How significant is irrigation for flood inundation modelling in deltas?

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Background

Deltas are home to approximately 7% of world population[1] and are under numerous threats[2,3] – one being flooding[4]. This work fits within my PhD work to improve flood inundation modelling in data-sparse deltas. Initial focus has been on the Mekong Delta in Vietnam/Cambodia, where a LISFLOOD-FP[5] model has been built to assess model skill and next steps to improve flood inundation modelling for such regions[6].

One conclusion from this study is that the complex human interaction with delta needs to be included. The Mekong Delta has been described as the 'Rice Basket' of SE Asia[7], with it's importance for the hydrology recognised[8,9]. Rapid changes in rice cropping patterns[10], upstream damming[11] and salinization[12] make this issue highly dynamic. Flooding in deltas is essential for agricultural productivity, so a need to distinguish between *good* and *bad* flooding is paramount, thus shifting the paradigm of typical flood studies focusing on the negative aspects.

Figure 1: Included and excluded channel in current LISFLOOD-FP model and delineation of paddies

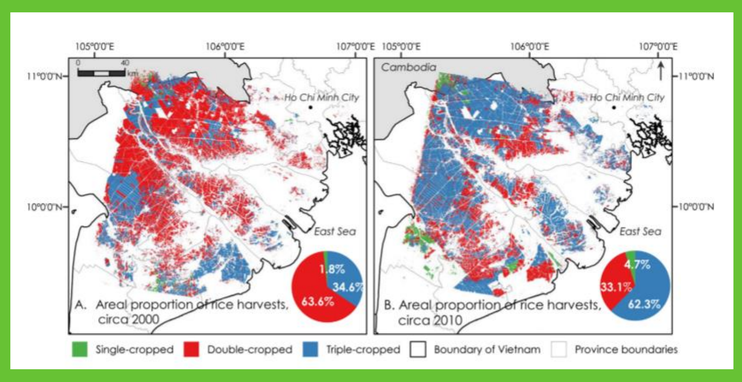


Figure 2: Changes in Rice cropping patterns in the Mekong[13]

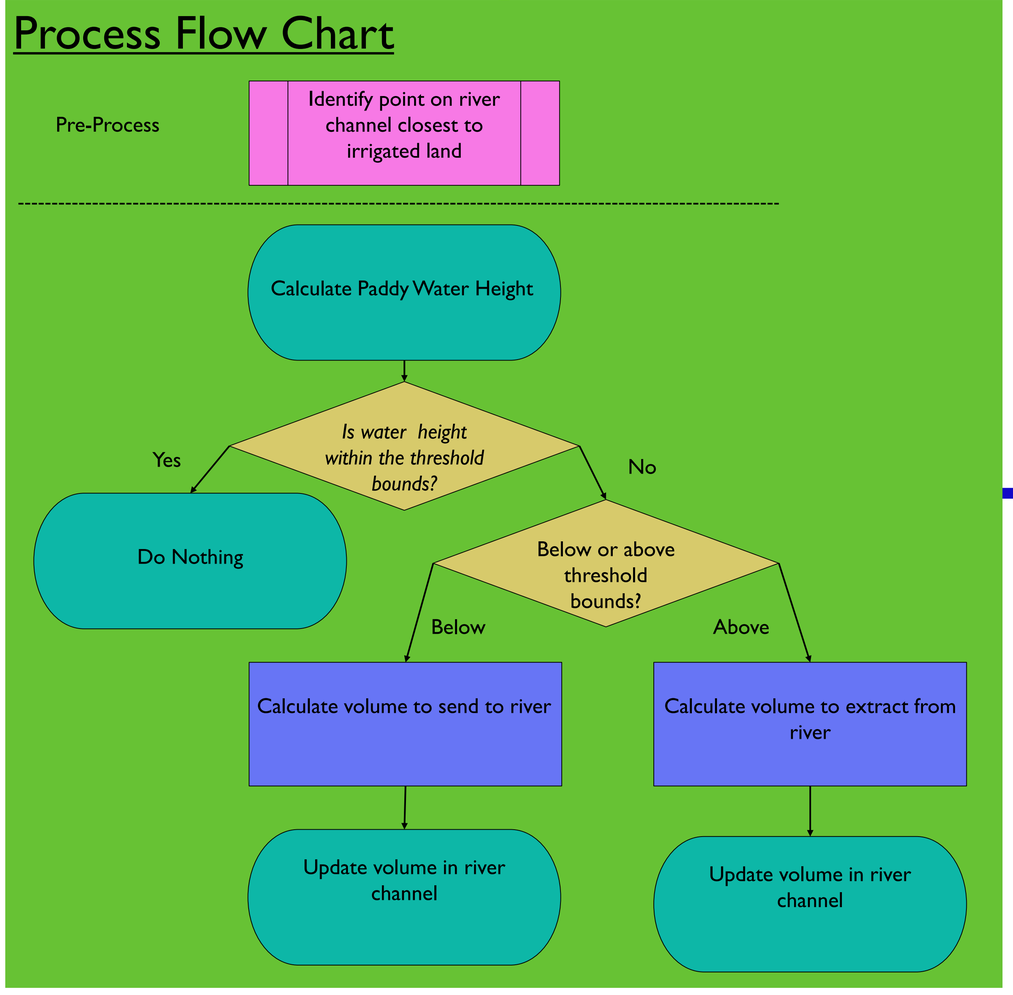
Aims

Main Aim: Introduce an irrigation scheme into LISFLOOD-FP

Why?

- Paddies are widespread in deltas
- Help distinguish between good and bad flooding
- Proxy for missing channels in the model
- Improve runoff processes

Process Flow Chart



Design

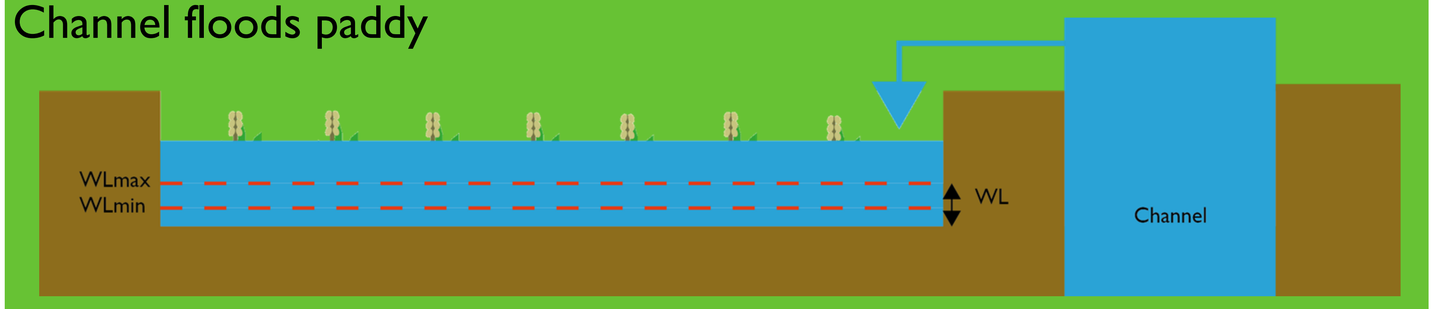
First a paddy water balance scheme is needed. This will include rainfall, evapotranspiration and infiltration. More complex parameters such as deep percolation, root extraction, seepage and groundwater flow will be ignored for simplicity. Note that the paddy appears flooded but this is good when within water level thresholds. WL = Water Level in paddy

Paddy Water Balance

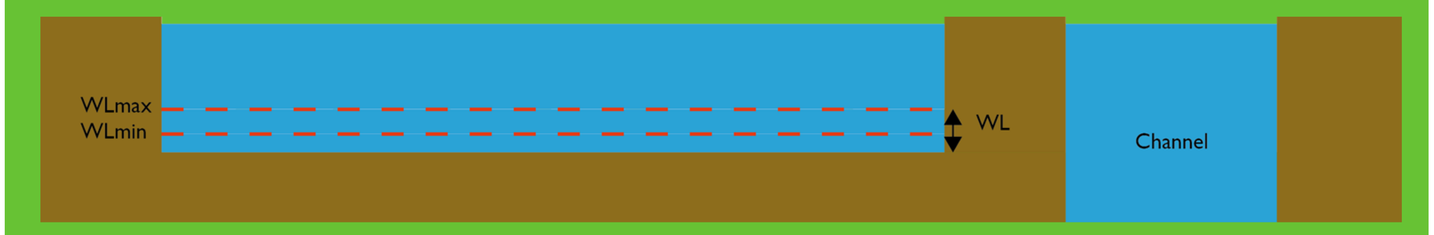
$WL = (WL^{t-1} + Rainfall) - (Evapotranspiration + Infiltration)$

if WL > WLmax	Vout = (WL-WLmax) x Paddy Area
if WL < WLmin	Vin = (WLmin-WL) x Paddy Area
if WL < WLmax & WL > WLmin	Do Nothing

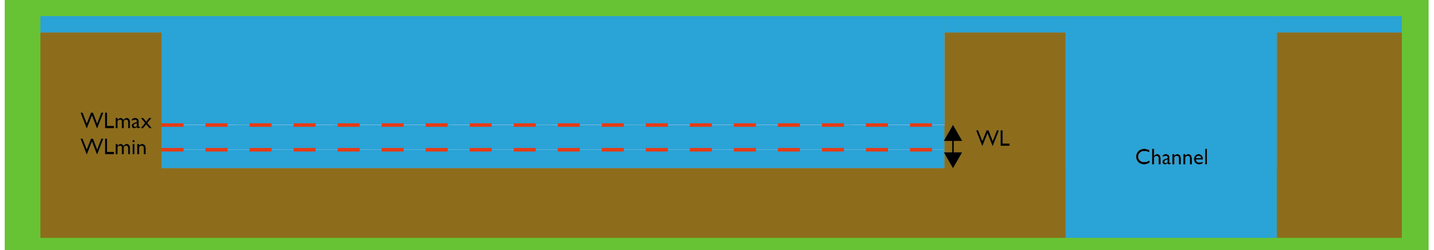
Channel floods paddy



Paddy acts as attenuation (crop may be damaged)

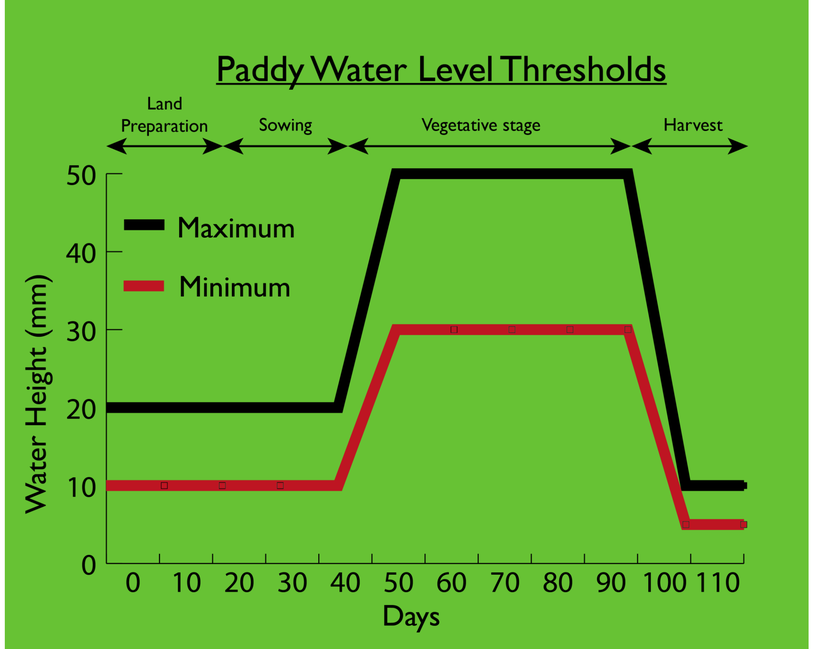


Total Flood (bad flooding)



Input data

Example Paddy Water Thresholds



Next Steps

- Complete coding
- Test on Mekong Delta
- Distinguish between groundwater fed and river channel fed irrigated