Future extensions of this work may look at generalizing the point Gaussian source to a dynamical system where the distribution of the source changes with time in some fashion. Another direction is to extend the problem formulation to estimate a random field where the data collected by the sensors are spatially-correlated, and/or the fading channels from the clusterheads to the FC are correlated instead of being statistically independent.

VI. APPENDIX

Proof: Lemma 3.1: Recall the c.d.f expressed in the ‘infinite-sum-series’ form given in (11). Note that when \( j = 1 \), the expression corresponds to the outage probability, i.e., \( \bar{F}_N(s_j) \equiv P_{\text{outage}} \). As \( P_{av} \to \infty \), \( s_{i,j} \to 0 \), and (11) can be simplified as,

\[
\bar{F}_N(s_j) \approx N \prod_{i=1}^N \left( \frac{m_i \lambda_i s_{i,j}}{1 + \sum_{i=1}^N m_i} \right)^{m_i} \frac{1}{\Gamma \left( 1 + \sum_{i=1}^N m_i \right)}
\]

The partial derivative of \( \bar{F}_N(s_j) \) w.r.t. \( s_{i,j} \) is given as

\[
\frac{\partial \bar{F}_N(s_j)}{\partial s_{i,j}} = \frac{\bar{F}_N(s_j)}{s_{i,j}} \frac{m_i}{s_{i,j}}
\]

Substituting (22) into the KKT conditions (10) gives

\[
\frac{\partial \Lambda_j}{\partial s_{i,j}} \left/ \frac{\partial \bar{F}_N(s_j)}{\partial s_{i,j}} \right. = \frac{\partial \Lambda_j}{\partial s_{k,j}} \left/ \frac{\partial \bar{F}_N(s_j)}{\partial s_{k,j}} \right. \\
\Rightarrow - \frac{\phi_i}{s_{i,j}^2} \bar{F}_N(s_j) m_i = - \frac{\phi_k}{s_{k,j}^2} \bar{F}_N(s_j) m_k \\
\Rightarrow P_{k,j} = \frac{m_k}{m_i} P_{i,j} \quad \forall i, k \in \{1, \ldots, N\}, j \in \{1, \ldots, L\}
\]