

MRC Workshop, Vientiane, Lao PDR, 21 – 22 October 2008

1. Monitoring land use change with remote sensing data: Application to sediment yield modeling
2. Remote sensing of turbidity and suspended sediment


Regional Workshop on Discharge and Sediment Monitoring and Geomorphological Tools for the Lower-Mekong Basin,  
Mekong River Commission, Vientiane, Lao PDR, 21 – 22 October 2008


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**Monitoring land use change with remote sensing data: Application to sediment yield modeling**

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**Some factors affecting sediment yield**


- Loss of vegetation cover
- Soil type
- Precipitation: when, where, how much
- Slope gradient

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**Use of remote sensing data**

- Vegetation cover
  - Relatively easy to map using vegetation indices
- Soil type
  - Not easy
- Precipitation
  - Spaceborne radar instrument
  - E.g. TRMM (Tropical rainfall monitoring mission)
- Slope gradient
  - SRTM (Shuttle radar terrain mission) provides DEM at 90 m postings, available for free
  - Generate DEM using stereo pairs of high resolution satellite images

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**ELSEVIER**  **GEOMORPHOLOGY**


Geomorphology 44 (2002) 221–239  
www.elsevier.com/locate/geomorph

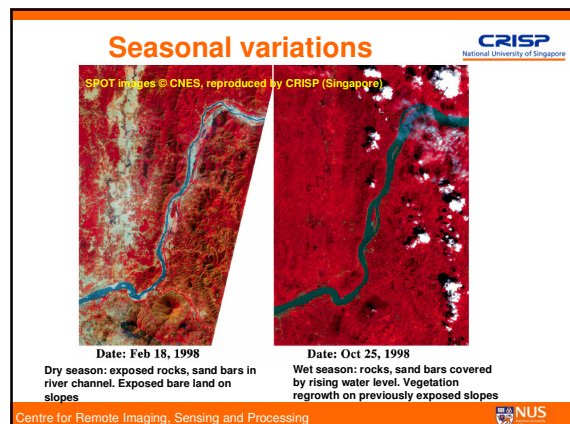
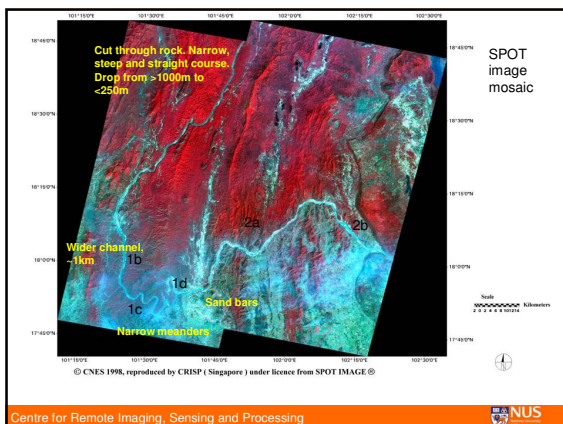
**Evaluation of part of the Mekong River using satellite imagery**

Avijit Gupta<sup>a,\*</sup>, Lim Hock<sup>b</sup>, Huang Xiaojing<sup>b</sup>, Chen Ping<sup>b</sup>

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<sup>b</sup>Centre for Remote Imaging, Sensing and Processing, National University of Singapore, Singapore 119260, Singapore

Received 5 March 2000; received in revised form 24 November 2000; accepted 19 October 2001

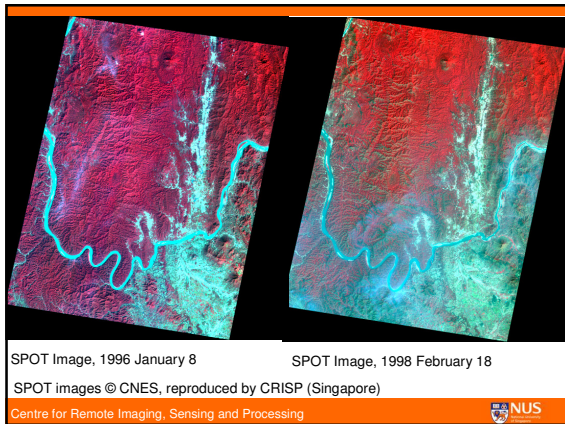
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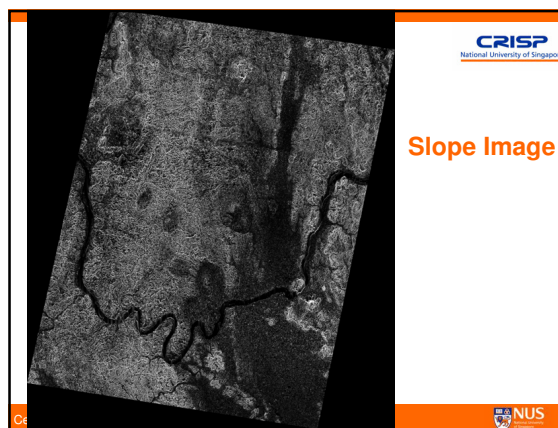
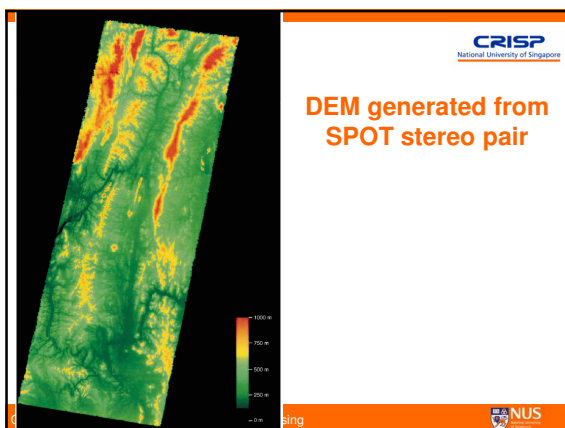
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### Mapping Parameters

- Land cover change, change in vegetation cover
- Slope of land where vegetation loss occurred
- River channel width, change in time
- Sediment in river channel
- Sand bars in river channel

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### Observations

- More vegetation depletion area observed in the Feb 1998 image.
- A large proportion (24.2%) of the cleared land has steep to very steep slopes ( $>25^\circ$ ).
- Vegetation depletion was observed mainly in the eastern side, but new vegetation began to regenerate in the southern and middle part of the image.

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### Observations

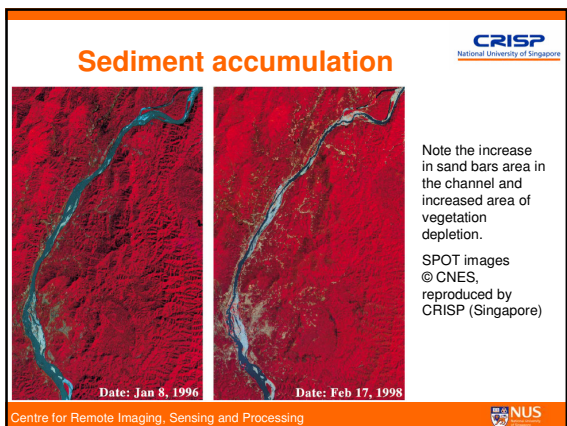
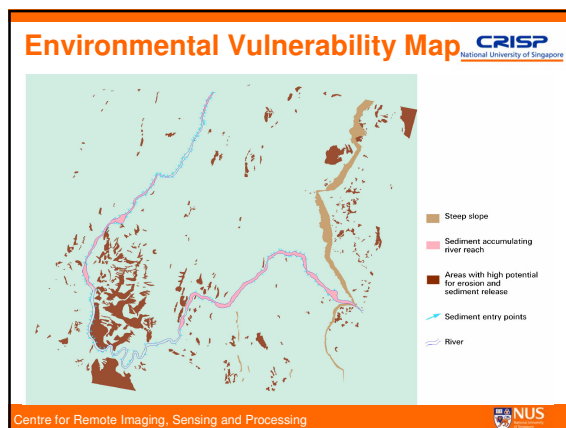
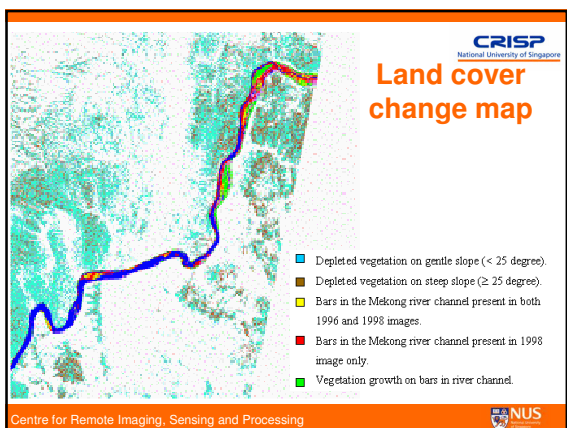
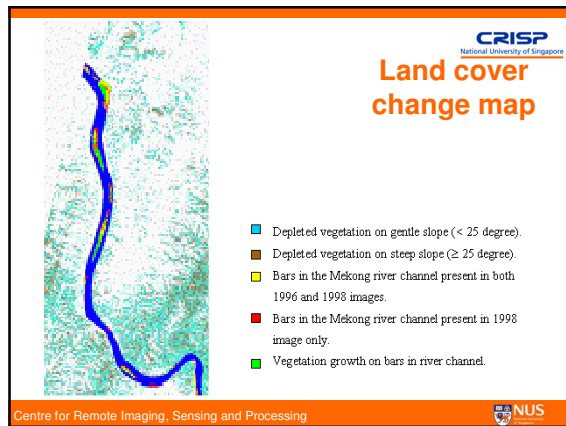
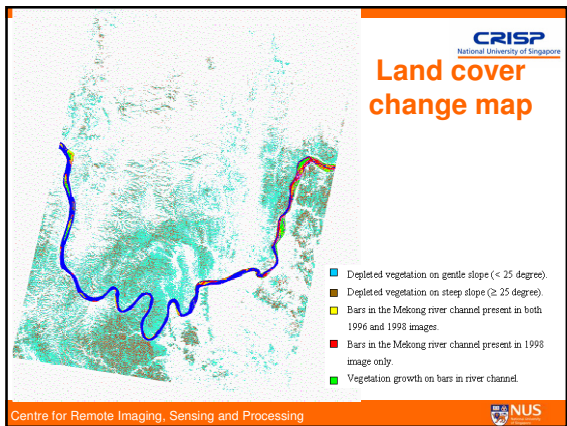
- Growth of bars in the Mekong river channel was observed.
- Land clearing on steep slope is vulnerable to erosion and sediment transfer during the wet monsoon periods. The sediments will eventually reach the Mekong river channel.

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## Remote Sensing of Water Turbidity and Suspended Sediment

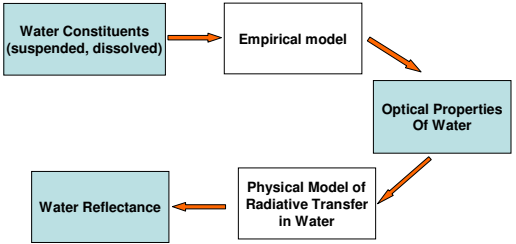
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## Reflectance and water quality parameters



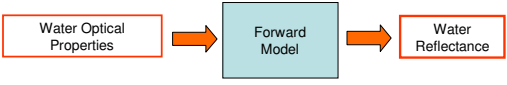
```

    graph TD
      A[Water Constituents (suspended, dissolved)] --> B[Empirical model]
      B --> C[Optical Properties Of Water]
      C --> D[Physical Model of Radiative Transfer in Water]
      D --> E[Water Reflectance]
  
```

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## Forward Modeling



```

    graph LR
      A[Water Optical Properties] --> B[Forward Model]
      B --> C[Water Reflectance]
  
```

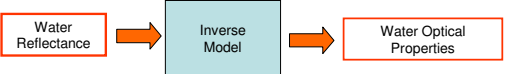
Computed reflectance spectrum  $R(\lambda)$

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## Inverse Modeling

Measured reflectance spectrum  $R(\lambda)$



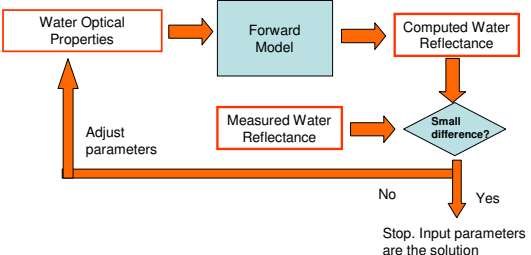
```

    graph LR
      A[Water Reflectance] --> B[Inverse Model]
      B --> C[Water Optical Properties]
  
```

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## Spectral fitting method



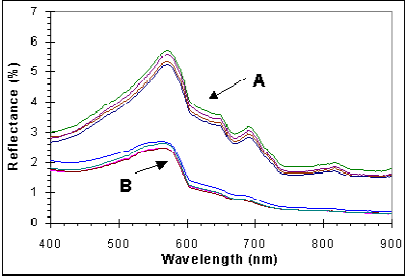
```

    graph TD
      A[Water Optical Properties] --> B[Forward Model]
      B --> C[Computed Water Reflectance]
      D[Measured Water Reflectance] --> E{Small difference?}
      E -- No --> F[Adjust parameters]
      F --> A
      E -- Yes --> G[Stop. Input parameters are the solution]
  
```


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## Typical Coastal Waters Reflectance Spectra



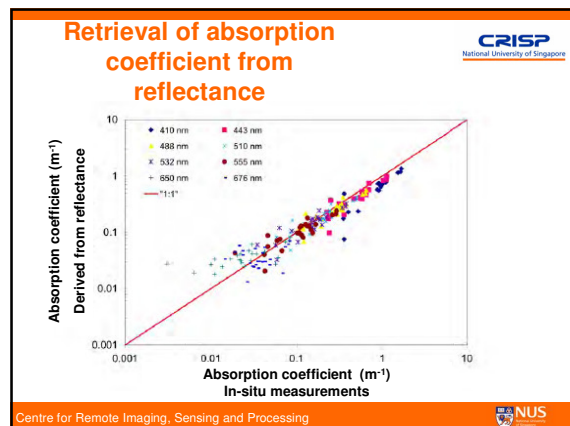
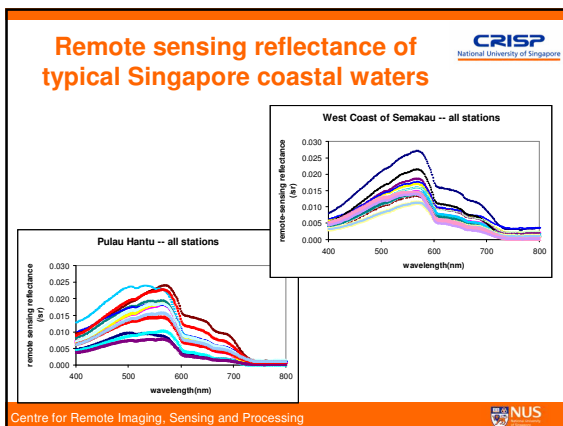
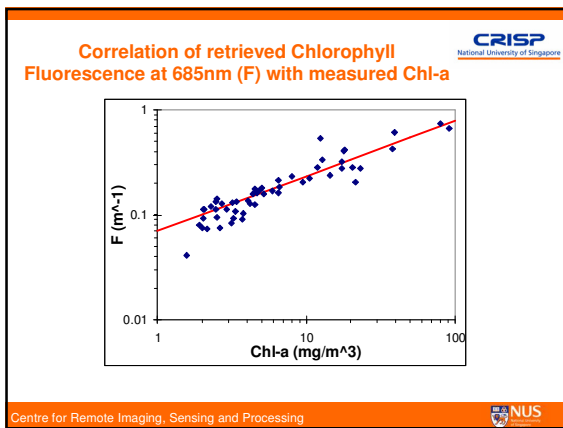
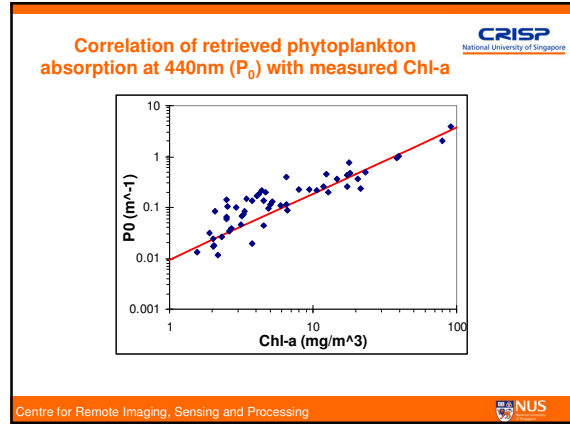
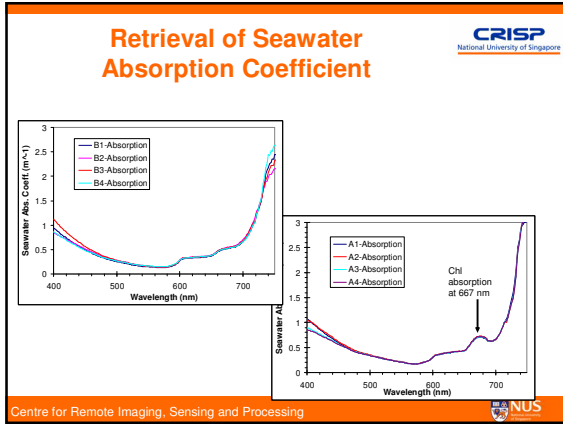
(A) Chl-a = 17.4 mg/m<sup>3</sup>, TSS = 74.1 g/m<sup>3</sup>  
(B) Chl-a = 3.8 mg/m<sup>3</sup>, TSS = 2.3 g/m<sup>3</sup>.

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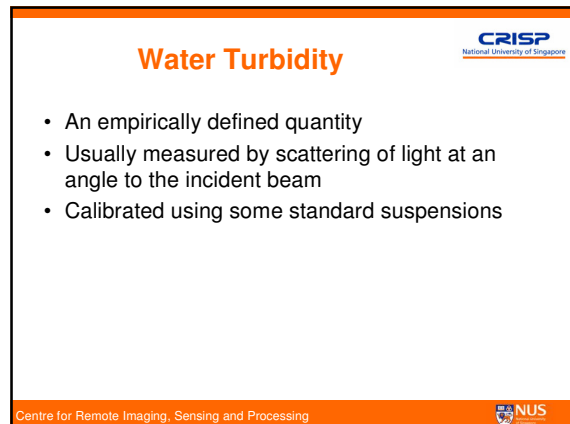
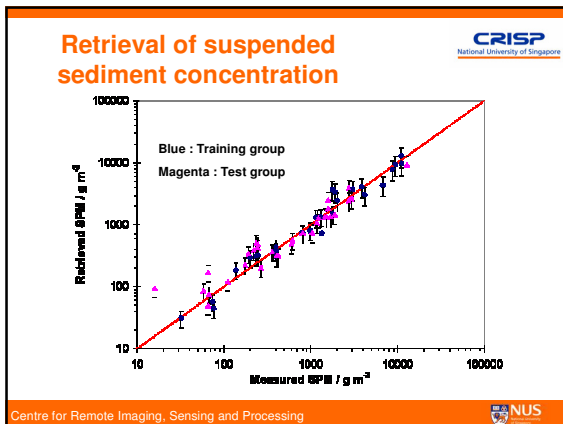
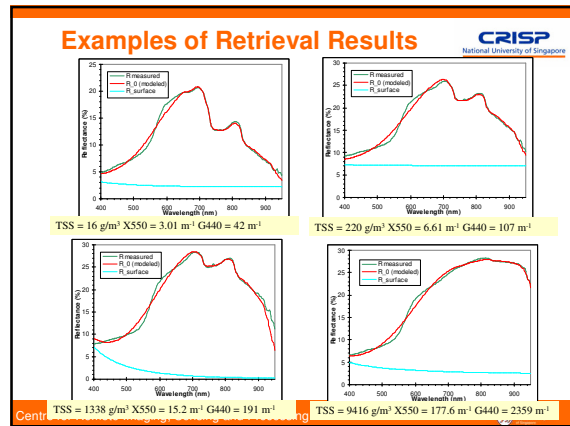
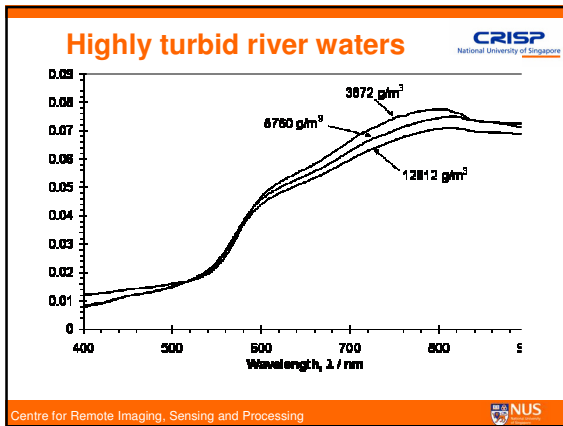
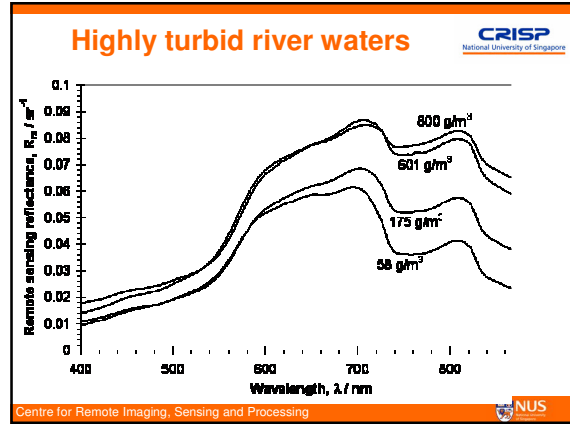
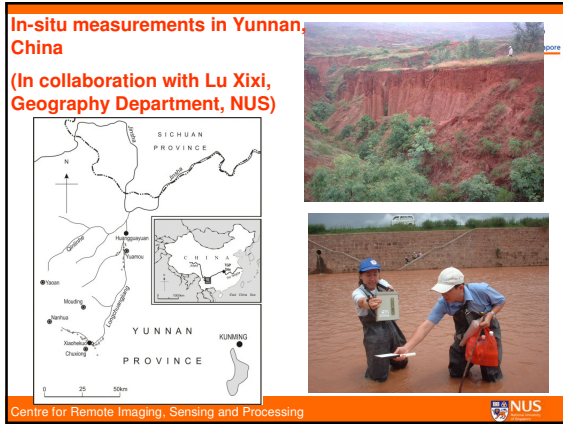


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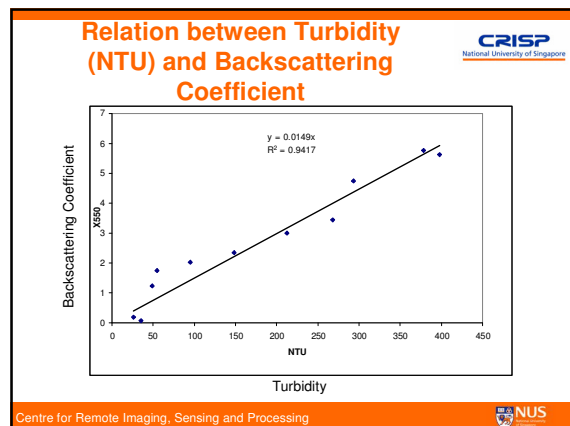
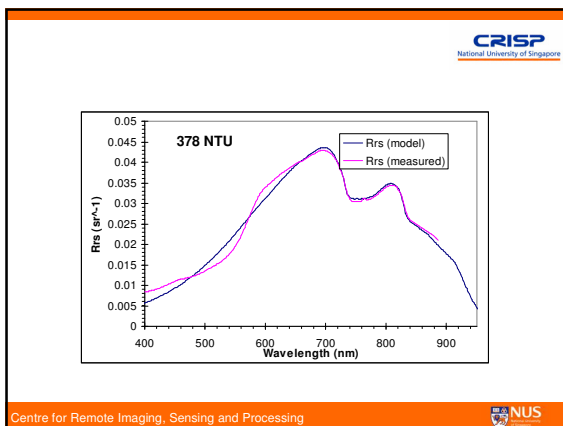
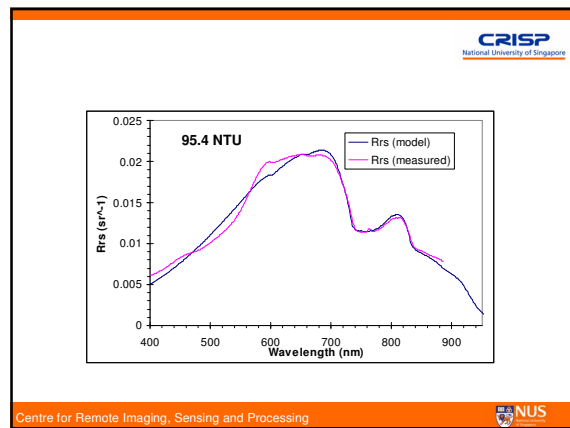
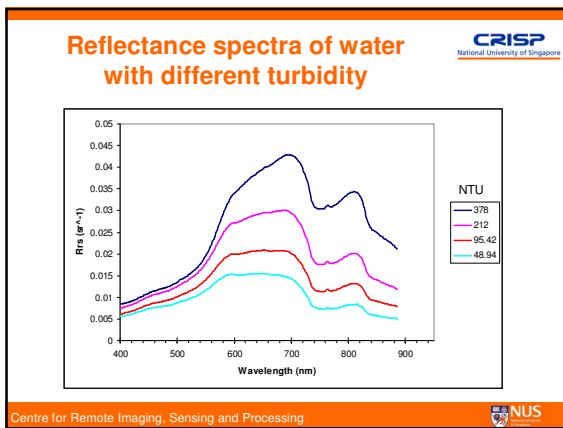
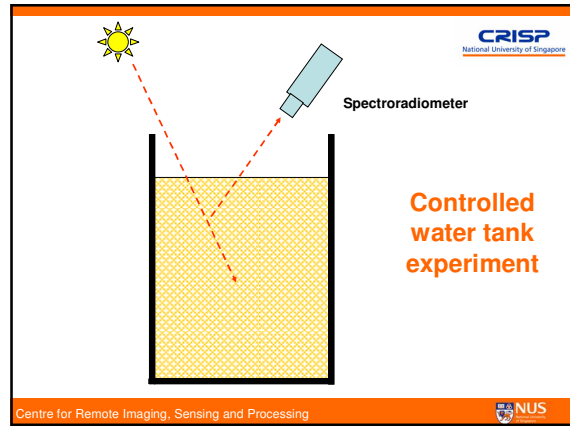
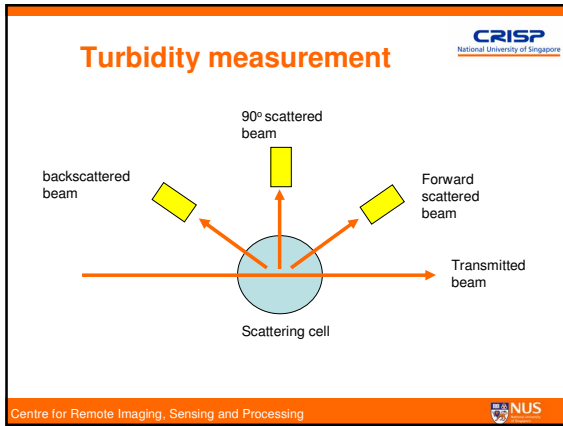
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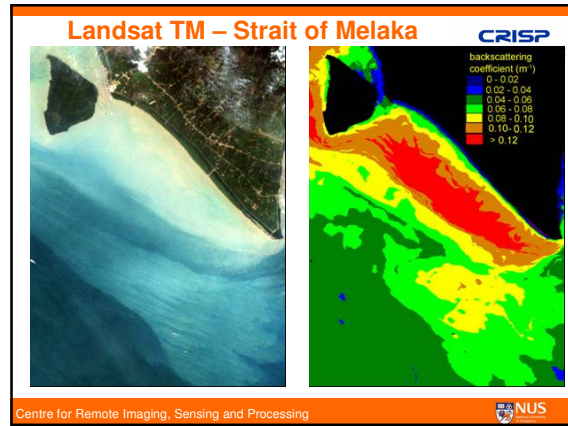
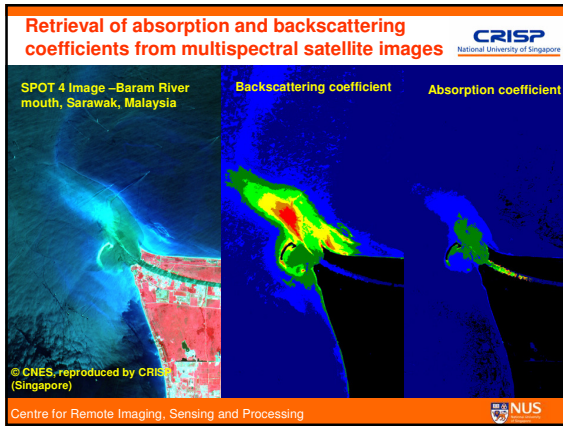
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