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)

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 function pullSWIFTtelemetry.m queries shoreside server for telemetry files
and then runs 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 of data
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

SWIFTtimelapse.m

reprocess_AQH.m which calls readSWIFTv3_AQH.m, dissipation.m and structurefunction.m
reprocess_AQD.m, which calls readSWIFTv3_AQD.m
Reprocess_SIG.m, which calls readSWIFTv4_SIG.m, dissipation.m and structurefunction.m

improved and phase-resolved dissipation rate profiles (AQH)
directional profiles (AQD)
Altimeter results, AHRS data (SIG)

Matlab functions on GitHub at
https://github.com/jthomson-apluw/SWIFT-codes
or 'SWIFTcodes' Dropbox folder (read only, jthomson@apl.uw.edu for access)

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
readSWIFTv3_ACS.m reads raw CT data (in 'ACS.dat' files)
readSWIFTv3_PB2.m reads raw Met data (NMEA formant 'PB2' files)
    which includes a backup GPS feed
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")