Characterizing Water Quality of Pit Lake through Modeling

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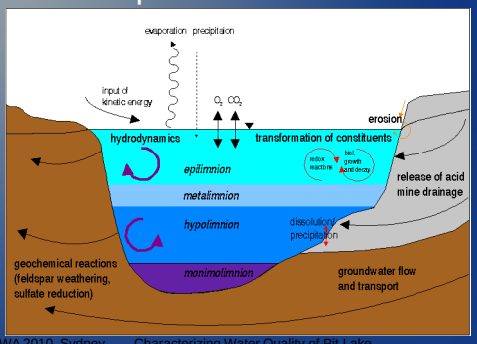
Introduction

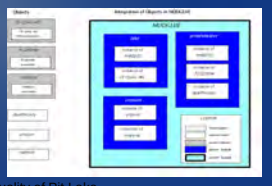
- Pit lake water quality is a problem
- Many processes and influences
- Modeling is complicated and feedback between processes are important
- A inter-disciplinary approach is needed
- A model that can account for all important processes and their feedback loops is required

Important Processes



The Model

- Coupled model
- CE-QUAL-W2
  - Hydrodynamics
  - Water quality in natural lakes
- PHREEQC
  - Chemistry
- PCGEOFIM, MODMST
  - Groundwater exchange
- Additional modules
  - Erosion
  - Sediment release
  - Treatment



Model Setup

- Lake is 2D with branches
- Water quality with PHREEQC

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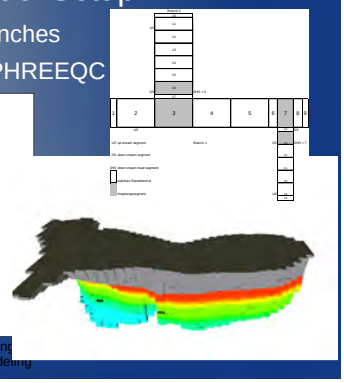
TITLE Example 1.--Add uranium and speciate
seawater.
SOLUTION 1  SEAWATER FROM NORDSTROM ET AL.
(1979)
        units   ppm
        pH      8.22
        pe      8.451
        density 1.023
        temp    25.0
        redox   O(0)/O(-2)
        Ca              412.3
        Mg              1291.8
        Na              10768.0
        K               399.1
        Fe              0.002
        Mn              0.0002  pe
        Si              4.28
        Cl              19353.0
        Alkalinity      141.682 as HCO3
        S(6)            2712.0
        N(5)            0.29    gfw   62.0
```



Applications

- Applied to lakes in Germany and Australia
- Different tasks
  - Hydraulic conditions
  - Water quality prediction
  - Water quality treatment
  - Density driven inflows

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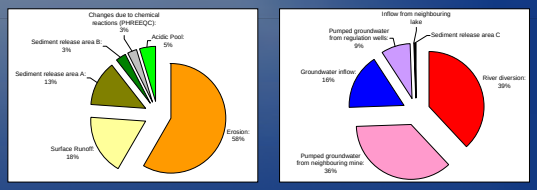
Results

- Percentages of sources of acidity
  - Due to inflows
  - Due to internal sources



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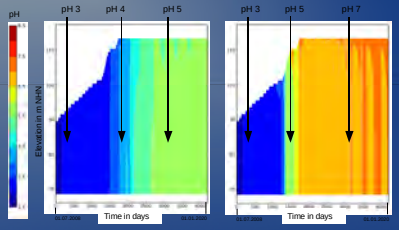
Results II

- Development of water quality over time and space



river diversion, no technical initial neutralisation

river diversion, technical initial neutralisation

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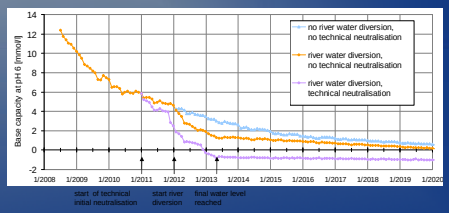
Results III

- Base capacity for different scenarios



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Conlusions

- The model can account for all important processes and their feedback
- Applications at lakes at different locations yielded good results
- Useful different type of tasks
- Application for other locations and types of tasks is possible
- If necessary features may be added or modified