Organic Aerosol Formation Downwind from the Deepwater Horizon Oil Spill
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• A WP-3D research aircraft made airborne measurements of the gaseous and aerosol composition of air over the Deepwater Horizon oil spill in the Gulf of Mexico.
• The lightest chemicals in the oil evaporated within hours, as scientists expected them to do. What they didn't expect was that heavier compounds -- the ones with more carbon atoms per molecule -- in the oil took longer to evaporate, spread out much more widely and contributed most to the formation of air pollution particles.
• A narrow plume of hydrocarbons was observed downwind that is attributed to the evaporation of fresh oil on the sea surface
• A much wider plume with high concentrations of organic aerosol (>25 micrograms per m$^3$) was attributed to the formation of secondary organic aerosol from unmeasured, less volatile hydrocarbons that were emitted from a wider area.
• The oil leak rate was estimated to be 68,000 barrels per day, with much of that accumulating on the sea surface.

• Recent research has indicated that secondary organic aerosols (SOA) formation in polluted air is much more efficient than expected from the measured VOC’s.
  • possibly as a result of formation from SVOC’s or IVOC’s
  • it was easy to measure since different parts of the oil slick were segregated depending on their volatility
• The evaporation of freshly surfaced oil was the dominant source of the VOC’s measured
  • the first 23% of the mass evaporated during a 2-hour period
  • the OA was largely formed from vapors released from the oil and the condensation of their atmospheric oxidation products onto existing particles
  • Aromatics and C$_8$ and C$_{11}$ alkanes are known to be SOA precursors
    • were measured at very high mixing ratios downwind
    • assuming that the evaporation rate of a compound is proportional to its vapor pressure, then evaporation for C$\geq 10^8$ ug m$^{-3}$ takes (C$_8$ hydrocarbons) <1 hour, for C = $10^4$ to $10^7$ ug m$^{-3}$ (C$_9$ to C$_{18}$ Hydrocarbons) evaporation takes place from 1 to 1000 hours.
  • The compounds responsible for SOA formation were most likely released on evaporation time scales of 10-100 hours, thus C$_{14}$ to C$_{16}$ Hydrocarbons.