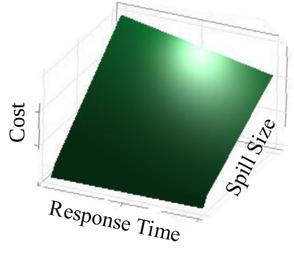
Optimization under Uncertainty: Stochastic Facility Location Model for Arctic Oil Spill Response

RQ1: What are the significant uncertain parameters for oil spill response location-allocation?

RQ2: How to quantify the uncertainties about key model variables?

RQ3: Which uncertain parameters or their combinations matter?

RQ4: What is the optimal configuration of oil spill facilities and resources



$$\boldsymbol{Max} \quad \sum_{o\in O}\sum_{e\in E}(w_1.\vartheta_o^e + w_2.\mathfrak{y}_o - w_3.t_{os}^e)\, p_e.Y_{os}^e$$

$$\lambda\sum_s \mathrm{w}_4.\mathrm{cf}_s.X_s + \sum_s w_5.cu_{sr}.Z_{sor}^e - \sum_o\sum_s\sum_r w_6.pn_{osr}.\mathrm{ef}_{\mathrm{sor}}.Z_{sor}^e$$

$$\boldsymbol{Min} \quad +\left(\sum_s\sum_o\sum_v w_7.ct.d_{so} + w_8.cp\sum_{sv}\max(t_{so}-tm,0)\right)V_{sov}^e$$

$$+\sum_s w_9.ce_o.Z_{sor}^e + \lambda\left(\frac{1}{1-\alpha}\sum_e \mathrm{p_e}.R_e\right)$$

Table 2. Strength of Evidence

Uncertain input parameters	Data		Model		J	A	SoE
	Q	Am	E	T			
Spill size							
Oil type							
Spill location							
Clean-up effectiveness							
Response time							
Response resource availability							
Weather conditions							
Economic factors							
Ecological factors							

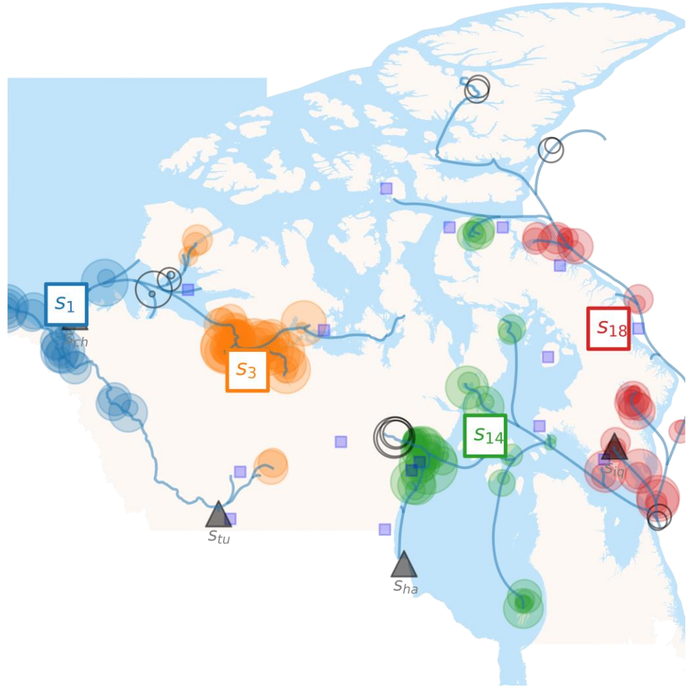


Fig 5. Cluster graph of facilities and oil spills

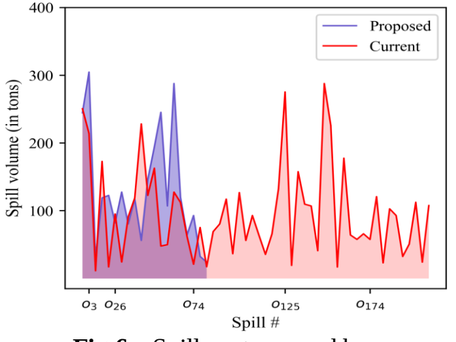


Fig 6a. Spills not covered by current or proposed facilities

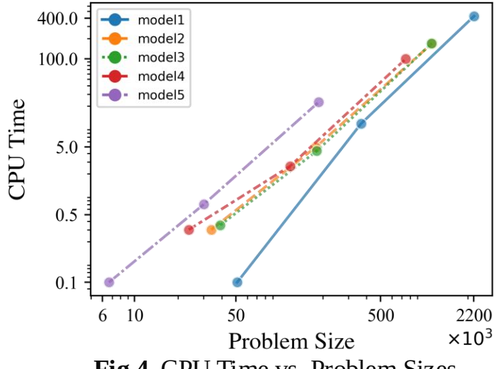


Fig 4. CPU Time vs. Problem Sizes