Tables

**Table 1: Flow and transport parameters used in Case 1**

|  |  |
| --- | --- |
| Flow simulation | Transient state |
| Total simulation time (days) | 10 |
| Stress period | 1 |
| Time steps | 100 |
| Grid spacing (m) | 5×5×5 |
| Model length (m) | 150 |
| Model width (m) | 5 |
| Model height (m) | 5 |
| Starting head (m) | 100 |
| Porosity | 0.3 |
| Specific storage (m-1) | 0.0001 |
| Longitudinal dispersivity (m) | 10 |
| Injection rate per well (m3/d) | 50 |
| Pumping rate per well (m3/d) | 45 |

**Table 2: Data assimilation related parameters used in different cases**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Case name | Dimension | Number of ensemble (*Ne*) | Number of assimilation step (*Ns*) | Optimize or not | Number of optimal sampling locations |
| Case 1 | 1 | 300 | 10 | Y | 2 |
| Case 2 | 2 | 100 | 10 | Y | 2 |
| Case 3 | 2 | 50 | 10 | Y | 2 |
| Case 4 | 2 | 300 | 10 | Y | 2 |
| Case 5 | 2 | 500 | 10 | Y | 2 |
| Case 6 | 2 | 1000 | 10 | Y | 2 |
| Case 7 | 2 | 100 | 10 | Y | 1 |
| Case 8 | 2 | 100 | 10 | Y | 5 |
| Case 9 | 2 | 100 | 10 | Y | 10 |
| Case 10 | 2 | 100 | 10 | Y | 20 |
| Case 11 | 2 | 100 | 10 | N | (2 fixed) |
| Case 12 | 2 | 100 | 10 | N | (10 fixed) |
| Case 13 | 2 | 100 | 10 | N | (20 fixed) |
| Case 14 | 2 | 100 | 8(50, 50)\* | Y | 2 |
| Case 15 | 2 | 100 | 8(50, 50) | Y | 5 |
| Case 16 | 2 | 100 | 12(20, 30, 50) | Y | 5 |
| Case 17 | 2 | 100 | 12(50, 30, 20) | Y | 5 |

\* The numbers in the parentheses are the group division of observation time, and the number in front of the parentheses is the number of assimilation steps. For example, 8(50, 50) represents that there are 8 steps in the assimilation and the observation time is divided into two groups with each group having an observation time of 50 days.

**Table 3: Flow and transport parameters used in Case 2**

|  |  |
| --- | --- |
| Flow simulation | Transient state |
| Total simulation time (days) | 100 |
| Stress period | 1 |
| Time steps | 200 |
| Grid spacing (m) | 5×5×5 |
| Model length (m) | 105 |
| Model width (m) | 65 |
| Model height (m) | 5 |
| Starting head (m) | 50 |
| Porosity | 0.3 |
| Specific storage (m-1) | 0.0001 |
| Longitudinal dispersivity (m) | 10 |
| horizontal transverse dispersivity (m) | 1 |
| Injection rate per well (m3/d) | 80 |
| Pumping rate per well (m3/d) | 120 |
| TCE injection concentration per well (mg/L) | 50 |

**Table 4: Computational costs**

|  |  |  |  |
| --- | --- | --- | --- |
| Case name | Times of model invoking | Times of GA invoking | computing time (using the same computer) |
| Case 2 | 10 | 10 | 2 h |
| Case 14 | 8 | 2 | 26 min |
| Case 15 | 8 | 2 | 26 min |
| Case 16 | 12 | 3 | 25 min |
| Case 17 | 12 | 3 | 25 min |