THE INTERPRETATION OF VAN DE CASTEELE DIAGRAMS

BY

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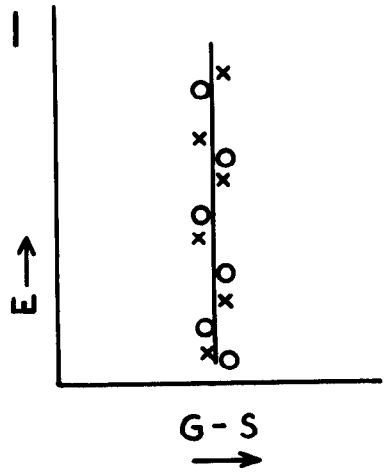
This Report was prepared before the Tidal Institute became the Institute of Coastal Oceanography and Tides.

I

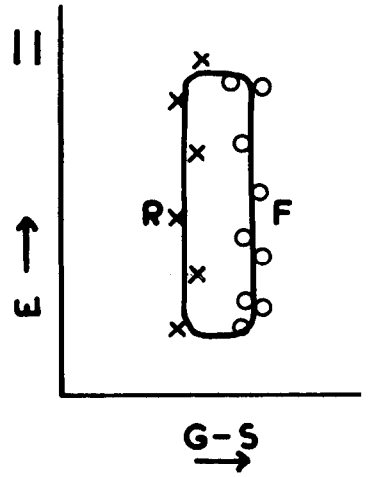


G = Tide gauge reading
S = Well-sounding converted to elevation above datum.
E = Tidal elevation
→ = Direction of increasing magnitude
R× indicates rising tide
F○ indicates falling tide.

NOTE: Ordnance Survey plot a quantity defined as "Zero in feet below Contact Point". Changes in this quantity are of same magnitude and of same sign as in G-S.

Above indicates perfect gauge. If sounding has been carried out accurately none of plots show a displacement left or right of line in excess of 0·01 ft.

II

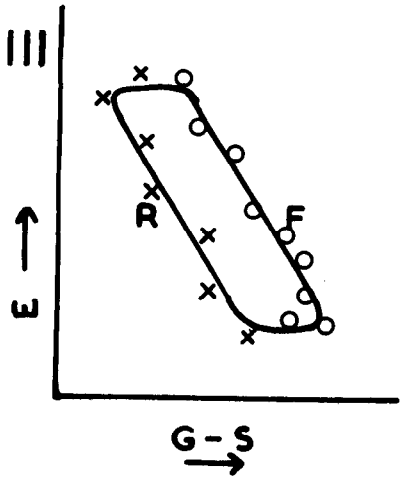


Common test result shows lag in response of gauge to water level movements in well

(a) due to backlash or friction in mechanism
(b) if gauge is remote recorder lag may be due to necessity to build up a differential at well before remote recorder can respond.
(c) where sounding is performed off-site (perhaps in another well) this may indicate tide gauge well orifice silted or otherwise too small.
(d) possibly float diameter too small.
(e) possibly gauge reading and sounding not simultaneous (sounding always after gauge reading).

Since almost all gauges show a looped diagram as above, this will now be taken as standard and other faults will be superimposed.

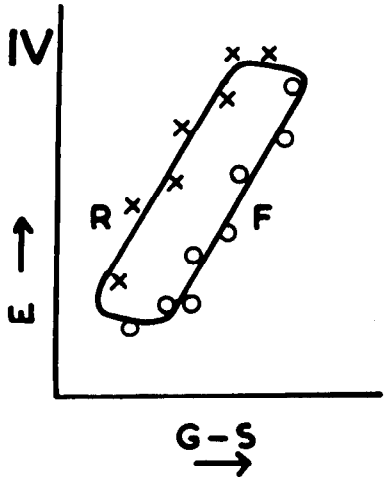
III



Fault is systematic non-linearity

Possible reasons:

a) Graduations on tide gauge chart untrue either due to poor printing or to fact that operating conditions are much more humid than those which obtained at time of printing. Spacing of graduations on chart is too large.
b) Float pulley too large. This may be due to the fact that too long a length of wire is attached to float so that riding turns are always present.
c) Possible overriding in pen carriage movement.
d) Errors in design, gears, pen carriage movement.



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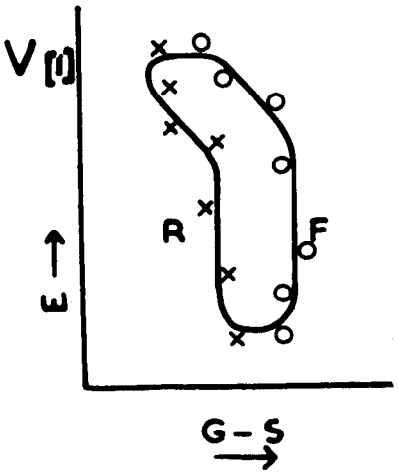
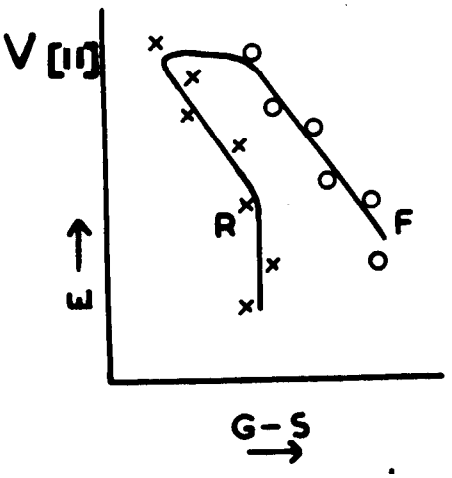
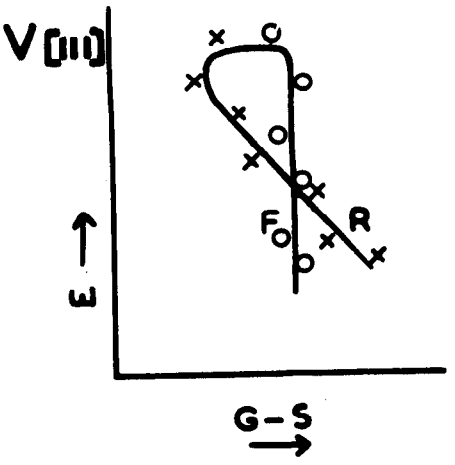


Non-linearity in higher tidal elevations.

a) Classic case of riding turns in float wire.
b) Riding turns in pen carriage movement.
c) Since test is conducted over several hours during which drum rotates and different parts of charts are used (above might indicate that for approximately 6 hours width of chart graduations on chart have a spacing which is too large).

Condition (c) shows itself more commonly as follows :





also non-linearity of reverse sign is possible.

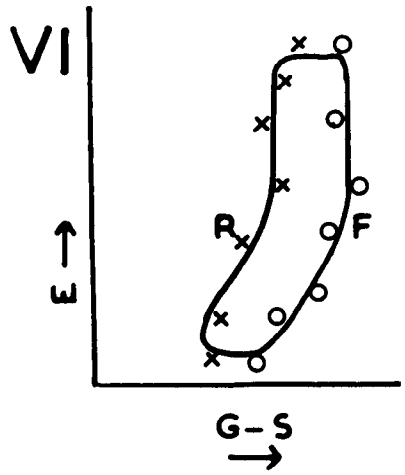
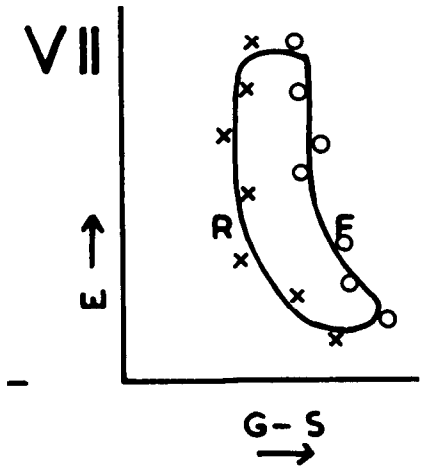
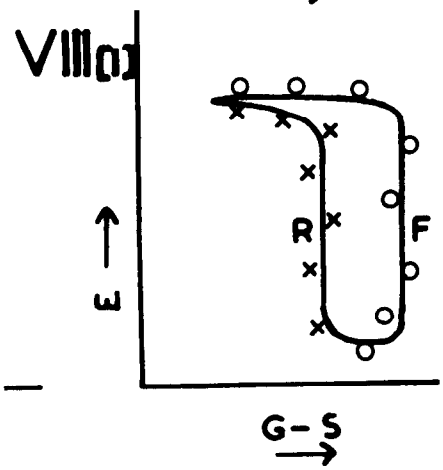


Diagram vertical at higher tidal elevations but becoming progressively negative at lower levels.

a) Possible explanation inconsistent counterweight affecting level of buoyancy of float. Most common where float suspension is tape rather than wire and particularly where counterweight is immersed at high water.
b) Float suspension tempered and containing kinks.
c) Counterweight of insufficient mass, particularly if plots for rising tide are more haphazard than for falling tide.
d) Float diameter too small particularly if plots for rising tide are more haphazard than for falling tide.

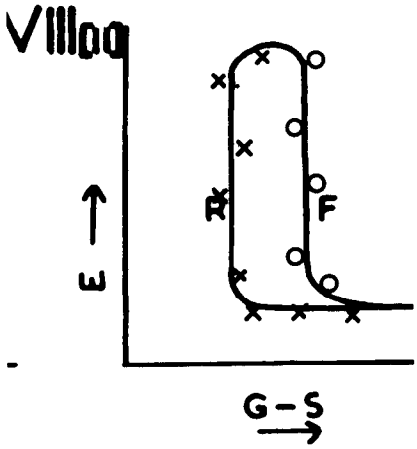


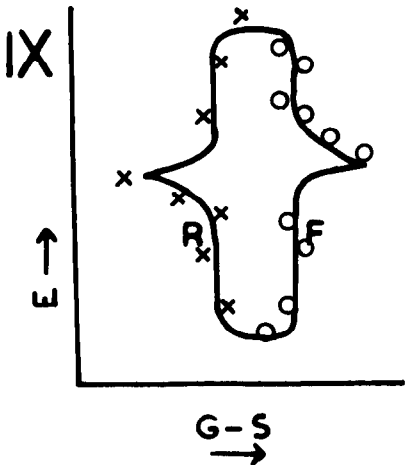
As in VI but diagram becoming progressively positive in lower levels possibly due to insufficient mass in sounding device or kinks in sounding tape.



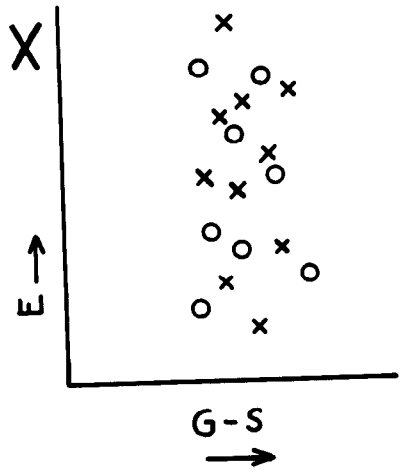
(i) Gauge unable to register maximum levels due to :
a) counterweight falling too low so that it fouls an obstructions.
b) float or pen carriage, on rising, reaches an obstruction.

(ii) Gauge unable to register minimum levels due to :
a) siltation of well.
b) counterweight rises too high so that it fouls an obstruction.
c) Float or pen carriage, on falling reaches an obstruction.

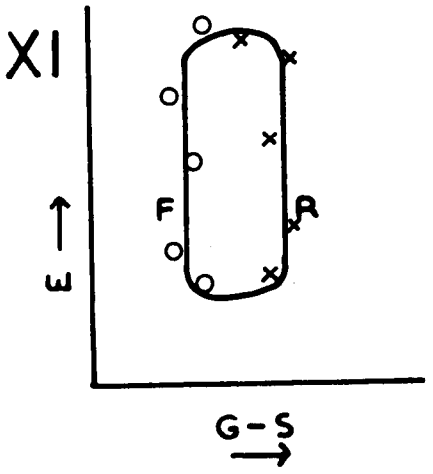




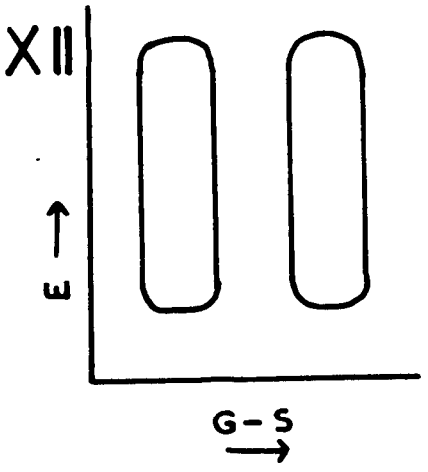
a) Float fouls an obstruction in well on both rising and falling tides.
b) Counterweight fouls an obstruction on both rising and falling tides.



Condition : plots from rising and falling tide haphazardly distributed so that no pattern emerges. Most probably due to poor quality of soundings.



Rotation of diagram anticlockwise. Difficult to understand in terms of gauge, since it implies that gauge is anticipating movement of water in well. This is most probably due to faulty sounding equipment or procedure e.g. sounding and tide gauge reading not simultaneous (gauge reading always made after sounding).



Condition : successive tests give markedly different datum - poor gauge maintenance in pen setting.

N.B. Where a condition may be explained

a) by faults in gauge from float pulley to float e.g. riding turns, float buoyancy, counterweight etc.

and also

b) by faults in gauge which occur between float pulley shaft and chart e.g. gearing, friction, pen carriage, chart graduations.

It can easily be decided whether faults of a) or b) type apply by:-

1. disconnecting float suspension.
2. determining designed diameter of float pulley (often an integral number of feet).
3. scribing a mark on float pulley which can be made to register against a fixed pointer.
4. rotating float pulley slowly and precisely through one rotation at a time from minimum level to maximum level and back to minimum level noting the pen reading at each rotation. The procedure should then be repeated from maximum level through minimum and back to maximum.

The term 'float pulley' also covers cases where a drum with spiral groove takes its place. When wire slips out of groove this has same effect as riding turns.