SWIFT ***real-time*** data flow

data collection in bursts of 512 s at 720 s intervals
duty cycle configurable from 1 to 5 bursts per hour

optional

AQH or AQD or Signature	GPS and IMU (Microstrain or SBG Ellipse)	CT-1	CT-2	CT-3	Met Airmar or Vaisala or 3D sonic	Camera
serial 4 Hz or 1 Hz binary or 8 Hz binary	serial 25 Hz binary	serial 1 Hz ASCII	serial 1 Hz ASCII	serial 1 Hz ASCII	4 Hz NMEA or 1 Hz SDI-12 or 10 Hz ASCII	serial 0.25 Hz jpg

raw files onboard SWIFT
(Sutron Xpert SD card, directories by com port)

Dissipation rate profile (AQH) or current profile (AQD) or dissipation + currents (Sig)	wave spectra directional coefs bulk parameters	mean value std deviation	mean value std deviation	mean value std deviation	mean value std deviation or inertial dissipation (3D sonic only)	n/a

processed files onboard SWIFT
(Sutron Xpert SD card, directories by com port)

first burst of each hour only:
combine processed results to single binary telemetry file for Iridium SBD transmission
jpg from camera included once per day, at 2100 UTC only

Database of received telemetry on shore-side server

Download zip archives of hourly files: http://faculty.uw.edu/jmt3rd/SWIFTdata/DynamicDataLinks.html
Live map: http://swiftserver.apl.uw.edu/map

Matlab script compileSWIFT_SBDservertelemetry.m
which loops thru all the SBD files in the downloaded archive (as the working directory)
and reads individual binary files using the function readSWIFT_SBD.m
then plots the whole dataset using the function plotSWIFT.m

Matlab structure of telemetry data and plots
(local machine)

SWIFT ***post-processing*** data flow

data collection in bursts of 512 s at 720 s intervals
duty cycle configurable from 1 to 5 bursts per hour

optional

AQH or AQD or Signature
serial
4 Hz or 1 Hz binary
or 8 Hz binary

GPS and IMU
(Microstrain or SBG Ellipse)
serial
25 Hz binary

CT-1
serial
1 Hz ASCII

CT-2
serial
1 Hz ASCII

CT-3
serial
1 Hz ASCII

Met
Airmar
or
Vaisala
or
3D sonic
4 Hz NMEA
or 1 Hz SDI-12
or 10 Hz ASCII

Camera
serial
0.25 Hz jpg

raw files onboard SWIFT
(Sutron Xpert SD card, directories by com port)

Dissipation rate profile (AQH)
or
current profile (AQD)
or
dissipation + currents (Sig)

wave spectra
directional coefs
bulk parameters

mean value
std deviation

mean value
std deviation

mean value
std deviation

mean value
std deviation
or
inertial dissipation
(3D sonic only)

n/a

processed files onboard SWIFT
(Sutron Xpert SD card, directories by com port)

Matlab script concatSWIFT_offloadedSDcard.m which builds
telemetry SBD files for *all* bursts (not just first each hour, as was done onboard),
and then calls compileSWIFT_SBDservertelemetry.m to loop thru all the SBD files
and reads the binary files using the function readSWIFT_SBD.m
then finally plots the whole dataset using the function plotSWIFT.m

Matlab structure of all processed data and plots
(local machine)

reprocess_IMU.m or reprocess_SBG.m,
which calls readSWIFTv3_IMU.m and rawdisplacements.m and XYZwaves.m

raw wave displacements
improved wave spectra (no slope bias)

time lapse video

reprocess_AQH.m which calls readSWIFTv3_AQH.m, dissipation.m and structurefunction.m
reprocess_AQD.m, which calls readSWIFTv3_AQD.m

improved and phase-resolved dissipation rate profiles (AQH)
directional profiles (AQD)

Notes: all Matlab functions in 'SWIFTcodes' Dropbox folder
contact jthomson@apl.uw.edu for access
submit revisions to 'beta' subfolder, archive in 'old' folder
.prj files and 'codegen' subfolder are C++ conversions (used onboard)

Other codes (separate from data flow):

timeaverageSWIFTdata.m makes longer ensemble (burst) averages
SWIFTdirectionalspectra.m estimates average directional spectra
    MEM_directionalestimator.m subroutine
    polarPcolor.m subroutine
wavenumber.m solves dispersion in intermediate depth
concatSWIFT_SBDemailattachments.m is for email SBD usage (backup)
readSWIFTv3_ACS.m reads raw CT data (in 'ACS.dat' files)
readSWIFTv3_PB2.m reads raw Met data (in 'PB2' files), includes GPS
SWIFT_breaker_detection.m scores images for breaking waves
    see 'ImageProcessing' subfolder

Raw (burst) file naming convention is *SWIFTXX_ZZZ_ddMonYear_HH_BN.dat*
where *XX* is the buoy serial number, *ZZZ* is the sensor, *ddMonYear* is the date, *HH* is the hour (UTC), and *BN* is the burst number within that hour (1 to 5).

SWIFT data structure fields in Matlab (results by burst):

SWIFT.uplooking.tkedissipationrate: vertical profiles of turbulent dissipation rate in W/kg (= m^2 / s^3)
SWIFT.uplooking.z: depth bins, in meters, for the tke dissipation rate profiles. wave-following reference frame
SWIFT.downlooking.velocityprofile: vertical profiles of horizontal velocity magnitude, in m/s, relative to the float (not corrected for drift)
SWIFT.downlooking.z: depth bins, in meters, for the velocity profiles
SWIFT.winddirT: true wind direction FROM, in degrees CW relative to North
SWIFT.winddirTstddev: standard deviation of true wind direction, in degrees
SWIFT.windspd: wind speed, in m/s, at 1 m height above the wave-following surface
SWIFT.windspdstddev: standard deviation, in m/s, of wind speed
SWIFT.time: UTC timestamp in MATLAB datenum format (serial days since 0 Jan 0000)
SWIFT.date: human readable date as day, month, year
SWIFT.airtemp: air temperature, in deg C, at 1 m height above the wave-following surface
SWIFT.airtempstddev: standard deviation of air temperature, in deg C
SWIFT.sigwaveheight: significant wave height, in meters
SWIFT.peakwaveperiod: peak of period orbital velocity spectra (note convention is usually wave height spectrum)
SWIFT.peakwavedirT: true wave direction FROM, in degrees CW relative to North
SWIFT.wavespectra.energy: wave energy spectral density, in m^2/Hz, as a function of frequency
SWIFT.wavespectra.freq: spectral frequencies, in Hz
SWIFT.wavespectra.a1: normalized spectral directional moments
SWIFT.wavespectra.b1: normalized spectral directional moment
SWIFT.wavespectra.a2: normalized spectral directional moment
SWIFT.wavespectra.b2: normalized spectral directional moment
SWIFT.lat: latitude in decimal degrees
SWIFT.lon: longitude in decimal degrees
SWIFT.watertemp: water temperature, in deg C, at 0.5 m below the surface
SWIFT.salinity: water salinity, in PSU, at 0.5 m below the surface
SWIFT.puck: three color channels of a WetLabs puck flourometer
SWIFT.driftdirT: drift direction TOWARDS, in degrees True (equivalent to "course over ground")
SWIFT.dirftspd: drift speed in m/s (equivalent to "speed over ground")