# Supplementary Material
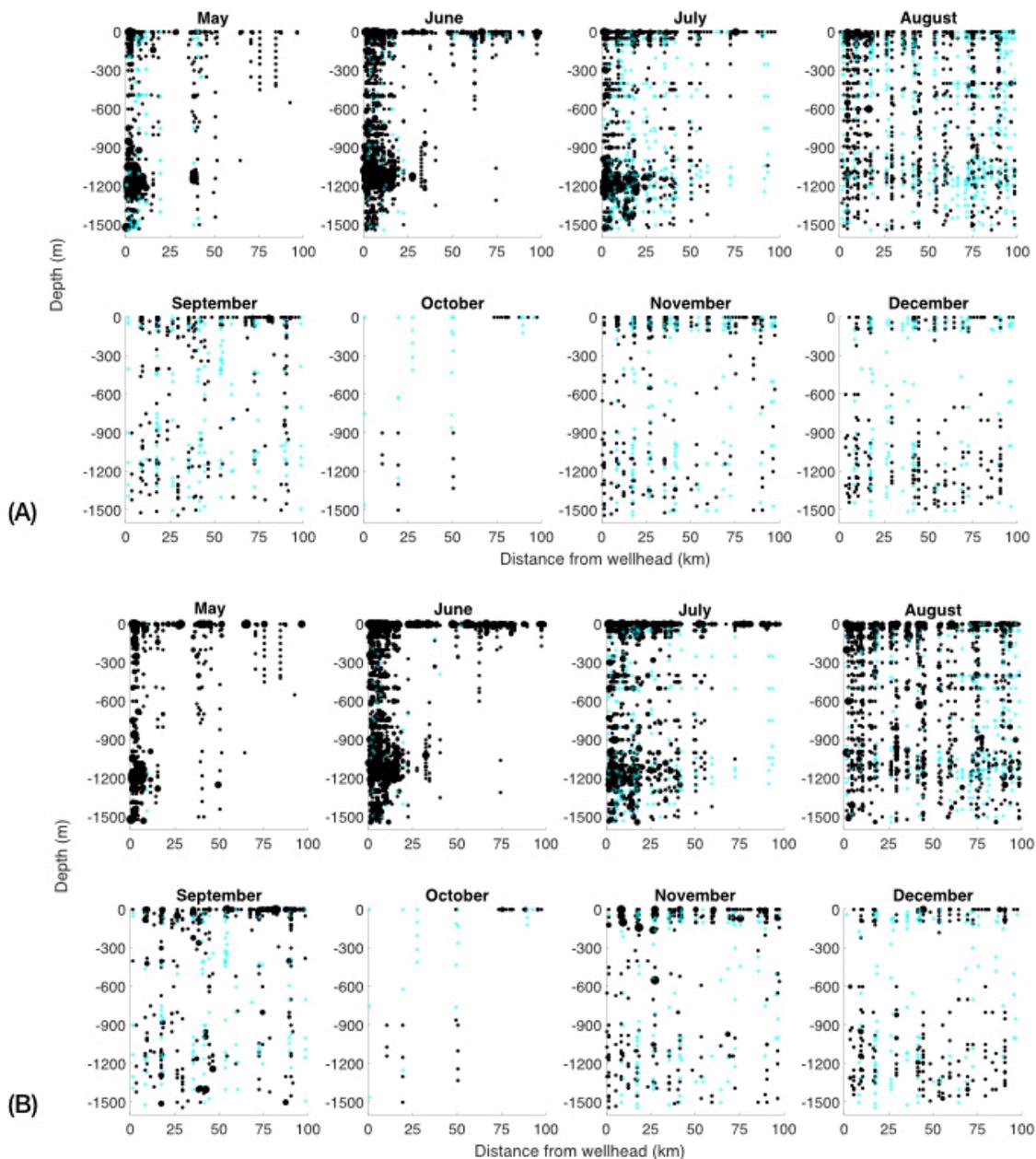


**Figure S1. Monthly distributions of oil concentrations from May to December, 2010**.
Maximum concentrations of (**a**) low (C5-C12) and (**b**) high (C13+) molecular weight
hydrocarbon fractions. Values of log (x +1) are computed into a grid of 10 m depth by 1 km bins.
Oil contaminated samples are represented by black dots scaled by concentration maximum of
58,731 µg/L and 101,777 µg/L for C5-C12 and C13+, respectively; cyan dots are
uncontaminated samples (0 µg/L); white area has no samples.
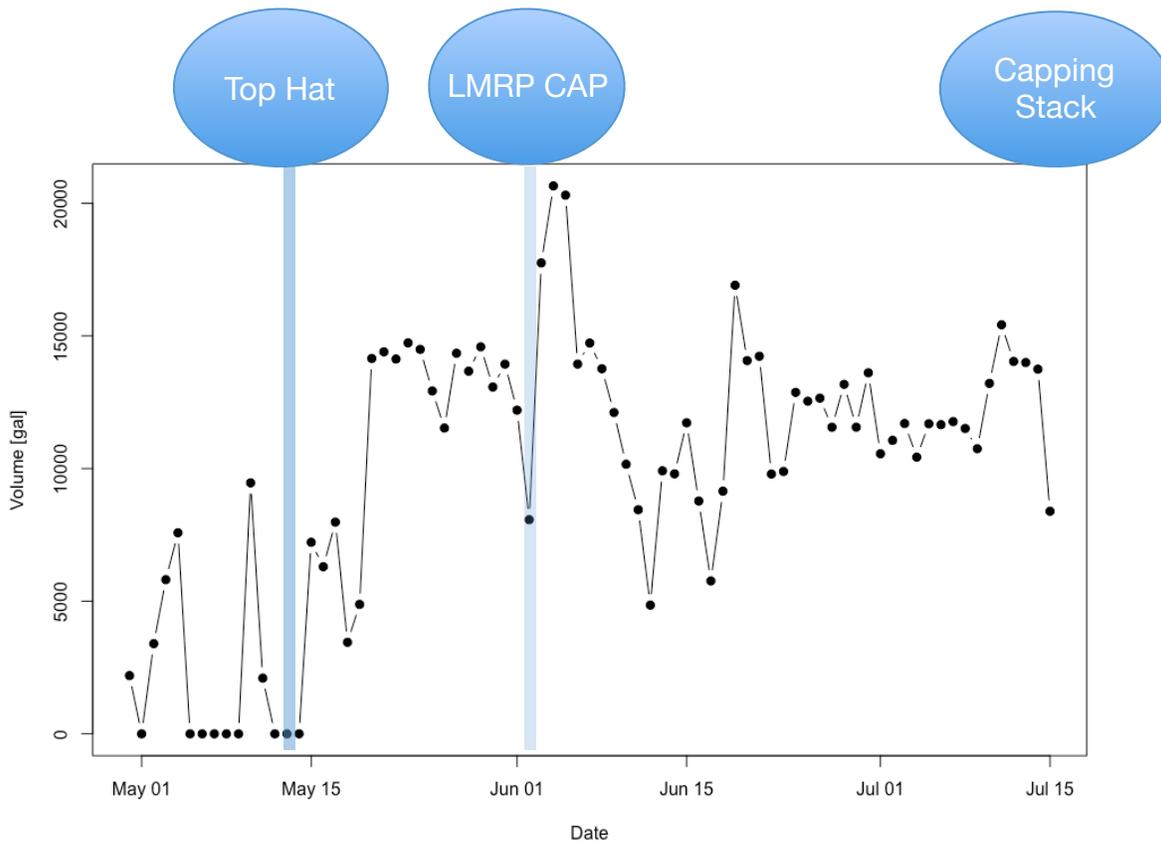
**Figure S2. Time series of sub-sea dispersant injection (SSDI)**. SSDI records from April 30, 2010 to July 15, 2010. SSDI is variable, with days of no dispersant and periods with low, intermediate and high volumes. The light blue lines correspond to the significant splits by days after the blowout in the regression tree analysis of factors explaining the spatio-temporal variance in PAH concentrations (days 23 and 42); opacity decreases with the importance of the split (see Fig.3).
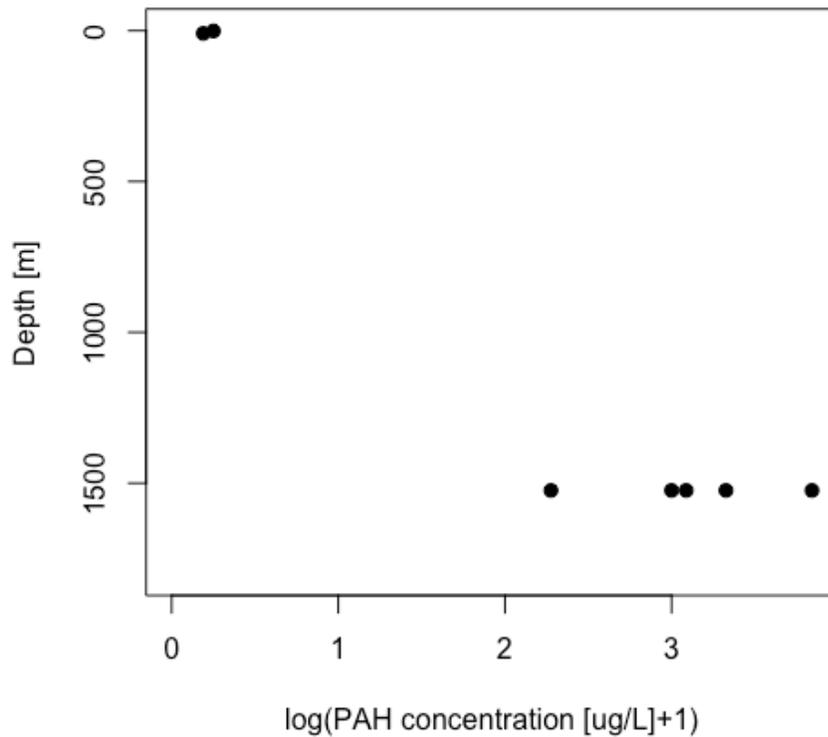
**Figure S3. Depth distribution of PAH samples taken before May 13, 2010 (day 23), corresponding to node (a) of the regression tree analysis in Figure 3**. All these samples were taken during May 5 and 12, 2010, when there was no sub-sea dispersant injection (SSDI, Figure S2). The highest PAH concentrations are below 1,000 m. Moreover, when the regression tree analysis 9Fig. 3) is run with these 7 samples excluded, the SSDI importance still remains negligible (importance: 0.04, ranked last among the explanatory variables).
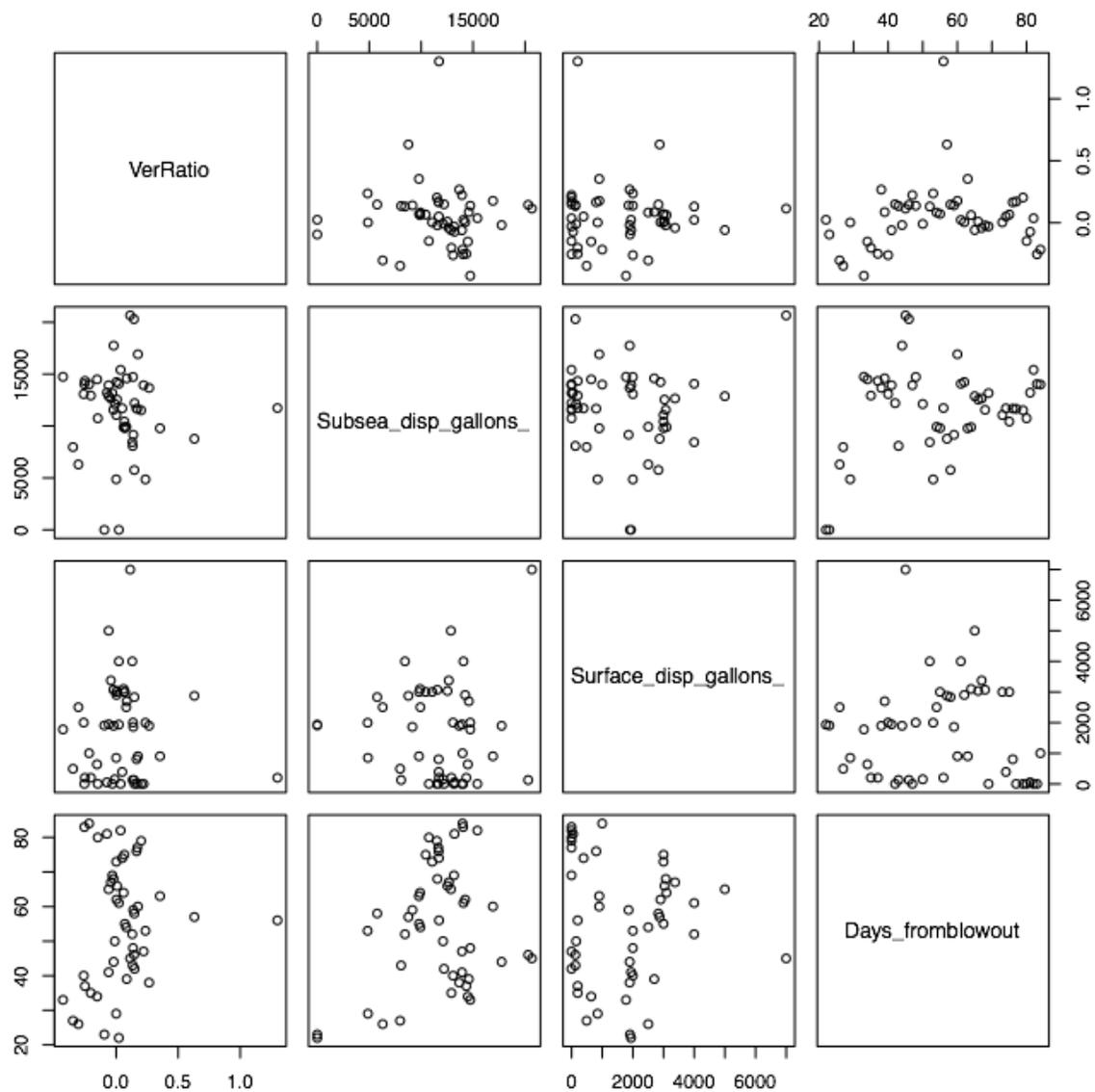
 **Figure S4. Scatterplots of the factors used in the Generalized Least Squares regression analysis** (see Table S3).

**Figure S5. The effect of volume of SSDI on the concentrations and  vertical distribution of oil**. **(a)** The linear fit of the GLS analysis represents the effect of SSDI on the vertical ratio between the mean oil concentration of the shallower layer (< 600 m) and the mean oil concentration of the deeper layer (≥ 600 m) while holding all other explanatory variables of their medians, regardless the trend that is not significant (see section 3.2) Shaded areas represent 95 % confidence regions of the GLS regression. **(b)** Scatterplot of the depth center of mass of oil concentrations and SSDI volume, between which no significant trend was detected. The data of both panels is computed within a 10 km radius from the Macondo wellhead. Oil concentrations [ug/L] were log(x+1) transformed.



a.



b.
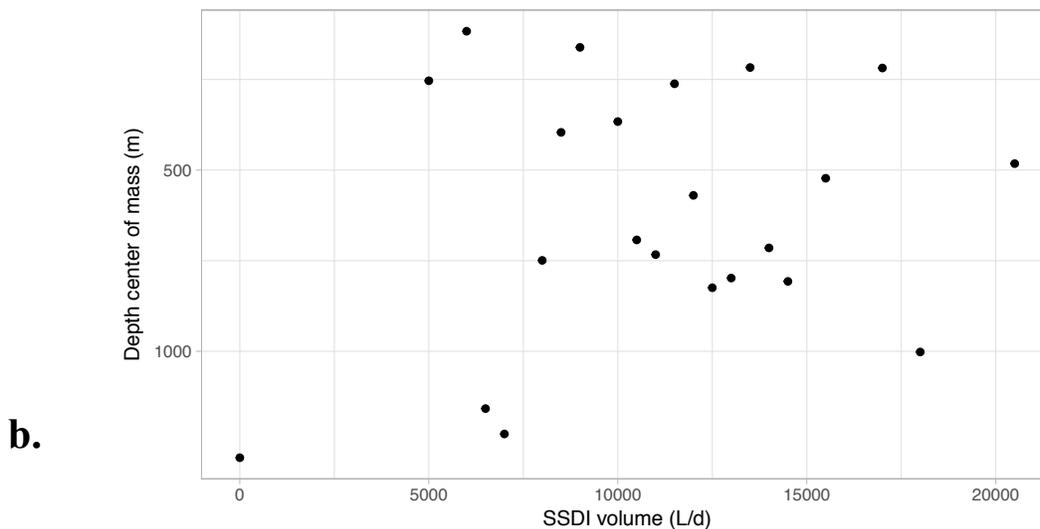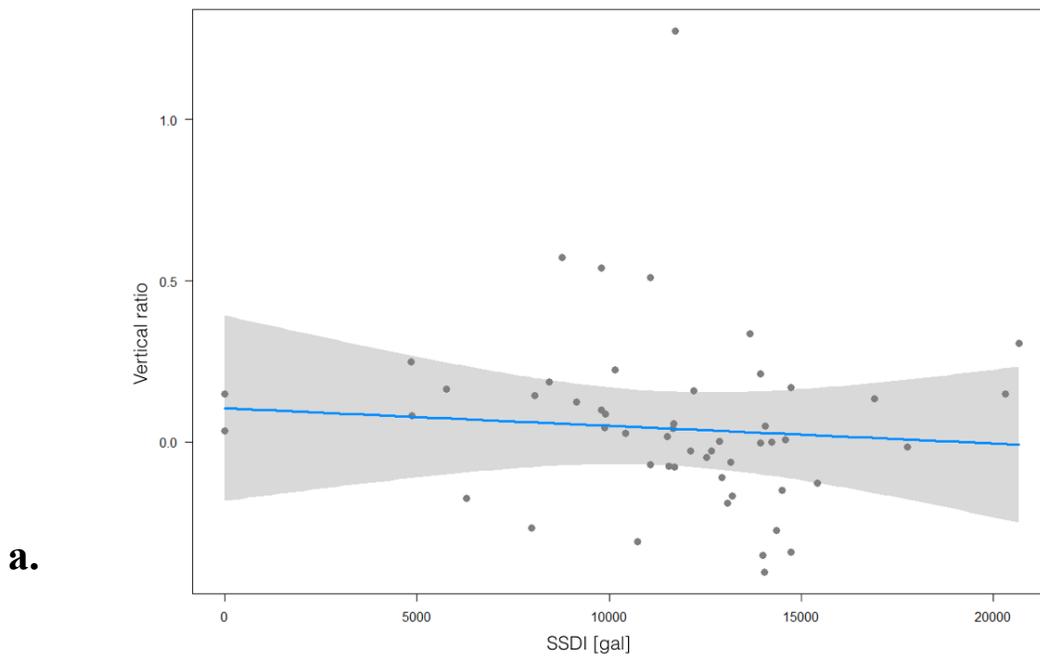
**Table S1a. Classification of the Gulf Science Data Water Chemistry Data**.
The hydrocarbon compounds from the Deepwater Horizon samples were classified into two mass fractions based on their molecular weight. a. C5-C12: low molecular weight compounds between five and twelve carbons. The data can be found on the GRIID-C website; filename: WaterChemistry_W-01v02-01.csv.

| | | | |
|---|---|---|---|
| C5-C12 | cis-Decalin | Dibenzothiophene | C4-Benzo(b)thiophenes | Ethylbenzene |
| | trans-Decalin | C1-Dibenzothiophenes | Naphthalene | o-Xylene |
| | cis/trans-Decalins | C2-Dibenzothiophenes | C1-Naphthalenes | m-Xylene |
| | C1-Decalins | C3-Dibenzothiophenes | C2-Naphthalenes | p-Xylene |
| | C2-Decalins | C4-Dibenzothiophenes | C3-Naphthalenes | m&p-Xylenes |
| | C3-Decalins | 1-Methylnaphthalene | C4-Naphthalenes | Xylenes, Total |
| | C4-Decalins | 2,6-Dimethylnaphthalene | Biphenyl | n-Nonane (C9) |
| | Benzo(b)thiophene | 2-Methylnaphthalene | Dibenzofuran | n-Decane (C10) |
| | C1-Benzo(b)thiophenes | Carbazole | Acenaphthylene | n-Undecane (C11) |
| | C2-Benzo(b)thiophenes | Benzene | Acenaphthene | n-Dodecane (C12) |
| | C3-Benzo(b)thiophenes | Toluene | | |

**Table S1b. Classification of the PB Gulf Science Data, Water Chemistry Data.**
The hydrocarbon compounds from the Deepwater Horizon samples were classified into two mass fractions based on their molecular weight. b. C13+: higher molecular weight compounds with more than thirteen carbons. The reported mass fractions correspond to species-averaged retention times in the column. The data can be found on the GRIID-C website; filename: WaterChemistry_W-01v02-01.csv.

| | | | | |
|---|---|---|---|---|
| C13+ | Fluorene | C3-Naphthobenzothiophenes | 2-Methylanthracene | n-Eicosane (C20) |
| | C1-Fluorenes | C4-Naphthobenzothiophenes | 2-Methylphenanthrene | n-Heneicosane (C21) |
| | C2-Fluorenes | Benz(a)anthracene | 3-Methylphenanthrene | n-Docosane (C22) |
| | C3-Fluorenes | Chrysene | 4/9-Methylphenanthrene | n-Tricosane (C23) |
| | Anthracene | C1-Chrysenes | 4-Methyldibenzothiophene | n-Tetracosane (C24) |
| | Phenanthrene | C2-Chrysenes | Chrysene | n-Pentacosane (C25) |
| | C1-Phenanthrenes/ Anthracenes | C3-Chrysenes | Chrysene/Triphenylene | n-Hexacosane (C26) |
| | C2-Phenanthrenes/ Anthracenes | C4-Chrysenes | Benzo(b)fluoranthene | n-Heptacosane (C27) |
| | C3-Phenanthrenes/ Anthracenes | Benzo(b)fluoranthene | Benzo(k)fluoranthene | n-Octacosane (C28) |
| | C4-Phenanthrenes/ Anthracenes | Benzo(k)fluoranthene | Dibenz(a,h)anthracene | n-Nonacosane (C29) |
| | Retene | Benzo(a)fluoranthene | 2,6,10 Trimethyldodecane (1380) | n-Triacontane (C30) |
| | Benzo(b)fluorene | Benzo(e)pyrene | n-Tetradecane (C14) | n-Hentriacontane (C31) |
| | Fluoranthene | Benzo(a)pyrene | 2,6,10 Trimethyltridecane (1470) | n-Dotriacontane (C32) |
| | Pyrene | Perylene | n-Pentadecane (C15) | n-Tritriacontane (C33) |
| | C1-Fluoranthenes/Pyrenes | Indeno(1,2,3-cd)Pyrene | n-Hexadecane (C16) | n-Tetratriacontane (C34) |
| | C2-Fluoranthenes/Pyrenes | Dibenz(a,h)anthracene | Norpristane (1650) | n-Pentatriacontane (C35) |
| | C3-Fluoranthenes/Pyrenes | Benzo(g,h,i)perylene | n-Heptadecane (C17) | n-Hexatriacontane (C36) |
| | C4-Fluoranthenes/Pyrenes | 1,6,7-Trimethylnaphthalene | Pristane | n-Heptatriacontane (C37) |
| | Naphthobenzothiophene | 1-Methyldibenzothiophene | n-Octadecane (C18) | n-Octatriacontane (C38) |
| | C1-Naphthobenzothiophenes | 1-Methylphenanthrene | Phytane | n-Nonatriacontane (C39) |
| | C2-Naphthobenzothiophenes | 2/3-Methyldibenzothiophene | n-Nonadecane (C19) | n-Tetracontane (C40) |

**Table S2. List of 50 specific polycyclic aromatic hydrocarbons (PAHs) used in the Sub-Sea Dispersant Injection  (SSDI) analysis.** The chemicals listed below are presented as PAH sums in the BP Gulf Science Data (GSD), Water Chemistry Data. The data can be found on the GRIID-C website; filename: WaterChemistry_W-01v02-01.csv.

| | |
|---|---|
| Naphthalene | Fluoranthene |
| C1-Naphthalenes | Pyrene |
| C2-Naphthalenes | C1-Fluoranthenes/Pyrenes |
| C3-Naphthalenes | C2-Fluoranthenes/Pyrenes |
| C4-Naphthalenes | C3-Fluoranthenes/Pyrenes |
| Biphenyl | C4-Fluoranthenes/Pyrenes |
| Dibenzofuran | Naphthobenzothiophene |
| Acenaphthylene | C1-Naphthobenzothiophenes |
| Acenaphthene | C2-Naphthobenzothiophenes |
| Fluorene | C3-Naphthobenzothiophenes |
| C1-Fluorenes | C4-Naphthobenzothiophenes |
| C2-Fluorenes | Benz(a)anthracene |
| C3-Fluorenes | Chrysene |
| Anthracene | C1-Chrysenes |
| Phenanthrene | C2-Chrysenes |
| C1-Phenanthrenes/Anthracenes | C3-Chrysenes |
| C2-Phenanthrenes/Anthracenes | C4-Chrysenes |
| C3-Phenanthrenes/Anthracenes | Benzo(b)fluoranthene |
| C4-Phenanthrenes/Anthracenes | Benzo(k)fluoranthene |
| Dibenzothiophene | Benzo(a)fluoranthene |
| C1-Dibenzothiophenes | Benzo(e)pyrene |
| C2-Dibenzothiophenes | Benzo(a)pyrene |
| C3-Dibenzothiophenes | Indeno(1,2,3-cd)Pyrene |
| C4-Dibenzothiophenes | Dibenz(a,h)anthracene |
| Benzo(b)fluorene | Benzo(g,h,i)perylene |

**Table S3. Summary of Generalized Least Squares Regression Analysis for Variables used in the Generalized Least of Squares regression of the two layers 0-600 m and 600-1500 m**. The data is computed within a 10 km radius from Macondo. Response variables for the different permutations were: (1) (2) (3) (4) (5) (6), (1L) (2L) (3L) (4L) (5L) (6L) where "L" indicate a lagged effect of the SSDI (see Figure S4). Vertical concentration ratio [ug/L] was computed as the logarithmic (log(x+1)) mean oil concentration of the two given depth ranges. For example in permutation (1) vertical ratio was computed as the mean oil concentration in upper layers (0-20 m and 20-400 m) minus the logarithmic mean oil concentration of the depth range of the second intrusion (400-1000 m).

| | Value | Std.Error | t.value | p.value |
|---|---|---|---|---|
| (Intercept) | -0.0513 | 0.2074 | -0.2472 | 0.81 |
| Subsea dispersant [gal] | $-10^{-6}$ | $10^{-5}$ | -0.1072 | 0.92 |
| Surface dispersant [gal] | $-3 \times 10^{-5}$ | $2 \times 10^{-5}$ | -1.3817 | 0.17 |
| Time from blowout [d] | 0.0025 | 0.0035 | 0.7159 | 0.48 |