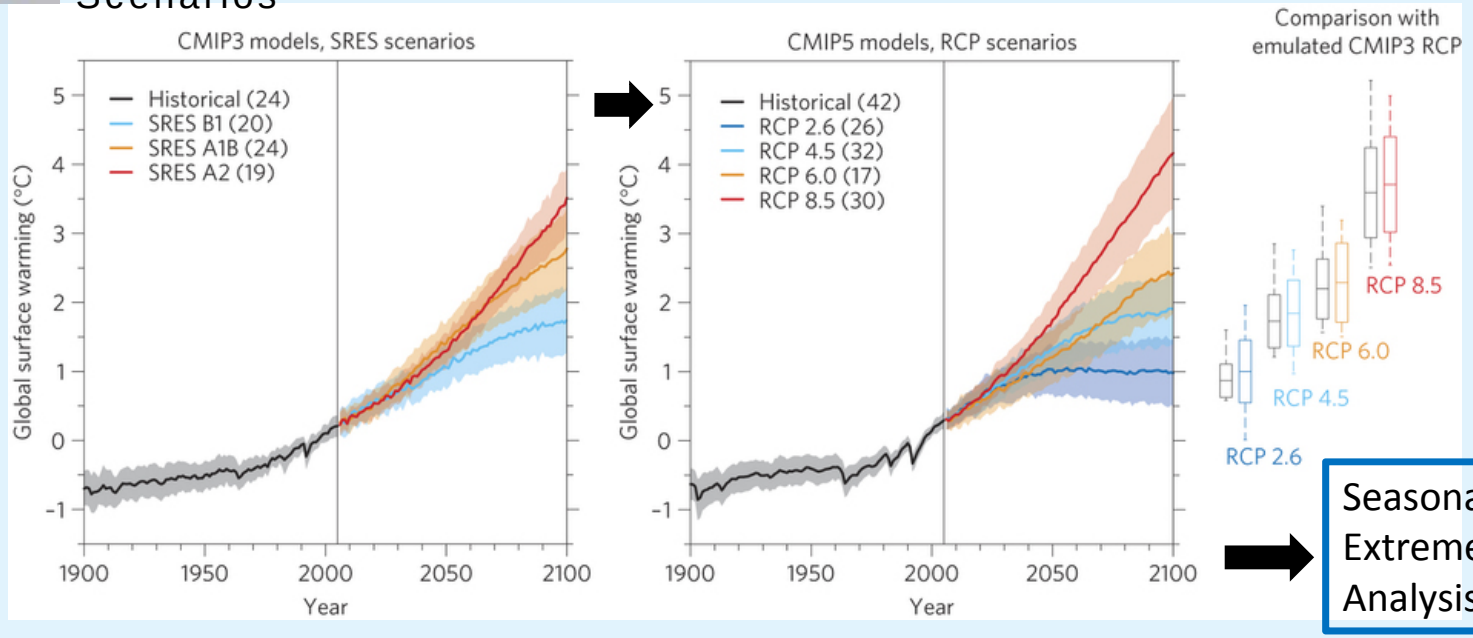
II. METHODOLOGY

Climate Projection Data

- **SOUSEI Program (Japan): MRI-AGCM 20-km**
- **SimCLIM (New Zealand): 40 Ensembel GCMs**

Projected Climate Data AGCM 20-km with SRES A1B & RCP 8.5 Scenarios

40 Ensemble of GCM (Downscalled to 90 m) with RCPs (2.6 - 8.5) Scenario



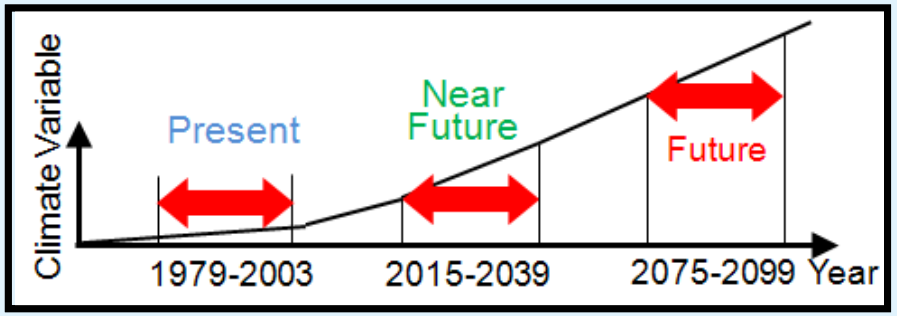
Seasonal & Extreme Rainafall Analysis

Special Report on Emissions Scenarios (SRES), AR1-4

Representative Concentration Pathway Scenarios (RCPs), AR5

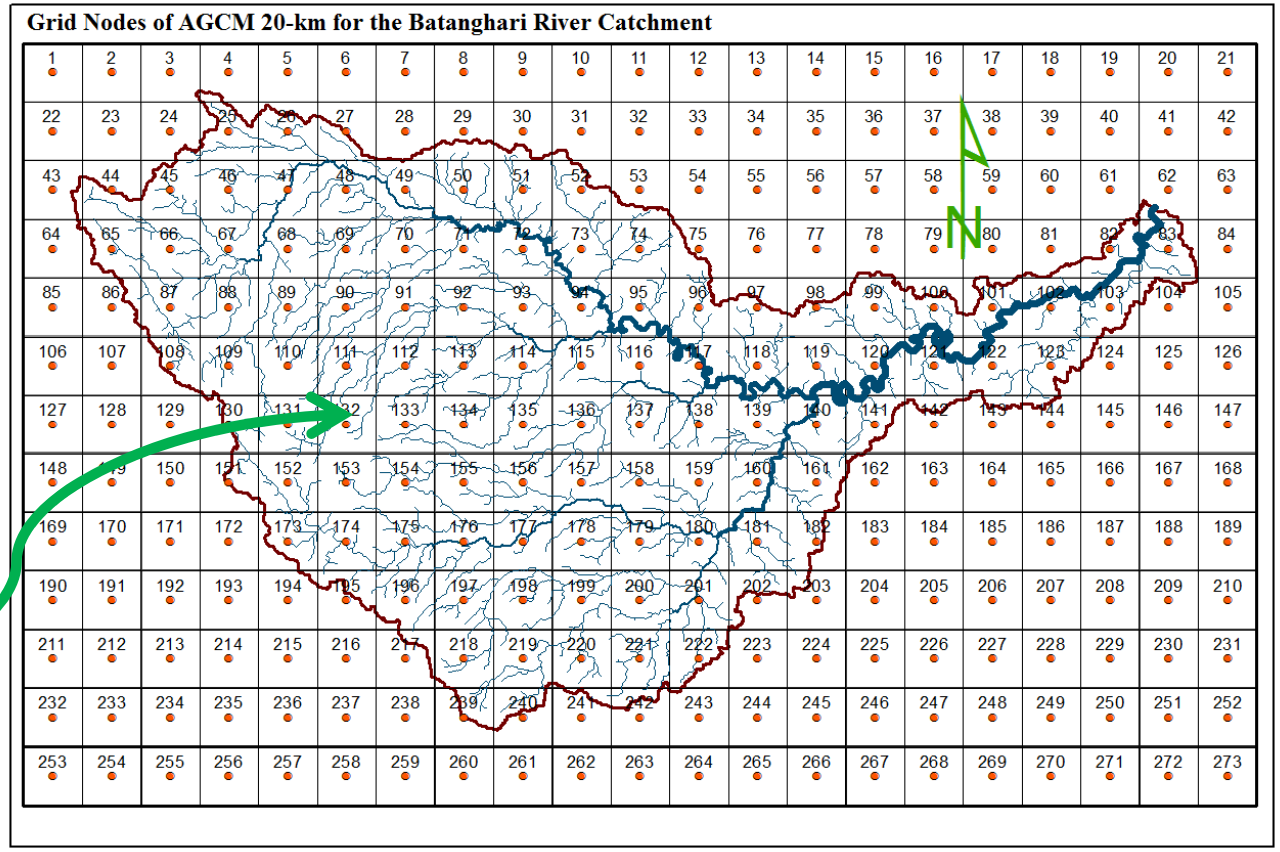
II. METHODOLOGY

Climate Projection Data



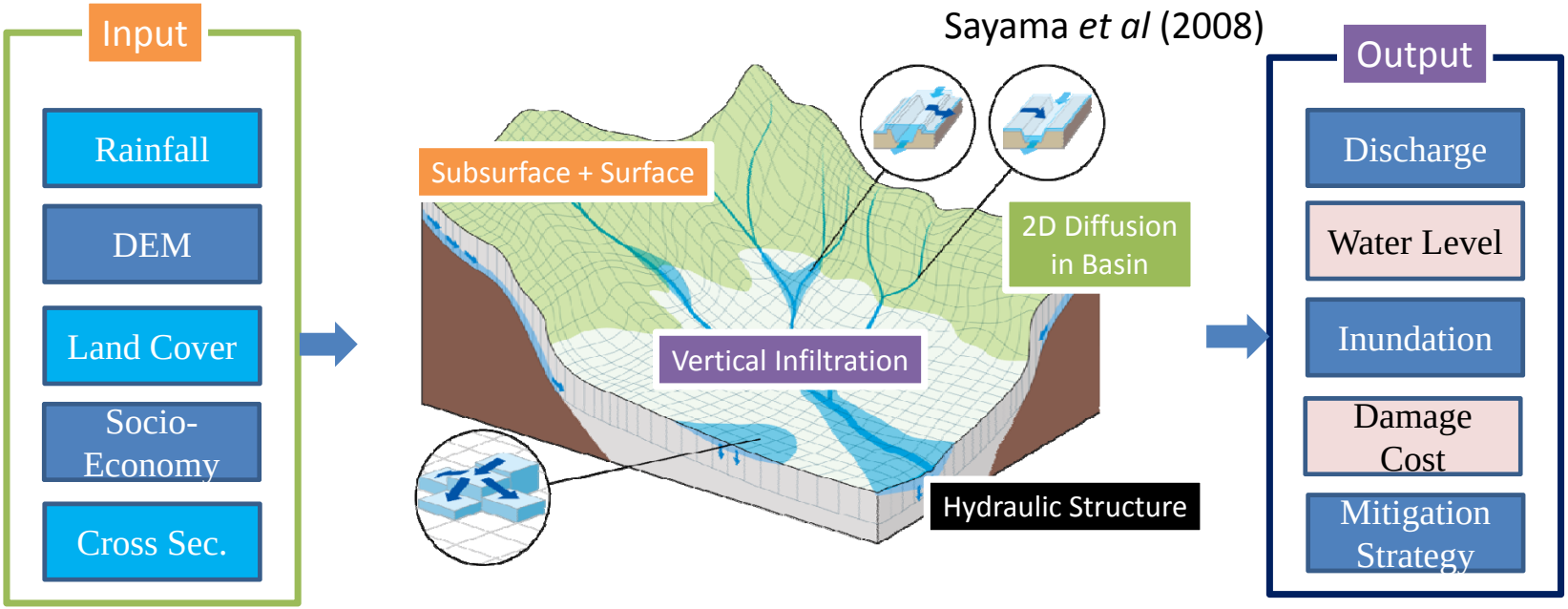
MRI-AGCM 20-km Products (hour/day/month/year):

1. **Rainfall**
2. **Air Temperature**
3. **Wind**
4. **Relative Humadity**



II. METHODOLOGY

Rainfall-Runoff-Inundation Model



Shallow water equations for typical 2D inundation

Mass balance equation

$$\frac{\partial h}{\partial t}+\frac{\partial q_x}{\partial x}+\frac{\partial q_y}{\partial y}=r$$

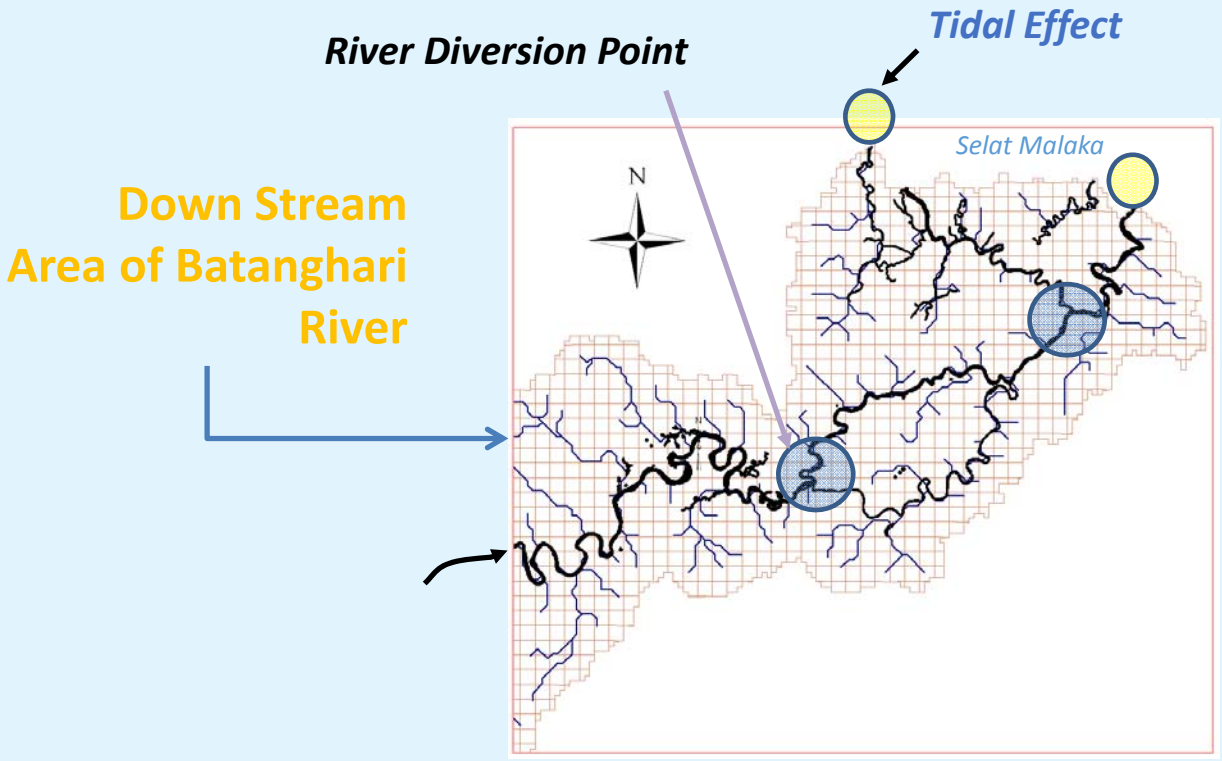
Momentum equations

$$\frac{\partial q_x}{\partial t}+\frac{\partial u q_x}{\partial x}+\frac{\partial v q_x}{\partial y}=-gh\frac{\partial H}{\partial x}-\frac{\tau_x}{\rho_w}$$

$$\frac{\partial q_y}{\partial t}+\frac{\partial u q_y}{\partial x}+\frac{\partial v q_y}{\partial y}=-gh\frac{\partial H}{\partial y}-\frac{\tau_y}{\rho_w}$$

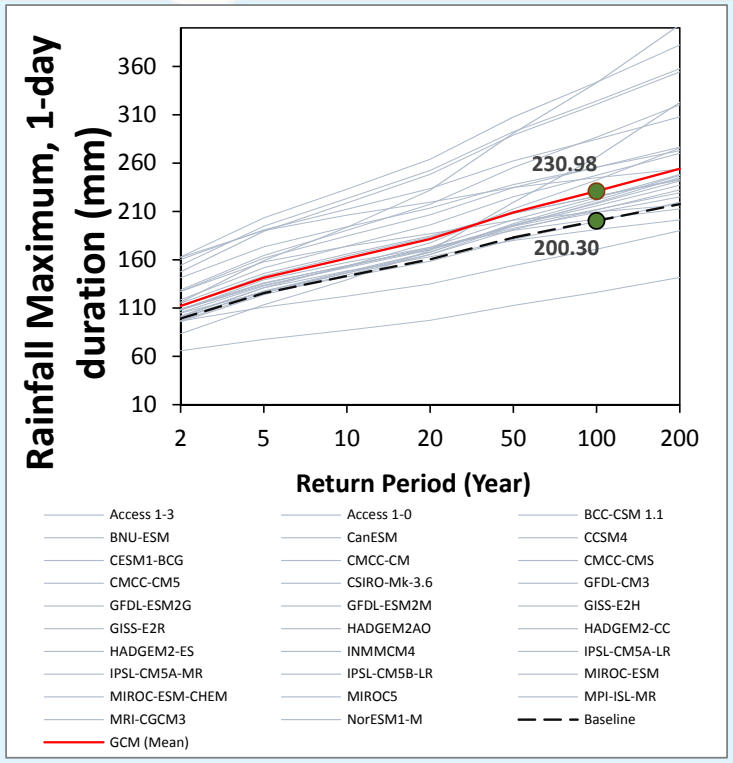
Rainfall-Runoff-Inundation Model

Considers Coastal Tidal Wave, River Diversion, and Embankment

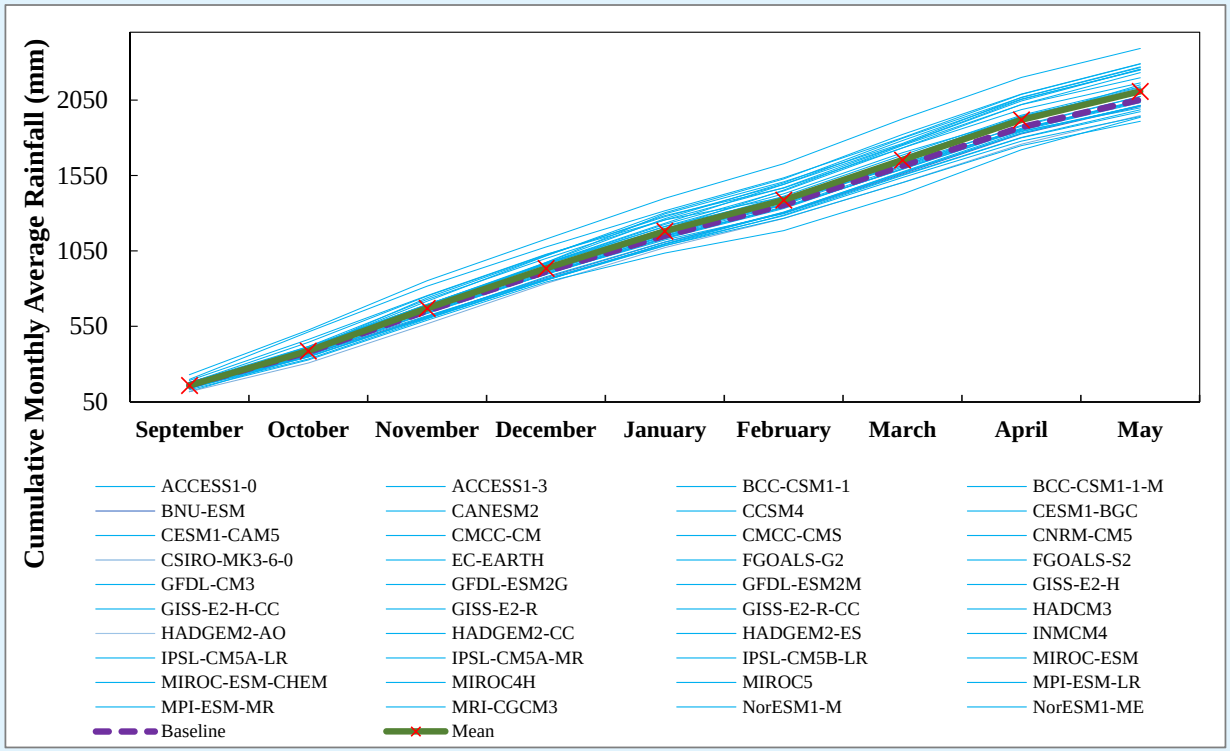


III. PRIMARY RESULTS

Extreme Rainfall Projection



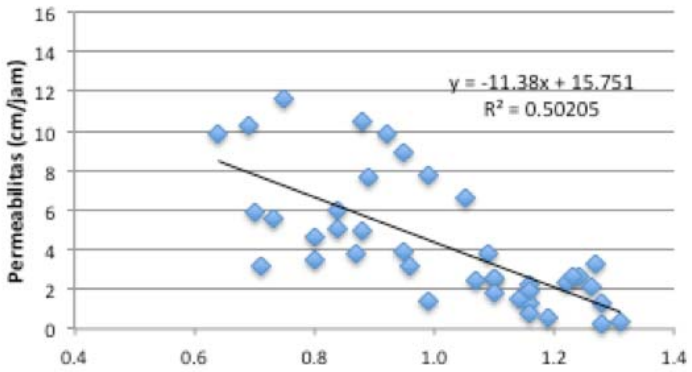
Projection of Seasonal Rainfall (Rainy)



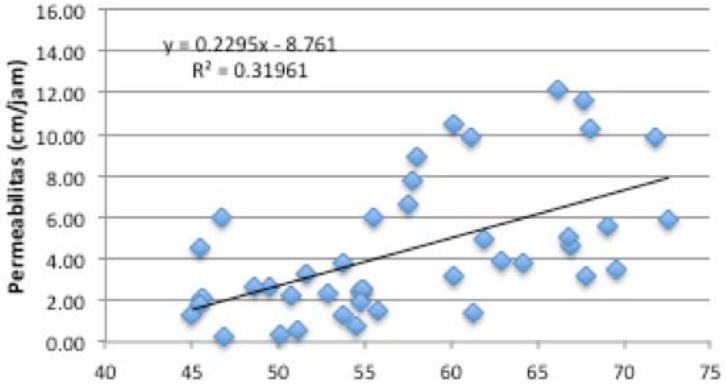
There is a signal that the monthly rainfall amount will increase during rainy season for the future climate condition

III. PRIMARY RESULTS

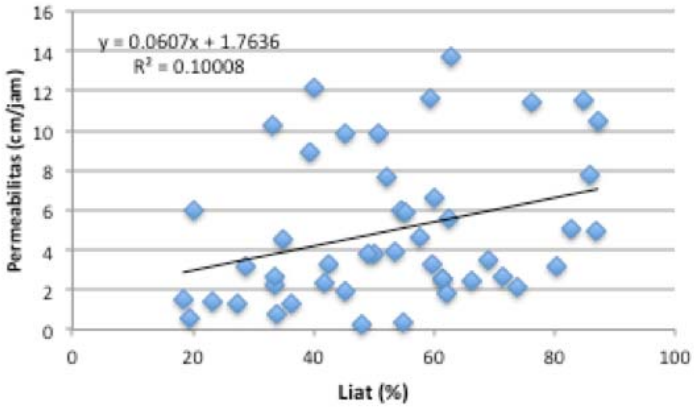
The relationship between permeability (cm / hour) and other soil properties

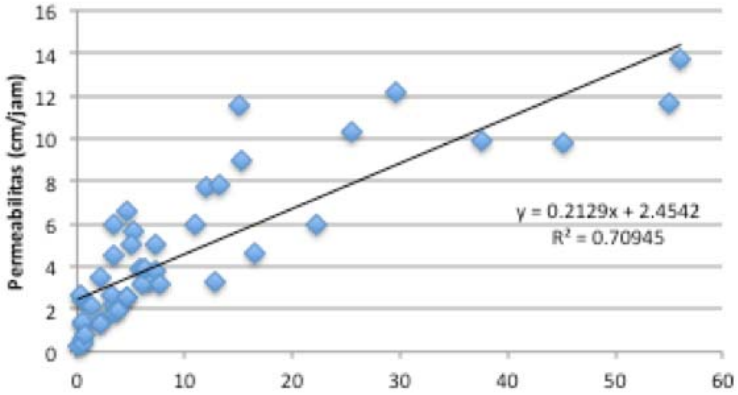


Bulk Density (g/cc)



Porosity (%)

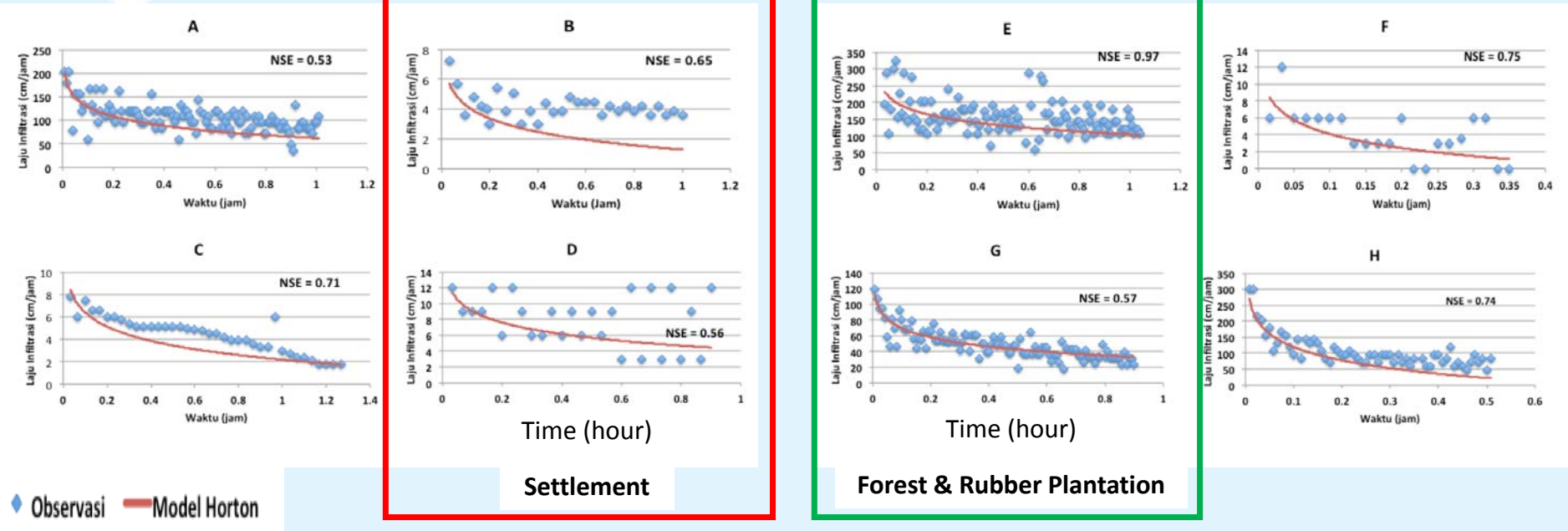




Organic Matter (%)

III. PRIMARY RESULTS

Infiltration Rate (mm/hour)



Landuse information: **A (mixed garden), B and D (settlement), C (shrub), E (city forest), F (bare land), G and H (rubber plantation)**

- NSE efficiency test results ranged from 0.53 – 0.97
- Infiltration rate highly influenced by soil types and land uses

III. PRIMARY RESULTS

Landuse Changes

The primary data used in this study was Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper + (ETM+) and Landsat 8 Operational Land Imager (OLI) with spatial resolution of 30 m. The satellite data was collected from year 1990, 1997, 2005 and 2015.

No	Land Use	Description
1	Water body	River and lakes
2	Settlement	Residential area, industrial area, transportaion and facilities
3	Agricultural land	Paddy field, dry land plantation includes rubber and oil palm plantation
4	Bush	Bush, shrub
5	Openland	Open land, abandoned land which exposed soil
6	Forest	National parks, mangrove forest, mixed forest