ETL Results from the SPANDEX-03 Study
Manly Water Research Tunnel
January/February 2003
Summary Data File
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The 49 runs taken by ETL during spandex have been processed to produce a data file (*sumfile_2_hds.txt)* with basic information and integrations of the run-average droplet spectra from the CIP. The data columns are as follows

Month	
Day	
Hr	
Run #	
CIP Height (m)	
Wind Speed (m/s)	Estimated, reference height of 0.29 m
Wave Height (m)	Eyeballed
U* (m/s)	Computed from wind speed using Charnock parameter of 0.019
Droplet mass (g/cm^3)	At CIP height, integral over smoothed spectrum
Droplet mass_h (g/cm^3)	At wave height, integral over smoothed spectrum (see below)
Mass flux (g/m^2/s)	Estimate of droplet mass flux, assumed in balance with fall speed

Calculation method:

Given the mean wind speed at z=0.29 m, a value for u is obtained using a Charnock formula. The mean wind speed at the CIP height is then computed using a log profile and that is input to the CIP concentration routine, which returns dn/dr, the number of droplets per unit volume per size increment.

*dn/dr is smoothed and the volume spectrum is computed

```
dvdr_s(j,:)=4/3*pi*(rs/1e4).^3.*dndr_s(j,:);%cm^3/cm^3/mic
```

and the mass at CIP height is computed by integrating

```
mass(j)=sum(dr.*dvdr_s(j,:));%gm/cm^3
```

*A ‘height-corrected’ concentration is computed to account for the decease in concentration above the production layer. This is done by assuming a Toba power law (balance of production and fall velocity)

```
dvdr_sh(j,:)=4/3*pi*(rs/1e4).^3.*dndr_s(j,:).*(zsc(j)/hwv(j)).^(2.5*vf_s./ust(j));
```

Note that this calculation depends on the assumed wave height and wind speed (thru u*). If the CIP is close to the wave tops, then no correction is made. If everything was perfect and there was no evaporation, dvdr_sh would be independent of height for fixed forcing. Mass is computed as before.

mass_h(j)=sum(dr.*dvdr_sh(j,:));%gm/cm^3

*A mass flux is computed by assuming

Flux = Concentration_h*Vf

where Vf is the size dependent droplet fall velocity

mass_flux(j)=1e6*sum(dr.*dvdr_sh(j,:).*vf_s);%gm/m^2/s

The factor of 1e6 is to convert from cm^3 to m^3. If this number is multiplied by 3.6, it converts it to mm/hr. A value of 10 mm/hr implies 10 mm of water is blown off the tank in one hour (of course, most of it falls back in). If there were no evaporation and the Toba law was exact, then this mass flux should be independent of height for a given forcing. I have inserted the dvdr_h spectra from CIP heights near the surface for the three different forcings. Notice that the lowest forcing has spurious droplet counts for very large droplets (red line). This causes an overestimate of the mass flux.

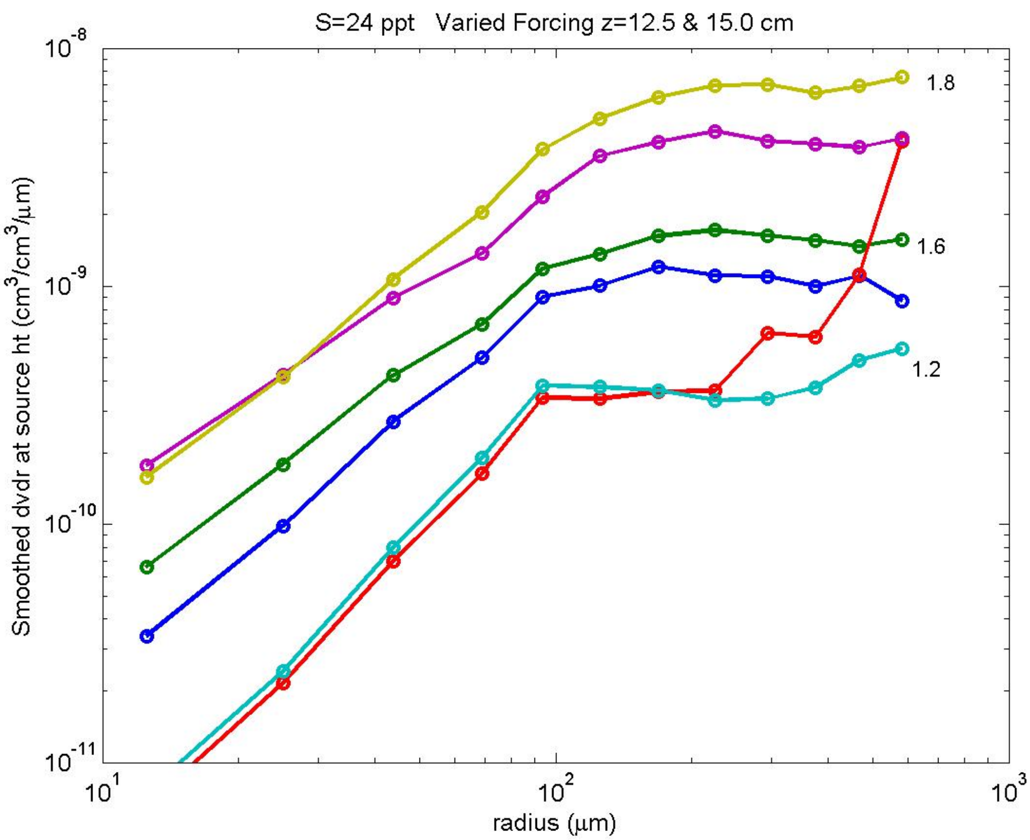

Figure 1. Droplet volume spectra normalized to source height for different forcings: u*=1.2, 1.6, and 1.8 m/s.