

O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

**“TOSHKENT IRRIGATSIYA VA QISHLOQ XO‘JALIGINI MEXANIZATSIYALASH
MUHANDISLARI INSTITUTI”
MILLIY TADQIQOT UNIVERSITETI**

Gidrologiya va gidrogeologiya kafedrası

Fan. “Quruqlik gidrologiyasi”

Mavzu: Daryolar suv oqim tezligi va sarfi.

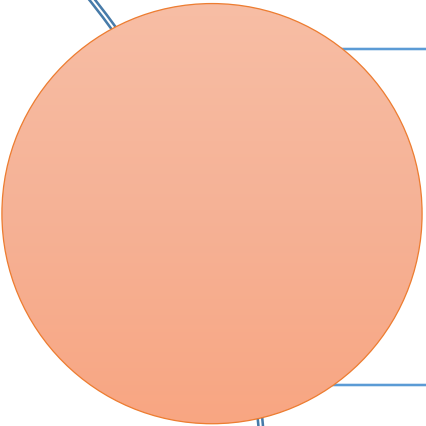


Mansurov Safar Raxmankulovich

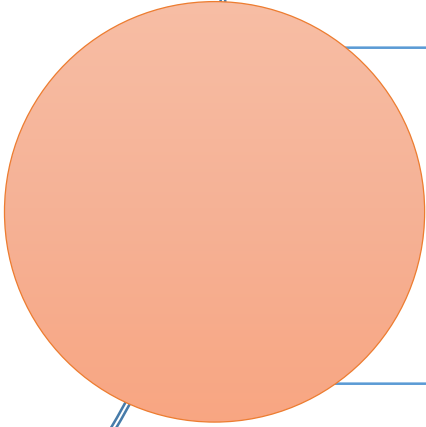


**Gidrologiya va gidrogeologiya kafedrası katta
o‘qituchisi**

Reja:



Suv harakati haqida umumiy ma'lumot. Suvning oqish tezligi turlari. Daryo oqimida suvning oqish tezligini taqsimlanishi. Suvning oqish tezligini aniqlashning zamonaviy usul va vositalari;



Suv sarfi va uni aniqlashda bajariladigan ishlar tarkibi. Suv sarfini aniqlash usullarining tasnifi. Sarf modeli va uning xususiyatlari.

Suvning oqish tezligini o'lchashni ahamiyati

Suvning oqish
tezligini o'lchash

ahamiyati

suv sarfini aniqlashda



Suvning oqish tezligini o'lchashni ahamiyati

Suvning oqish
tezligini o'lchash

ahamiyati

**gidrotexnik inshootlarni loyihalash va
qurishda**



Suvning oqish tezligini o'lchashni ahamiyati

Suvning oqish
tezligini o'lchash

ahamiyati

ilmiy-amaliy masalalarni
hal qilishda

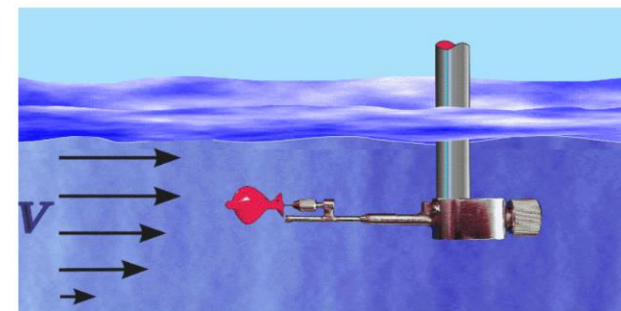


Tezlikni o'lchashdan ko'zlangan maqsad

Suv rejimining asosiy elementi hisoblangan suv sarfini aniqlashdan

Xalq xo'jaligini tarmoqlarini rivojlantirish uchun suv sarfini aniq bilish

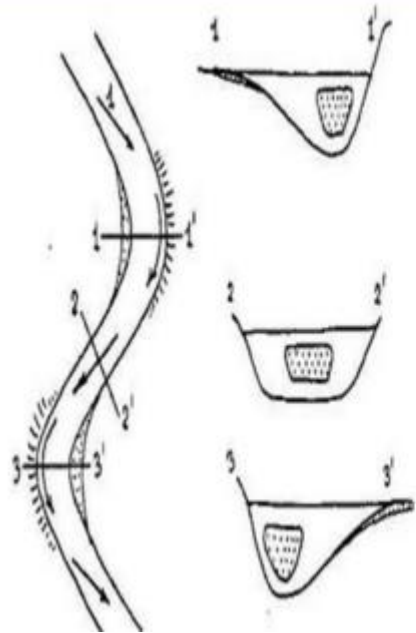
Buning uchun esa o'zandagi oqim tezligini aniqlash talab etiladi



Turli gidrotexnik va suv xo'jaligi inshootlarini loyihalash, qurish va ulardan foydalanishda ham o'zanda suvning oqish tezligini hisobga olish zarur bo'ladi.



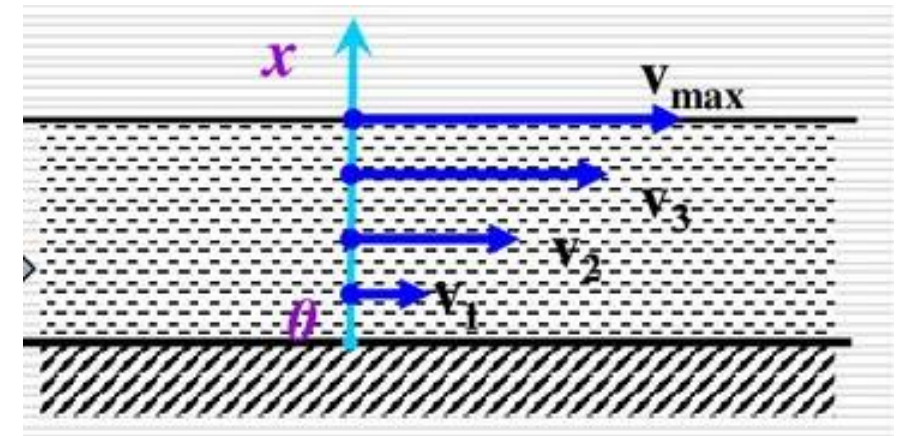
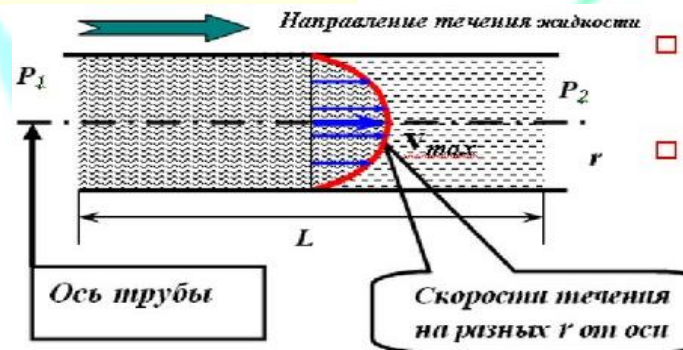
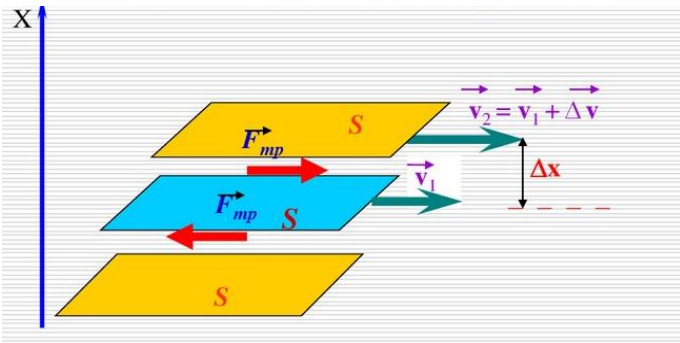
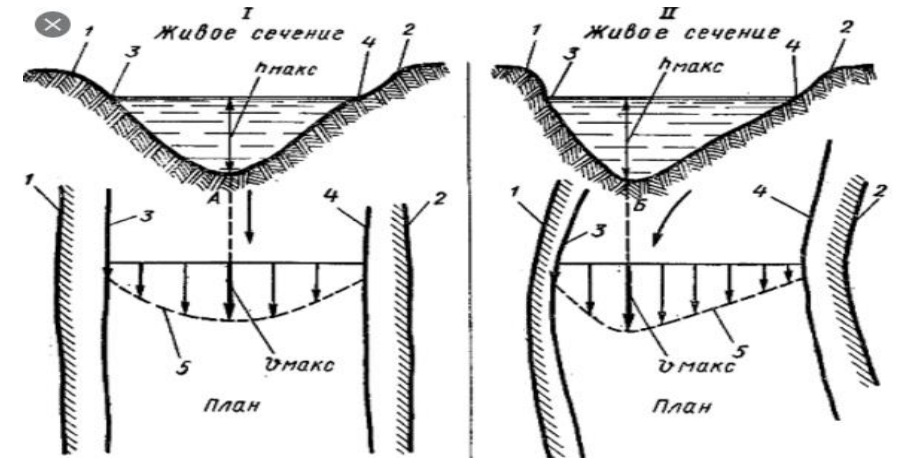
Suvning oqish tezligi



1) градиентом уклона русла;

Daryo o'zanidagi suv massasining vaqt birligi ichida bosib o'tgan masofasi suvning oqish tezligini ifodalaydi

с максимальной скоростью течения.

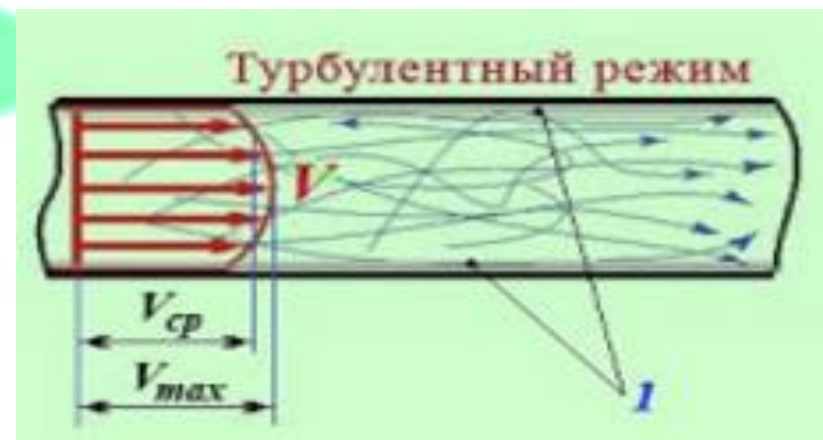
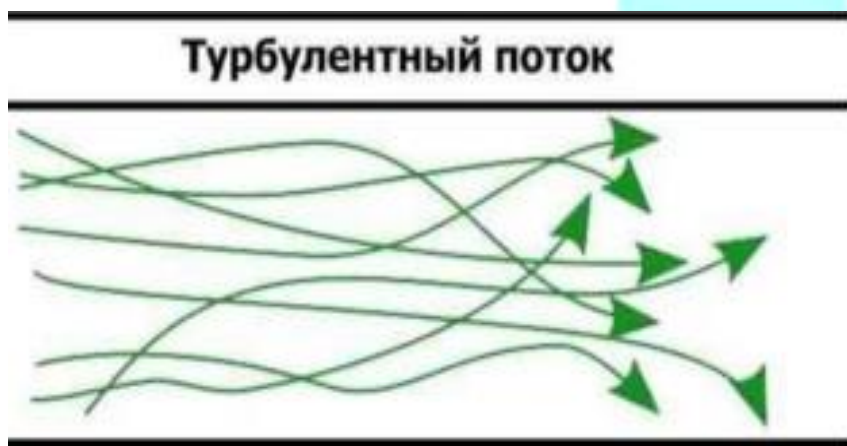


Suvning oqish tezligini murakkab taqsimlangan bo'lishi sababi

Suvning oqish tezligi jonli kesma bo'yicha juda murakkab taqsimlangan bo'ladi

Chunki

o'zandagi suv massasi aksariyat hollarda turbulent rejimli harakatda bo'ladi.



Laminar va turbulent rejimli harakatlar

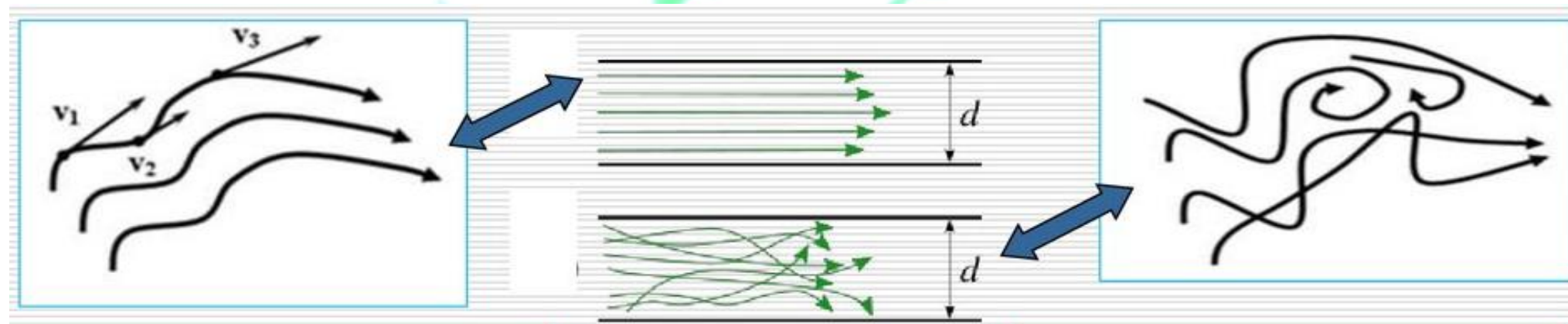
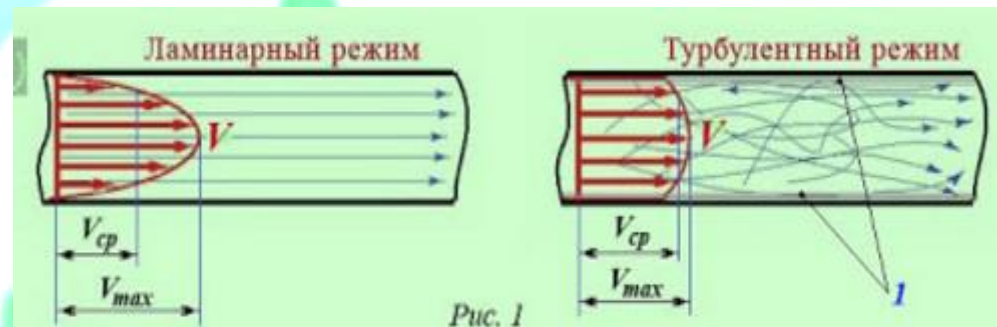
Umuman
suyuqliklar
harakati

laminar

va

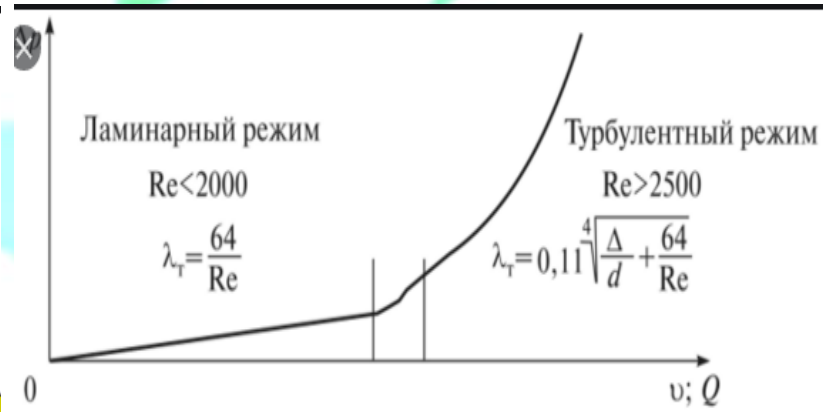
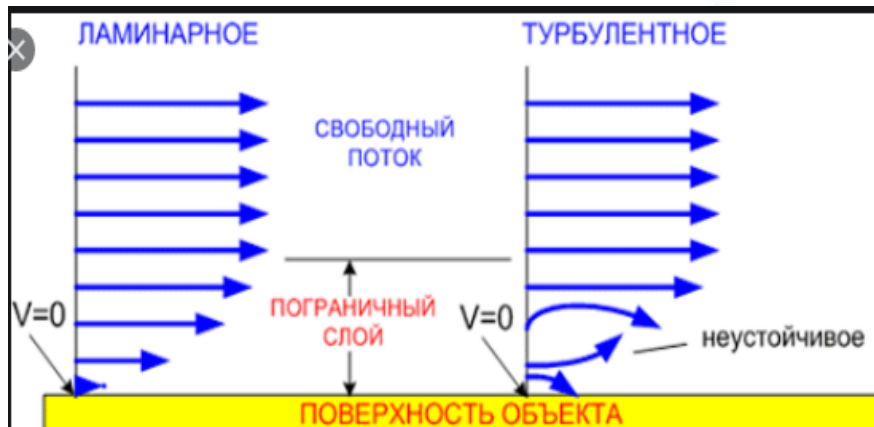
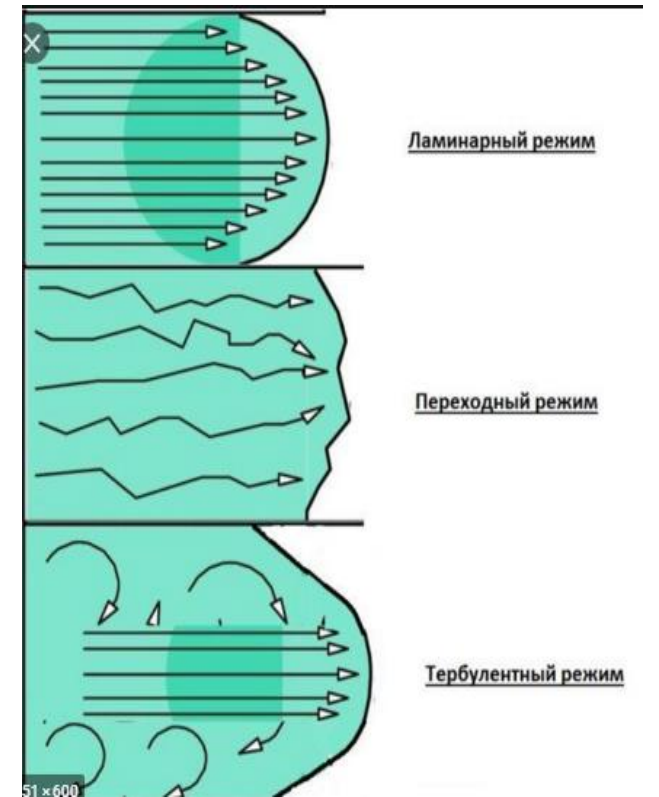
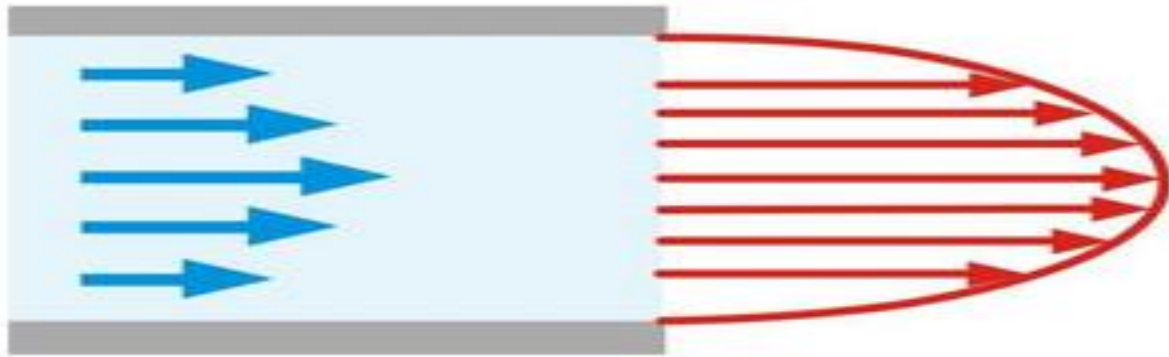
turbulent
rejimli

rejimli
harakatlarga
bo'linadi.



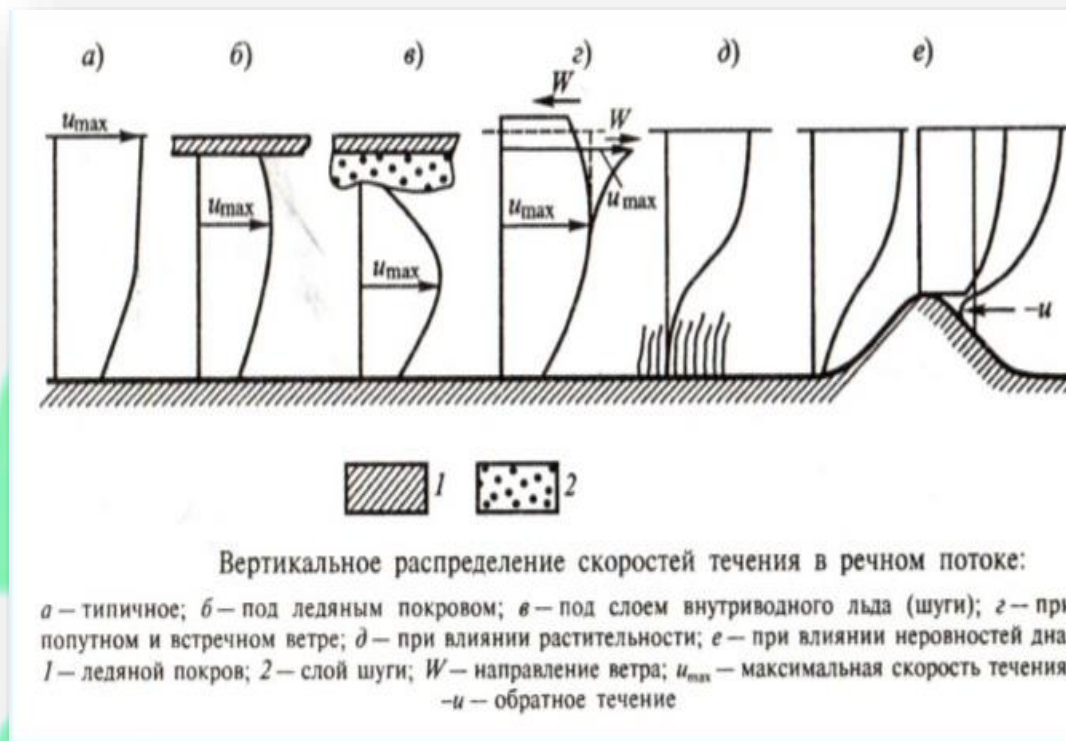
Laminar rejimli harakat

Laminar rejimli harakatda suyuqlik massasini tashkil etuvchi qatlamlar va zarrachalar bir xil yo'nalishda, o'zaro parallel harakat qiladi



Oqim tezligi o'zan chuqurligi va shakliga bog'liq notekis taqsimlanganligi

Oqim tezligi o'zan chuqurligi va shakliga bog'liq va jonli kesma bo'ylab notekis taqsimlangan.



Masalan, oqimning hususiyati to'g'ri uchastkalarda aylanma o'zanli oqimdan farq qiladi

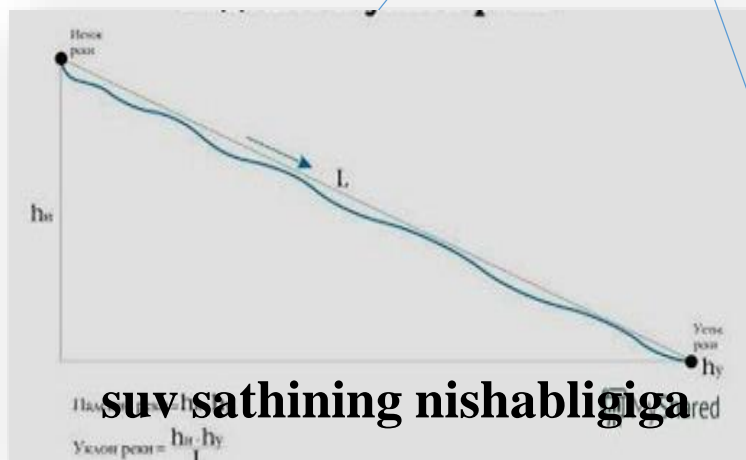
Daryo oqimida tezlikning taqsimlanishini bog'liqligi

Daryo oqimida tezlikning taqsimlanishi quyidagilarga bog'liq bo'ladi

daryo turiga (pastekislik, tog' daryolari va h.k.)



o'zanning g'adir-budurligiga



сuv sathining nishabligiga



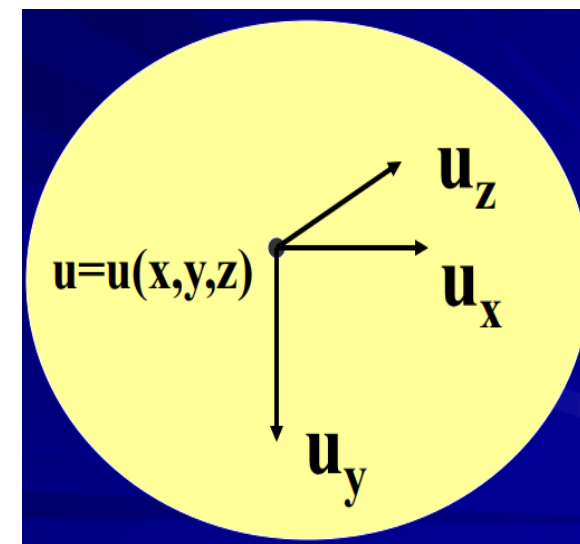
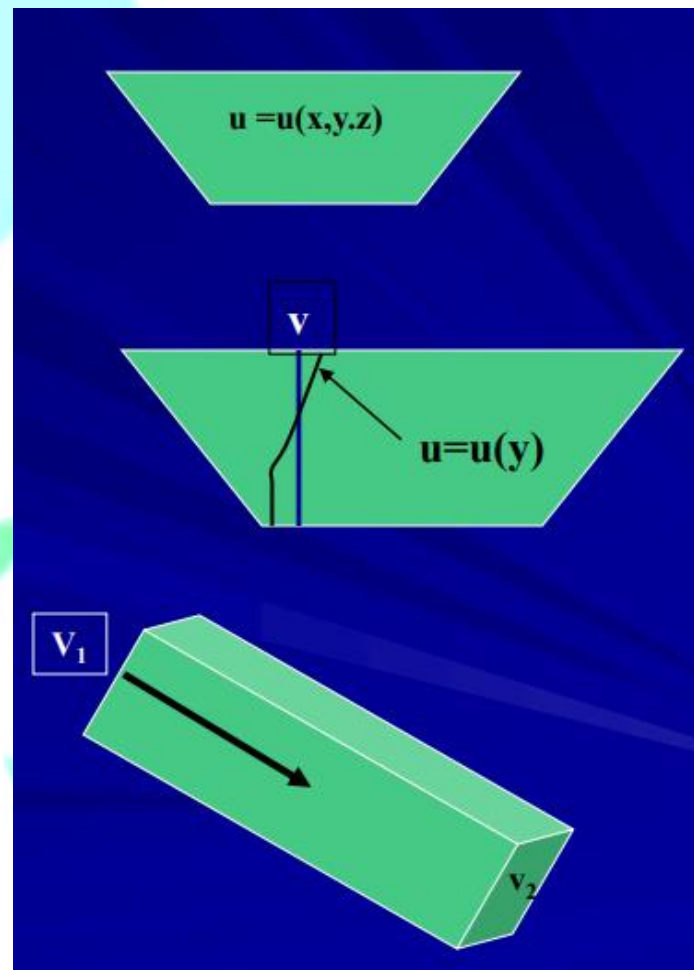
morfologik xususiyatlariga

Tezlik turlari

Mavjud tezliklar

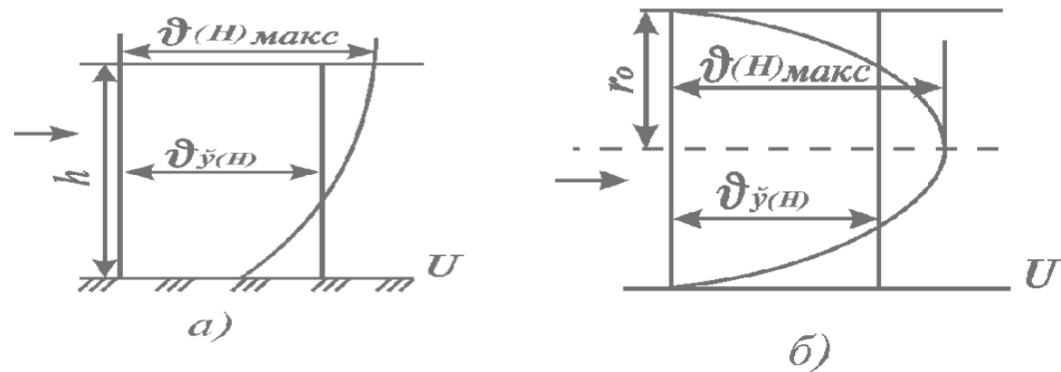
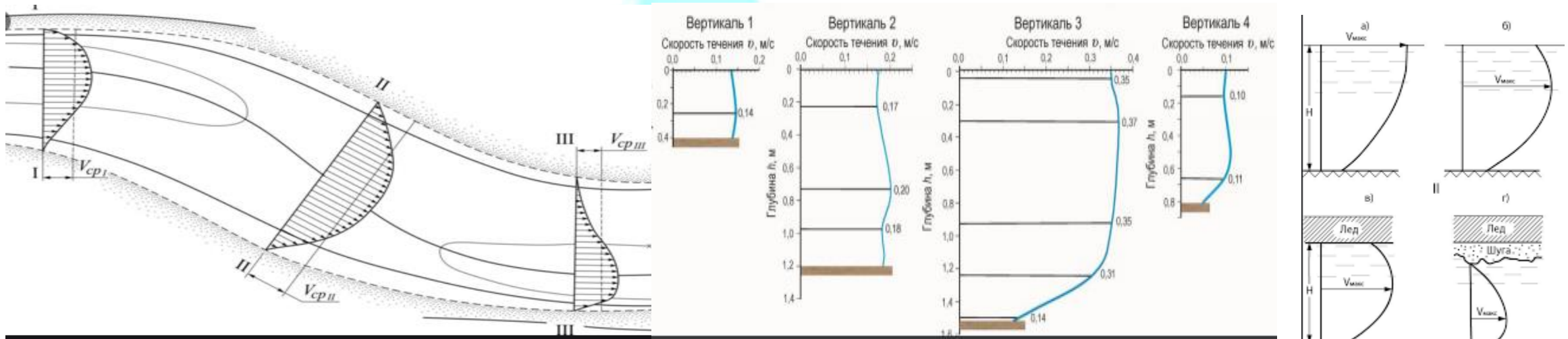
bir onli

o'rtacha yoki mahalliy tezliklar

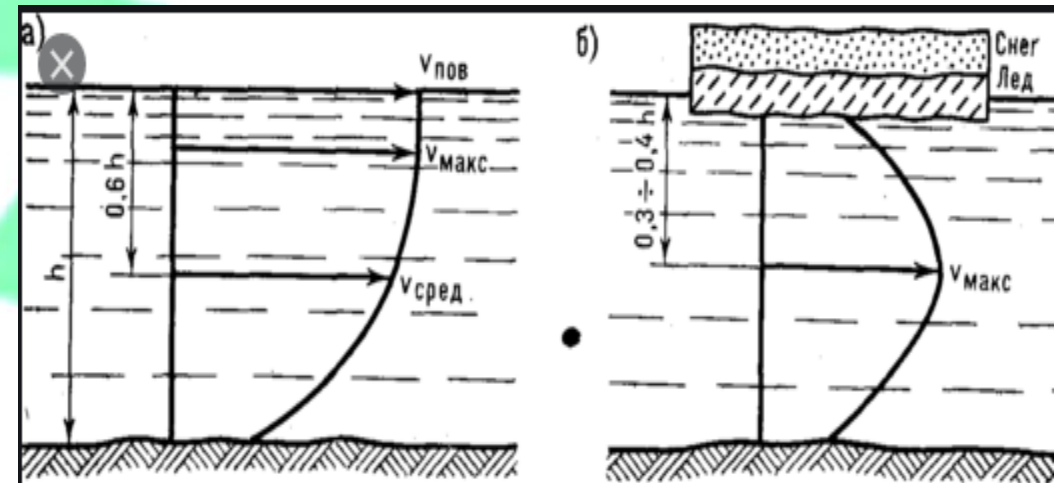


Tezlik epyurasi

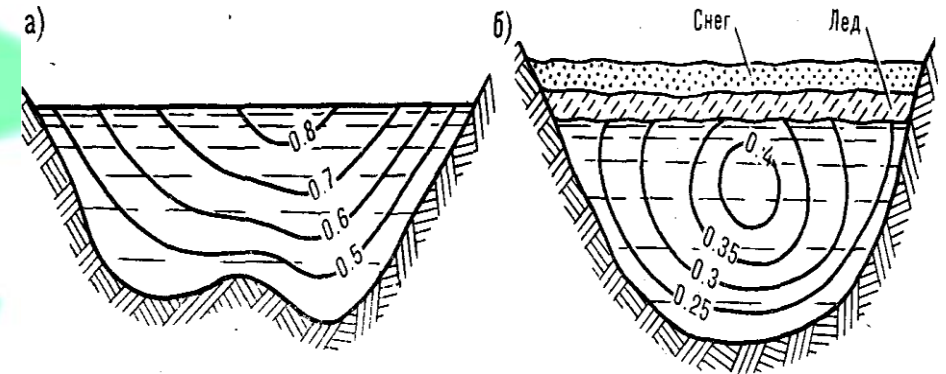
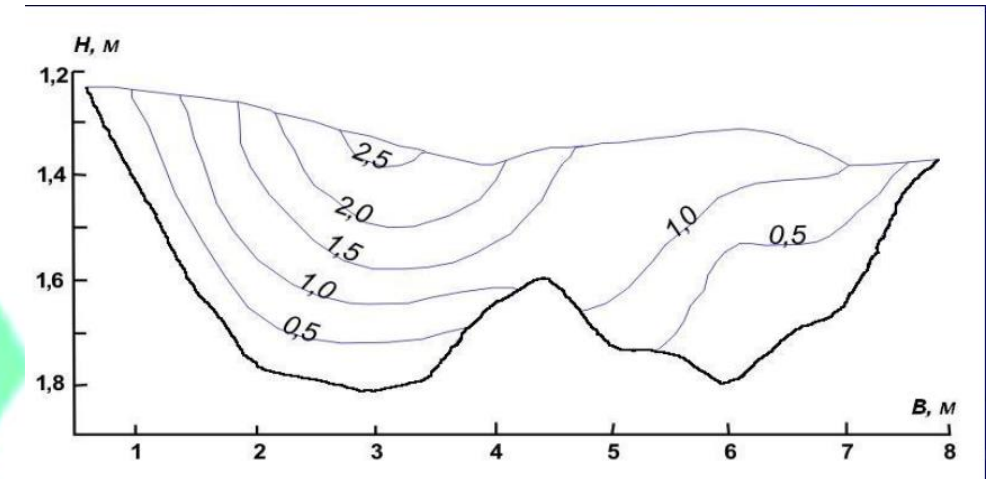
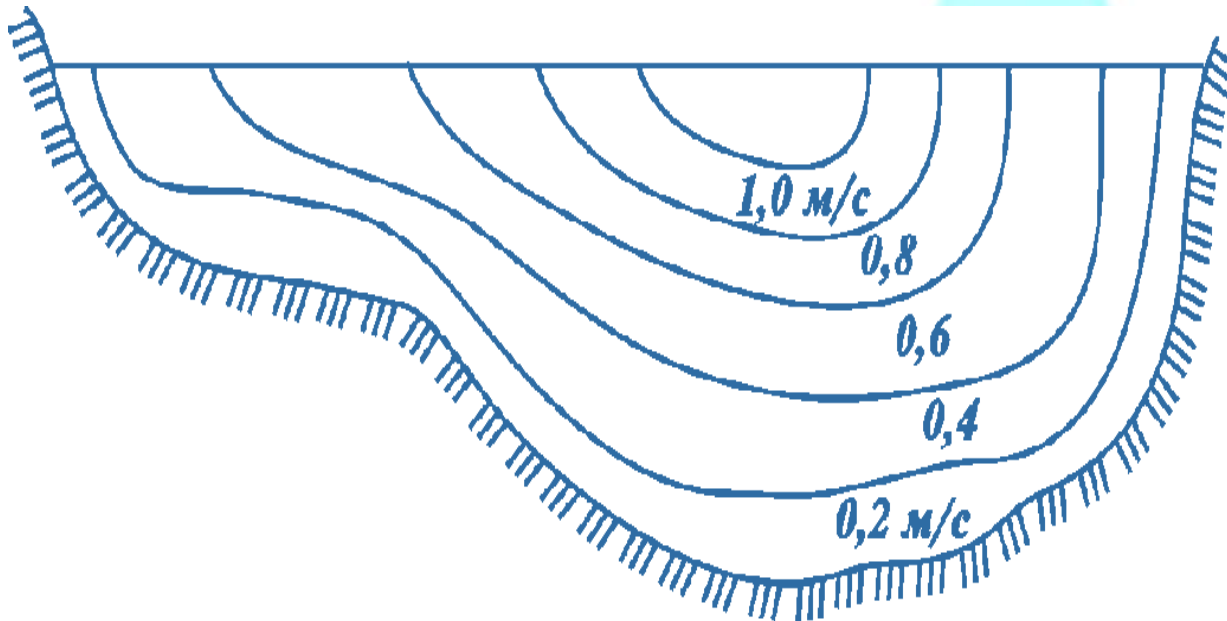
Tezliklar kesimi bilan hegaralangan shakl tezliklar epyurasi deb ataladi



Ochiq (a) va yopiq (quvur) (b) kanallarda o' lchangan o' rtacha suv tezliklarining taqsimlanish epyurasi



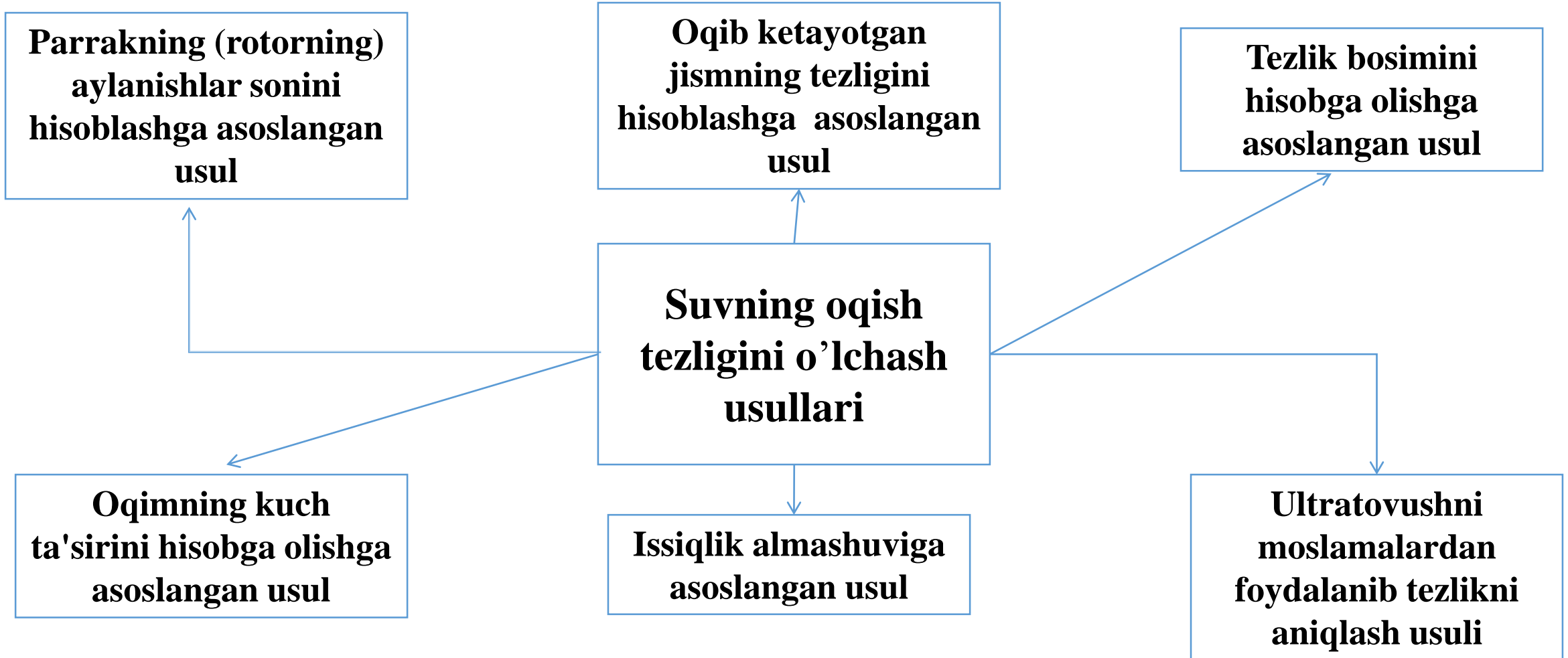
Izotaxalar



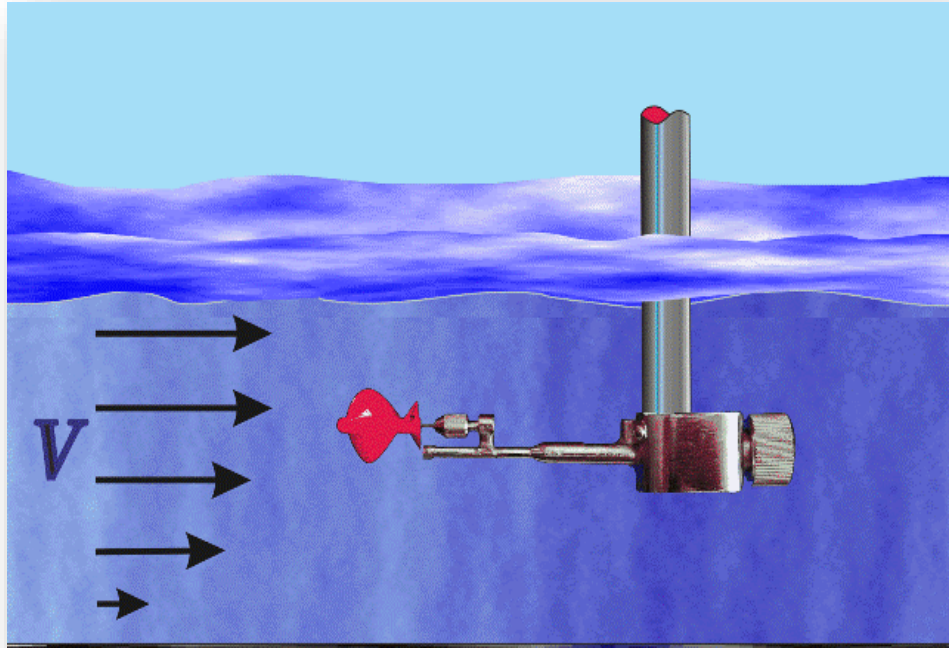
Oqim ko'ndalang kesimida miqdor jihatdan bir xil bo'lgan tezliklarni birlashtiruvchi chiziq **izotaxa** deb ataladi.

Oqim ko'ndalang kesimida izotaxalarning tasvirlanishi

Suvning oqish tezligini o'lchash usullari klassifikatsiyasi



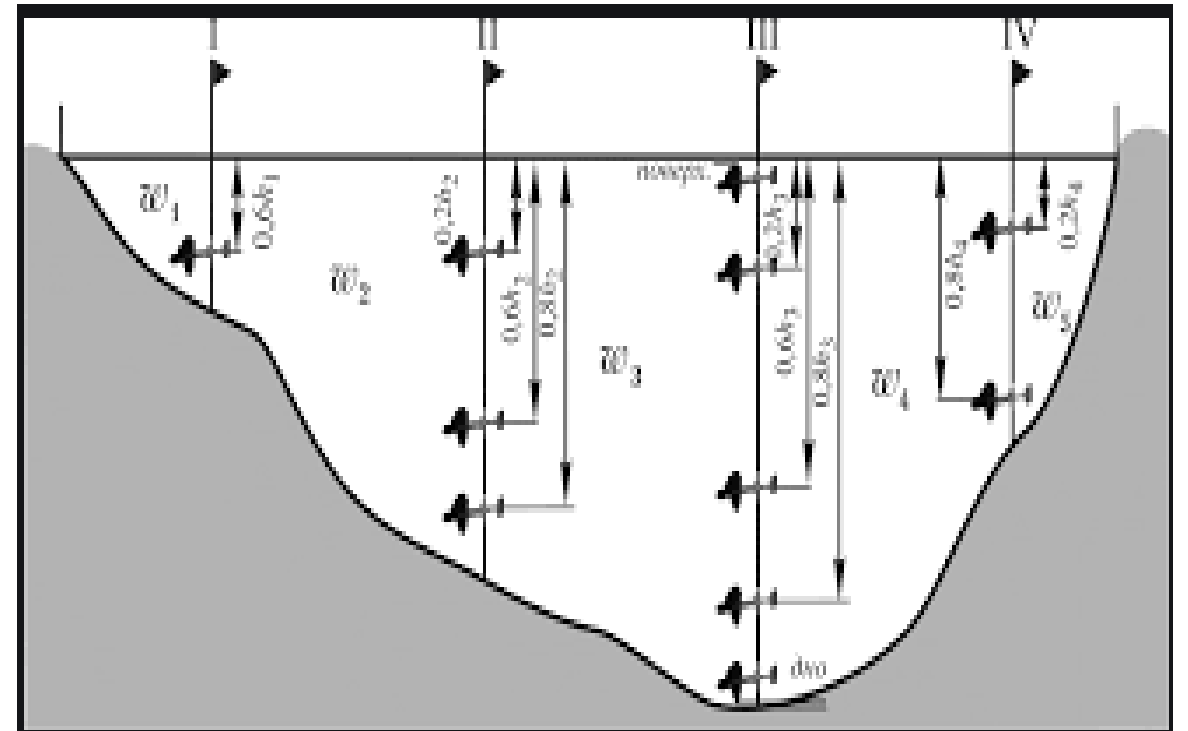
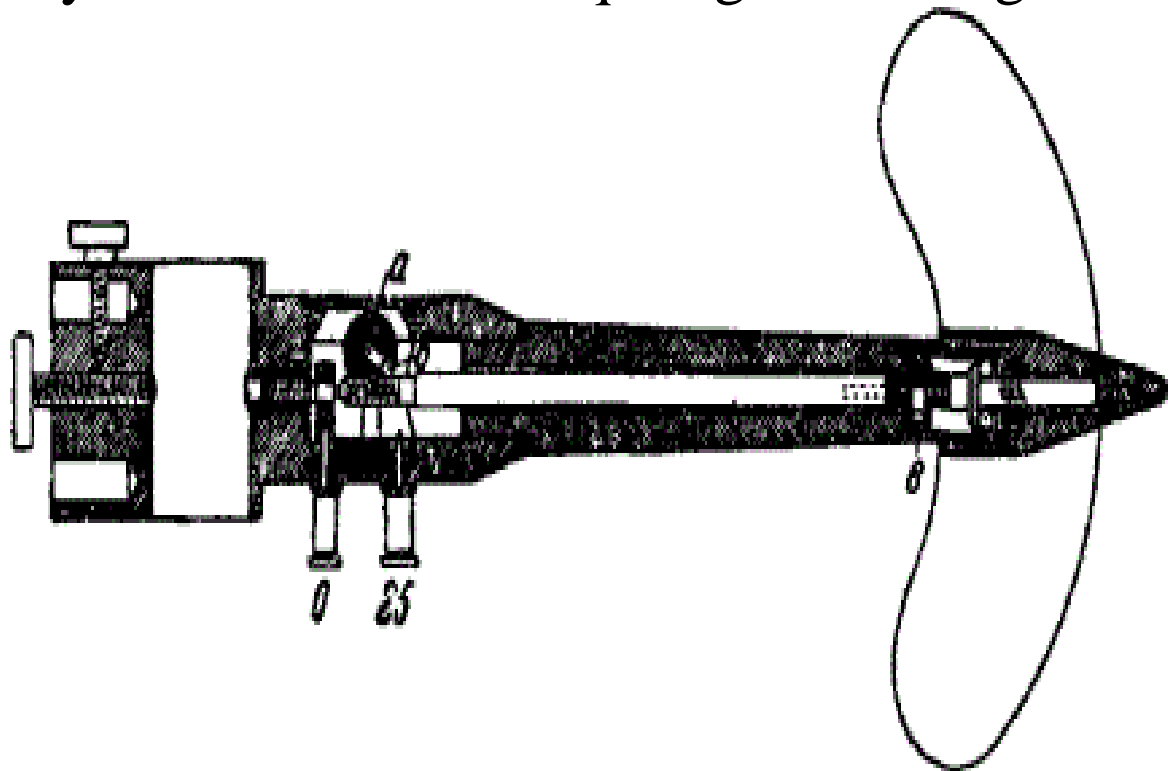
Parrakning (rotorning) aylanishlar sonini hisoblashga asoslangan usul



oqim tezligini o'lchash uchun eng keng tarqalgan asboblar gidrometrik parraklardir. Ular, odatda, oqimning alohida nuqtalarida mahalliy oqim tezligini o'lchaydilar.

Gidrometrik parrak

tezlikni gidrometrik parrak yordamida o'lchash parrakning 1 sekunddagi aylanishlar sonini aniqlashga asoslangan



Gidrometrik parrak suvning oqish tezligini jonli kesmaning istalgan nuqtasida o'lchash imkonini beradi.

Gidrometrik parrak aylanish tezligi suvning oqish tezligiga bog'liqligi



Gidrometrik parrak suvning oqishi natijasida harakatga kelib va aylanish tezligi suvning oqish tezligiga bog'liq bo'ladi.

Suvning oqish tezligini hisoblash ifodasi

Parrakning bir sekunddagi aylanishlari sonini aniqlab, suvning oqish tezligini quyidagi ifoda yordamida hisoblash mumkin:

$$V = V_0 + K \times n,$$

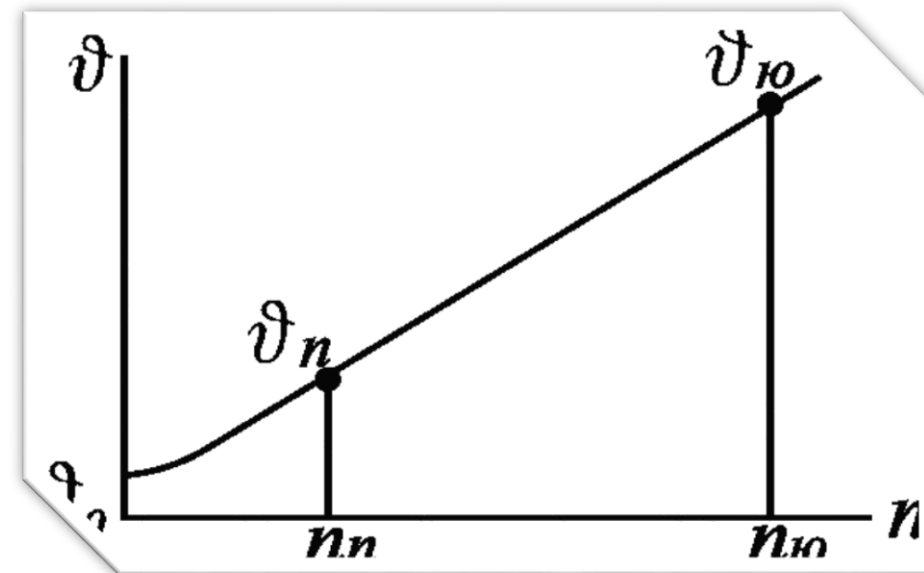
bu yerda:

V —suvning oqish tezligi, m/s;

V_0 -boshlang'ich tezlik, m/s;

K -koeffitsient,

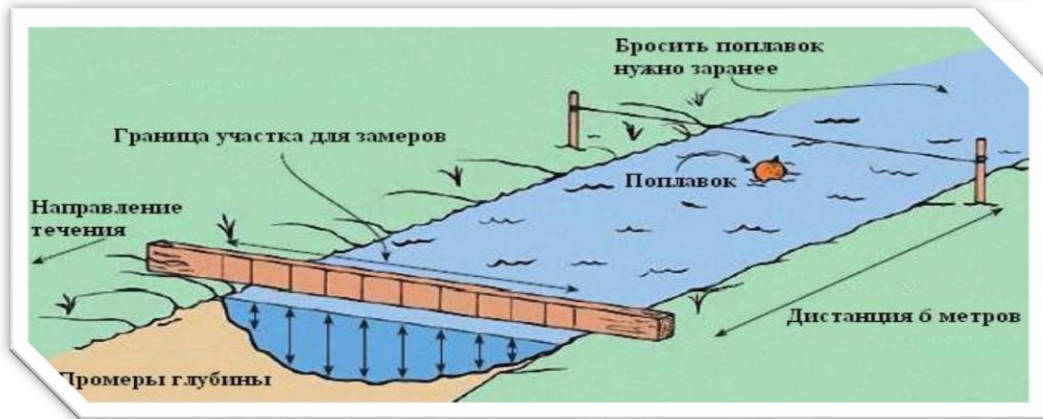
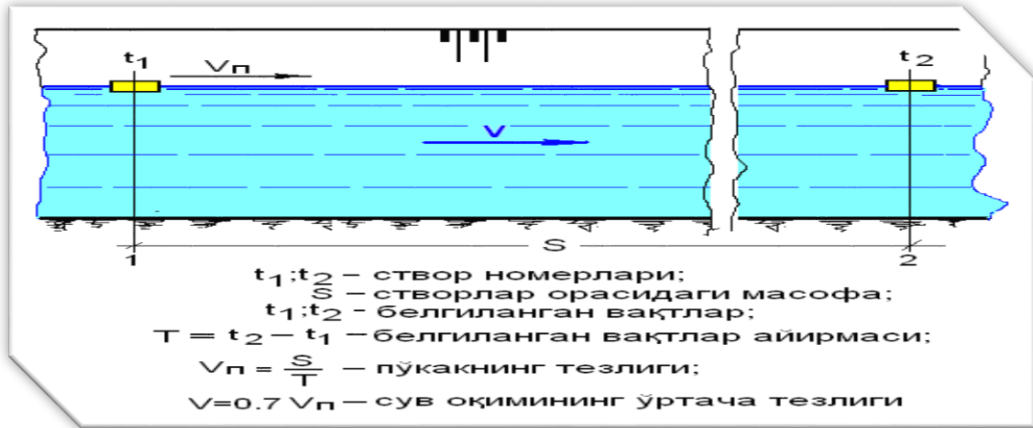
n -parrakning 1 sekunddagi aylanishlari soni. Ko'pchilik hollarda $V_0 = 0,03 - 0,07$ m/s oralig'ida bo'ladi.



Gidrometrik parrakning
 $V = f(n)$ bog'lanish grafigi

Oqib ketayotgan jismning tezligini hisoblashga asoslangan usul

Tezlikni o'lchash uchun turli xil suzuvchi vositalardan (po'kaklardan) foydalaniladi, ularni kerakli chuqurlikka tushirish mumkin.



Yuza po'kaklari

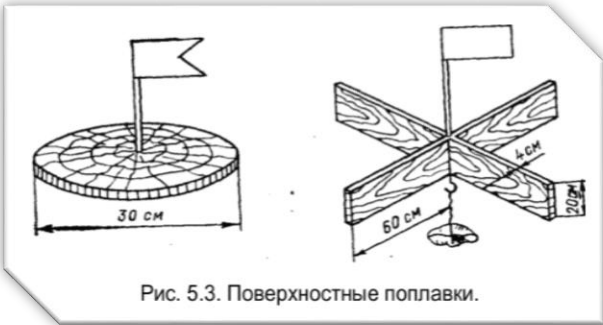


Рис. 5.3. Поверхностные поплавки.

Chuqurlik po'kaklari

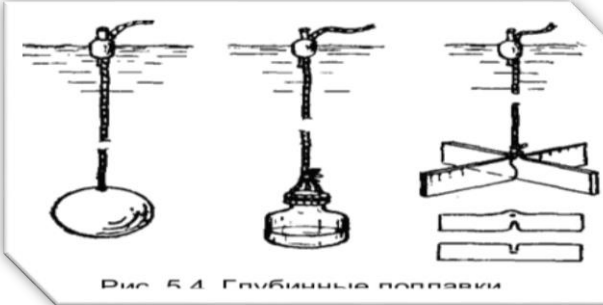


Рис. 5.4. Глубинные поплавки

Integrator po'kaklar

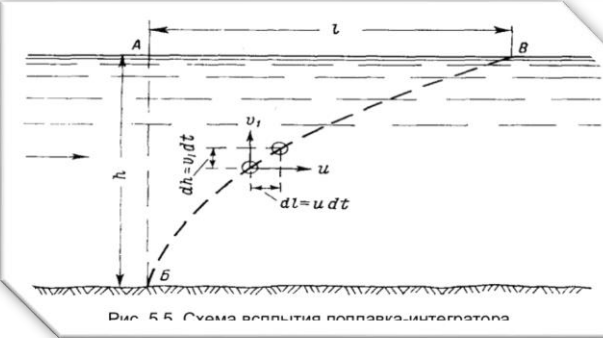
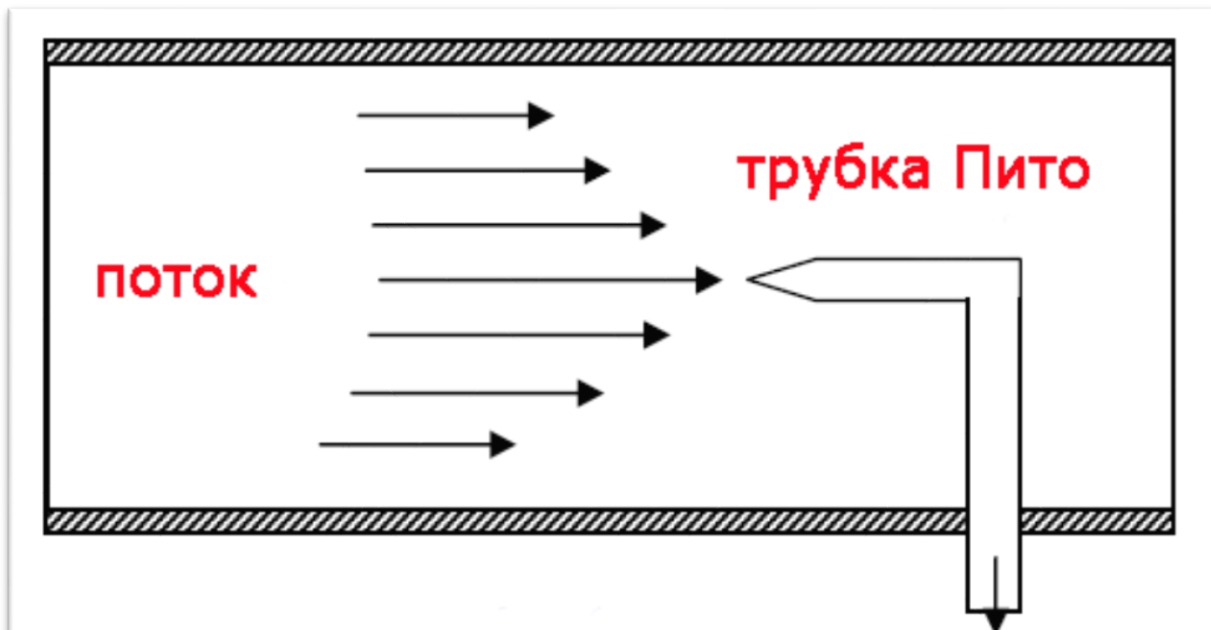


Рис. 5.5. Схема работы поплавка-интегратора

Tezlik bosimini hisobga olishga asoslangan usul

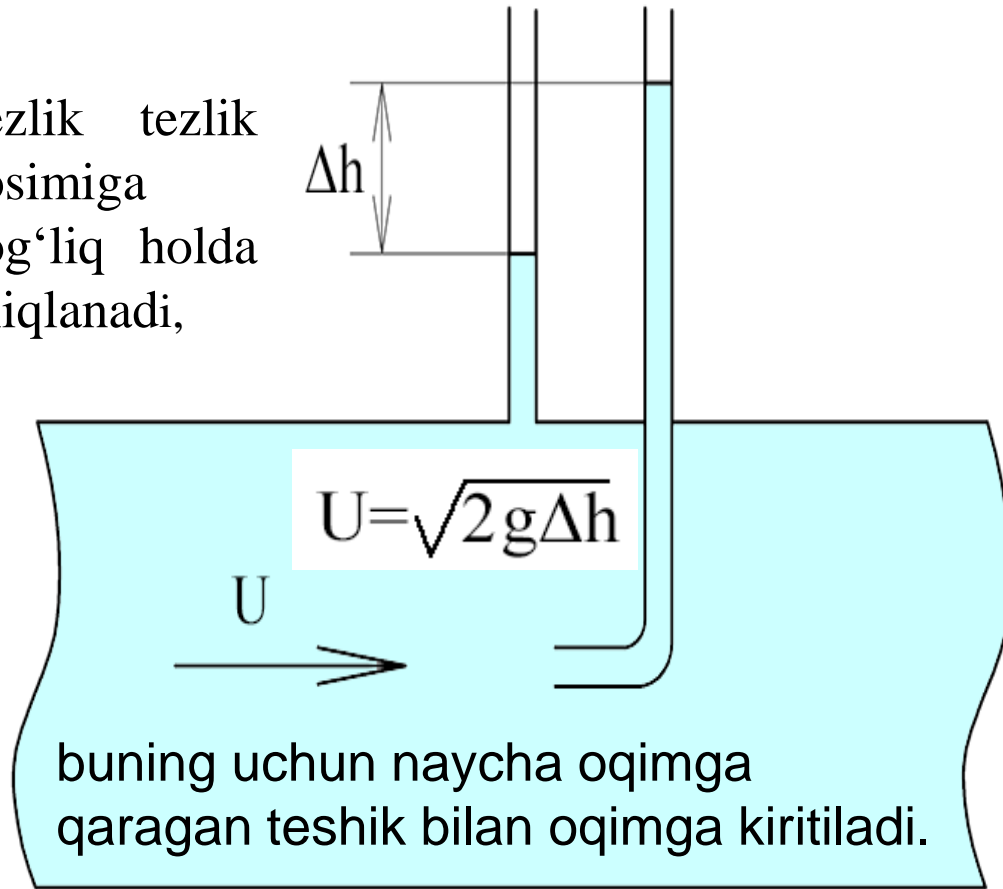


Tezlikni o'lchash uchun turli xil konstruktsiyalardagi gidrometrik naychalar ishlatiladi, ularning prototipi Pito trubkasi

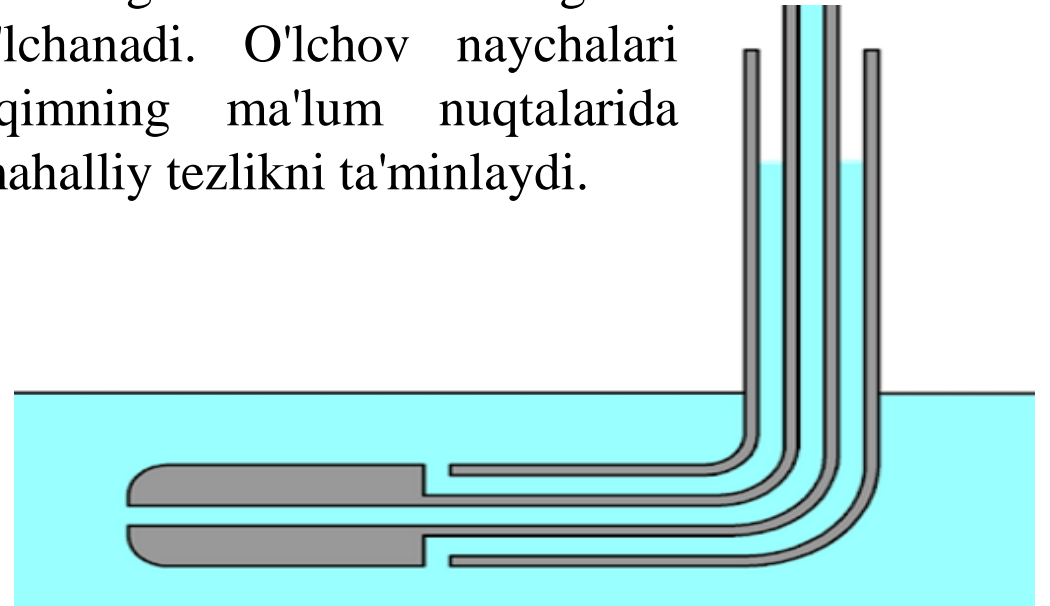


Pito trubkasi

Tezlik tezlik bosimiga bog'liq holda aniqlanadi,



Tezlik bosimi to'g'ridan-to'g'ri trubadagi sath balandligidan o'lchanadi. O'lchov naychalari oqimning ma'lum nuqtalarida mahalliy tezlikni ta'minlaydi.



Oqimning kuch ta'sirini hisobga olishga asoslangan usul

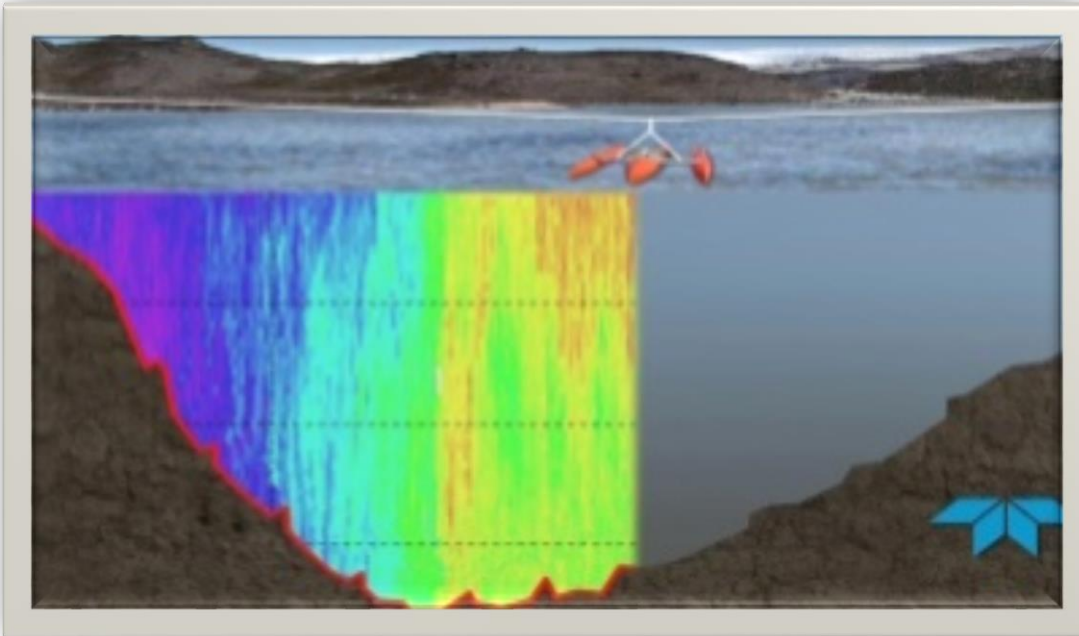
Tezlikni o'lchash uchun oqimning kuch ta'sirini sezadigan, sezgir elementi mavjud bo'lgan qurilmalar qo'llaniladi(tenzometr).

Ular tezliklarning pulsatsiyasini tekshirishga, oqimning alohida nuqtalarida tezlik qiymatlarini doimiy ravishda yozib olishga imkon beradi.



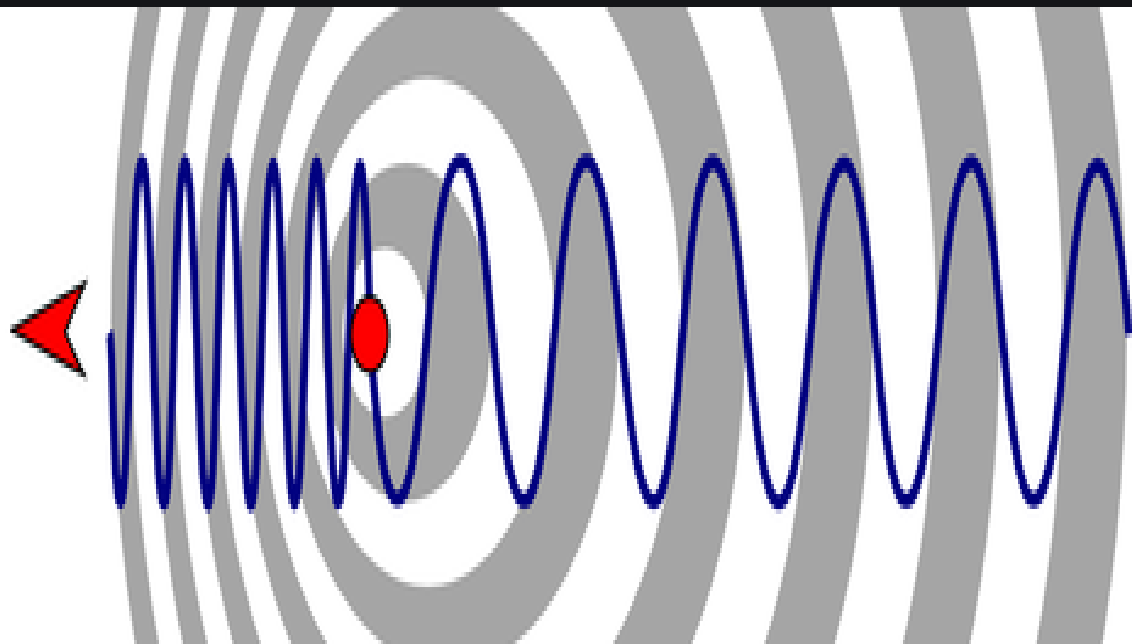
Issiqlik almashuviga asoslangan usul

Tezlikni o'lchash uchun ishchi organ sifatida qizdirilgan elementga ega qurilmalar qo'llaniladi. Oqim tezligi sezgir elementning sovutish tezligiga qarab aniqlanadi: tezlik qancha yuqori bo'lsa, sovutish darajasi ham shuncha yuqori bo'ladi. Ushbu asboblarni tezlikni doimiy ravishda yozib olish bilan o'lchaydilar.



Ultratovushni moslamalardan foydalanib tezlikni aniqlash usuli

Akustik turdagi o'lchagichlar oqim tezligini o'lchash uchun Doppler effektidan foydalanadi.



Gidrometrik parrak(vertushka)lar

Gidrometrik parrak suvning oqish tezligini o'lchashda qo'llaniladigan eng asosiy asbobdir.



Gidrometrik parrak xatoligi

Gidrometrik parrak yordamida suvning oqish tezligini 1-3 % gacha xatolikda aniqlash mumkin

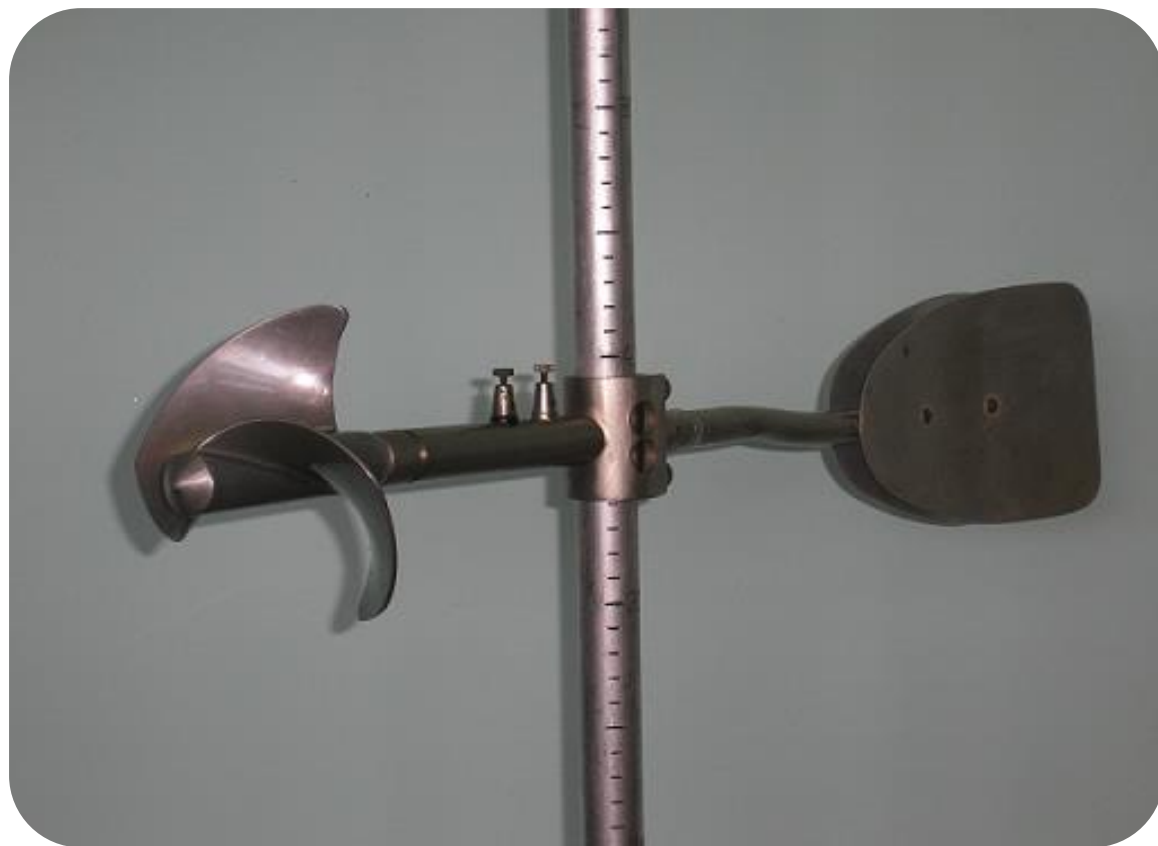
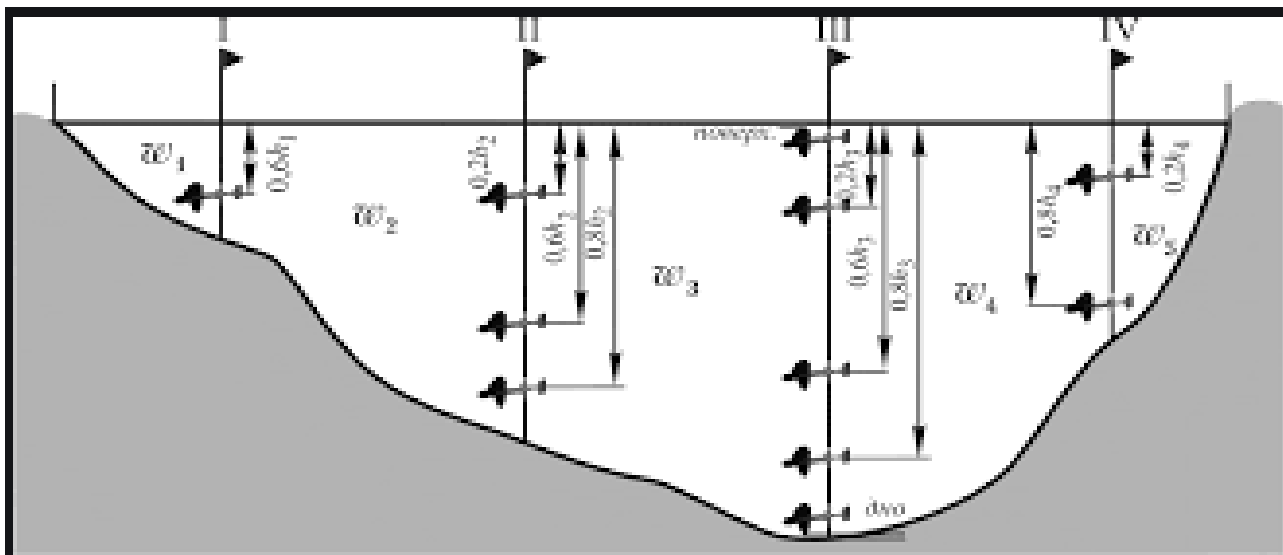


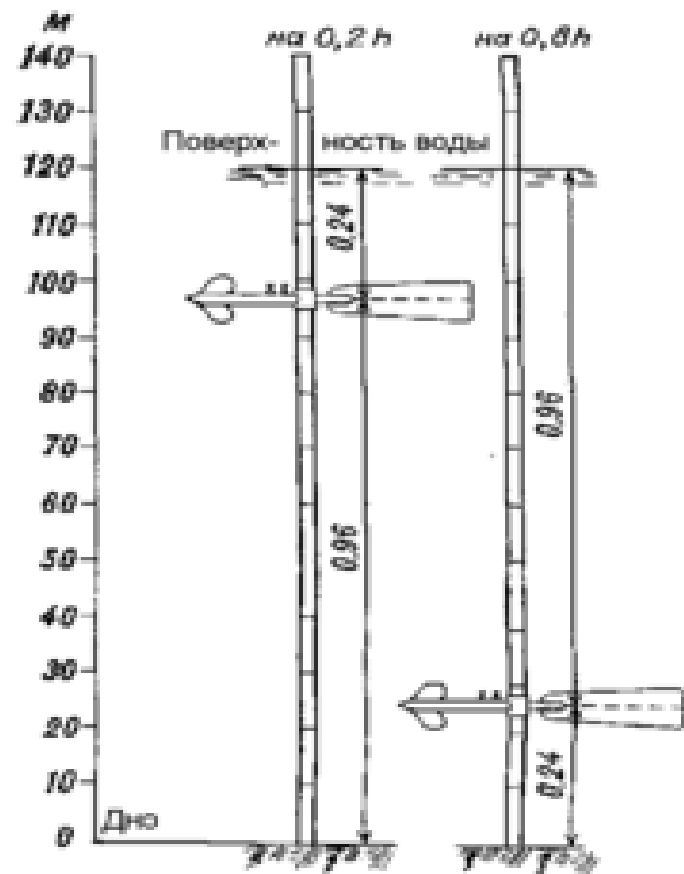
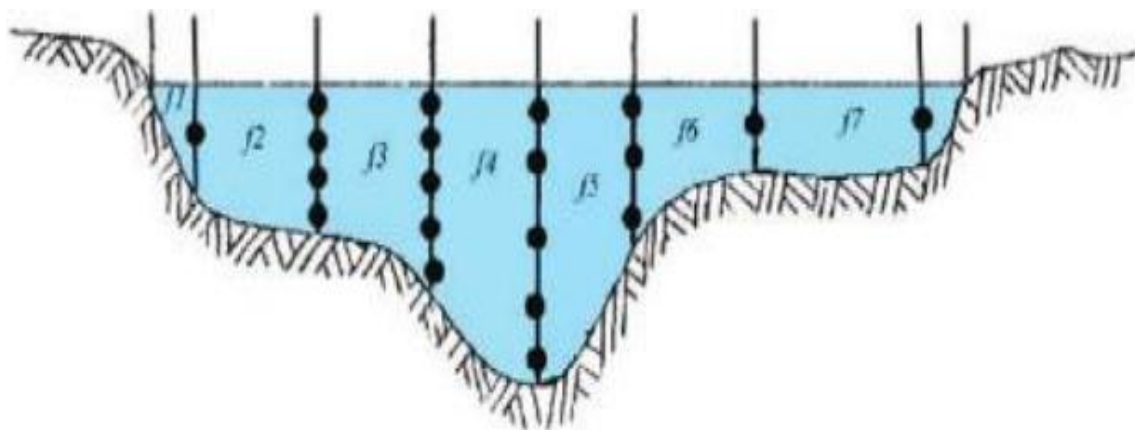
Таблица 2 – Средства измерения скорости течения воды

Тип устройства (страна изготовитель)	Диапазон измерения	Погрешность измерения	Выходная информация	Электропи- тание
1	2	3	4	5
Гидрометрические вертушки				
«Гидрометрическая микровертушка ГМЦМ-1» (Беларусь)	0,05-4,0 (м/с)	± 1,0 (%)	Визуальная	Постоянное напряжение 9 В
Гидрометрическая вер- тушка М 2010 (США)	0,03-7,5 (м/с)	± 1,0 (%)	Визуальная	Постоянное напряжение 9 В
Гидрометрическая вер- тушка М 3000 (США)	0,032-7,5 (м/с)	± 1,0 (%)	Визуальная	Постоянное напряжение 9 В
Вертушка гидрометри- ческая С 2 (Германия)	от 0,025 до 5 (м/с)	± 1 %	Визуальная	Постоянное напряжение 6 В
Вертушка гидрометри- ческая С 20 (Германия)	от 0,03 до 2,5 (м/с)	± 1 %	Визуальная	Постоянное напряжение 6 В
Универсальная гидро- метрическая вертушка С 31 (Германия)	от 0,025 до 10 (м/с)	± 1 %	Визуальная	Постоянное напряжение 6 В
Расходомер- скоростемер МКРС (Россия)	0,025-5,000 (м/с)	± 1,5 %	Визуальная	Постоянное напряжение 4,5 В
Измеритель скорости «Зонд» (Россия)	0-10,0 (м/с)	± 2,5-4,5 (%)	Визуальная	Постоянное напряжение 12 В

Suvning oqish tezligini jonli kesmaning istalgan nuqtasida o'lchash



Gidrometrik parrak suvning oqish tezligini jonli kesmaning istalgan nuqtasida o'lchash imkonini beradi.

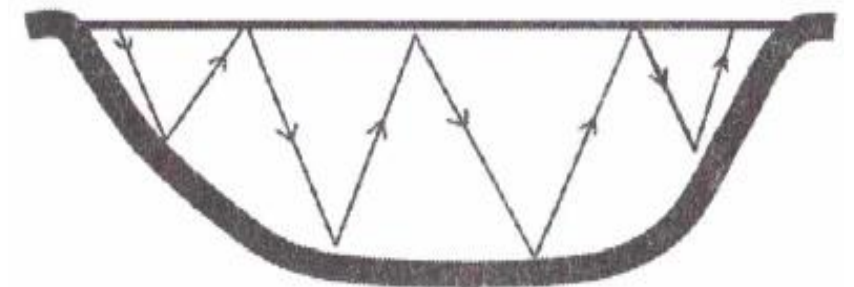
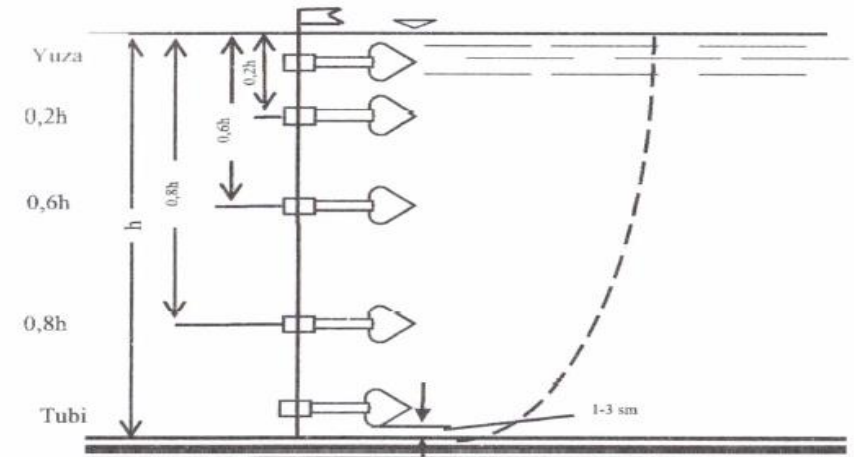


Gidrometrik parrak yordamida tezliklarni o'lchash vaqtida qo'llaniladigan usuliyar

Gidrometrik parrak yordamida tezliklarni o'lchash vaqtida asosan quyidagi ikki usul qo'llaniladi

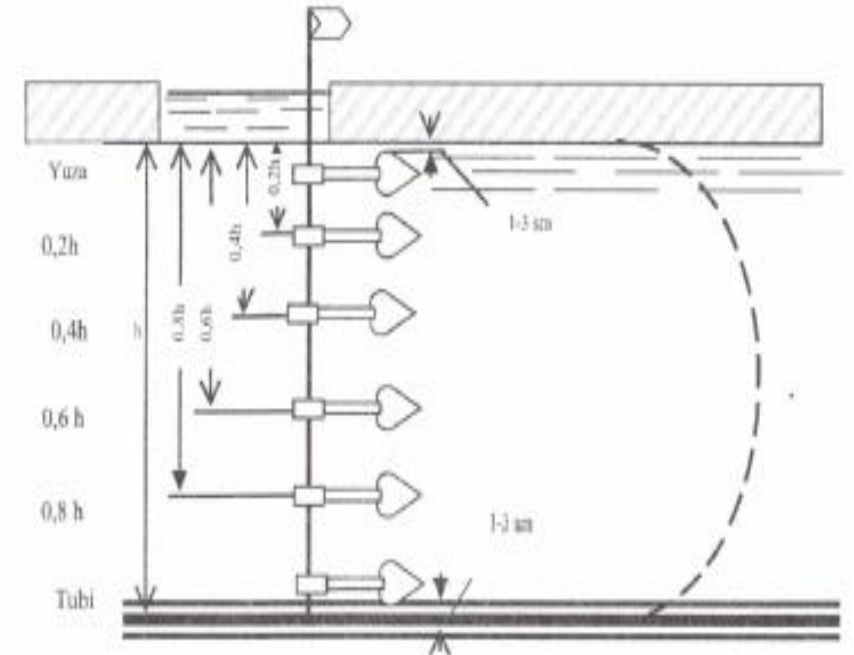
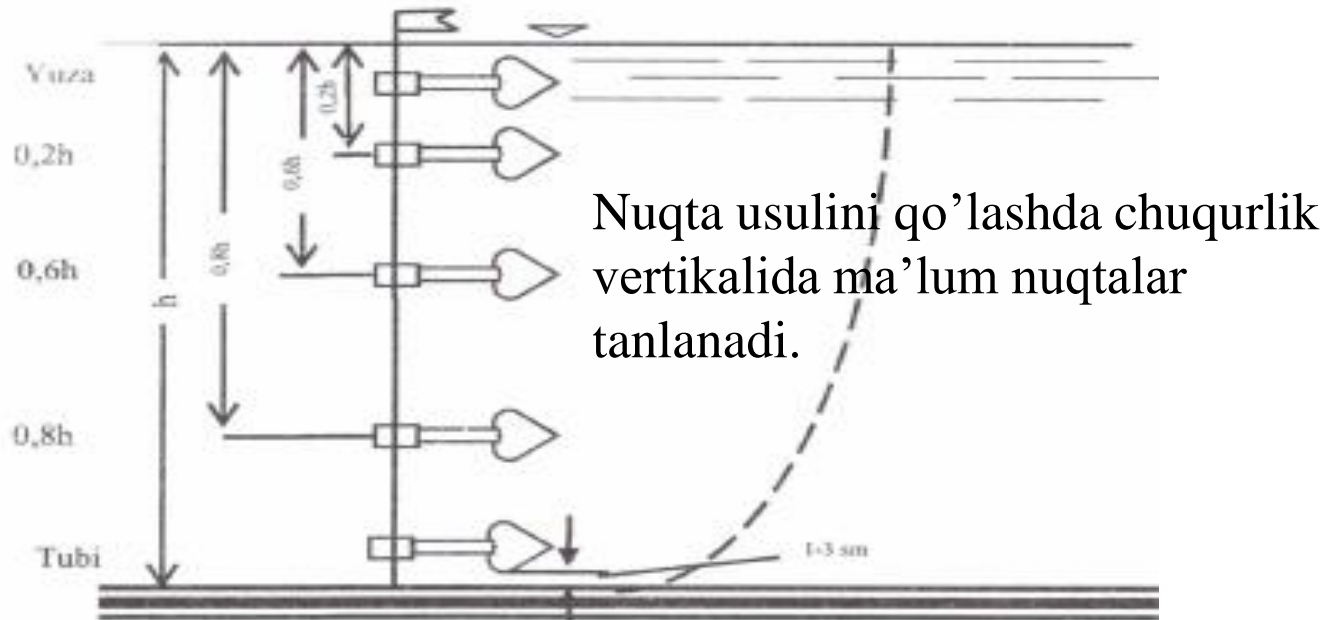
nuqta usuli

integratsion usul



4.5-rasm. Tezlikni integratsion usul bilan o'lchash sxemasi.

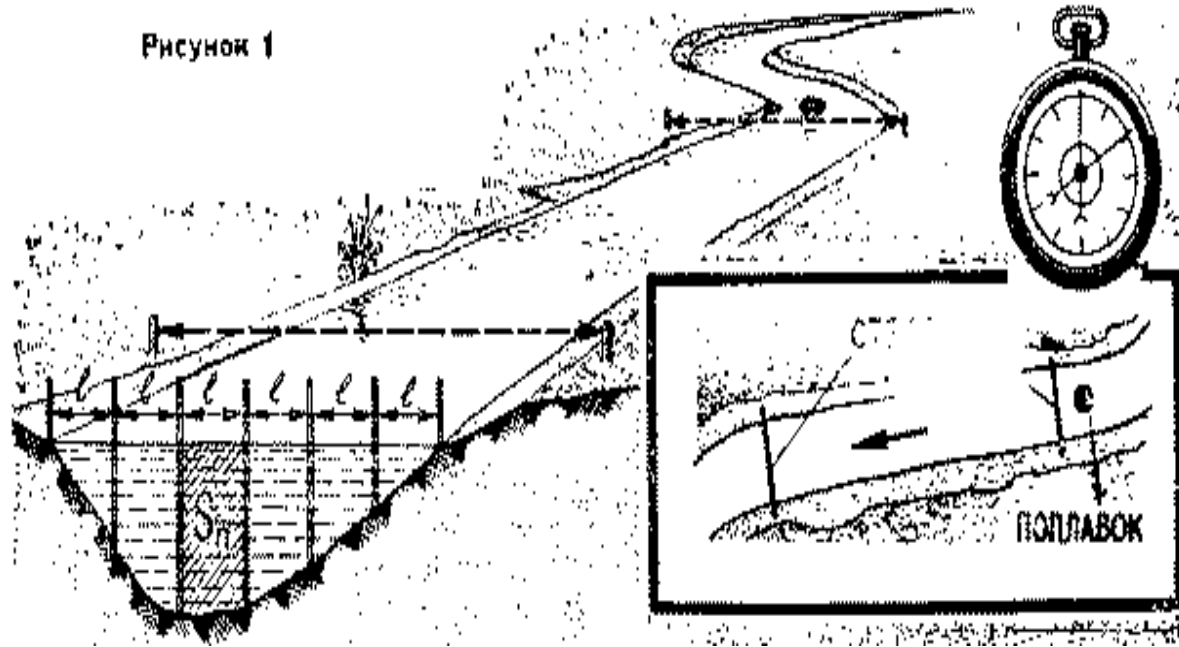
Nuqta usuli



Agar vertikalda 5 ta nuqtada tezliklarni o'lchamoqchi bo'lsak, ularning chuqurliklari quyidagi tartibda belgilanadi:

- 1-nuqtada parrak suv yuzasidan 10 sm chuqurlikka tushiriladi;
- 2-nuqta $0,2h$ chuqurlikda;
- 3-nuqta $0,6h$ chuqurlikda;
- 4-nuqta $0,8h$ chuqurlikda;
- 5-nuqta o'zan tubiga yaqin bo'ladi

Integratsion usul



Bu usul yordamida vertikalidagi oʻrtacha tezlikni yoki butun jonli kesma boʻyicha oʻrtacha tezlikni toʻgʻridan toʻgʻri aniqlash mumkin.

Vertikalidagi oʻrtacha tezlikni integratsion usul bilan aniqlashda gidrometrik parrak asta-sekin suv yuzasidan oʻzan tubiga tushiriladi. Shu vaqt davomida qayd etilgan signallar soni sanab boriladi.

Gidrometrik parrakni tushirish tezligi uni koʻtarish tezligiga teng boʻlishi kerak

Gidrometrik parrak yordamida nuqtada o'lchangan tezlikni hisoblash

Buning uchun tezlikni o'l chash jadvali tuziladi

Tezlikni o'lchash jadvali, vertikalning chuqurligi 2,54 m

T.r.	Parrak №	Ishchi chuq-k, h, m	Vertushka tushirilgan chuqurlik		Qo'ng'iroq soni	Vaqt, sek	Umumiy aylanishlar soni, N	1 sekunddagi aylanishlar soni, n	Tezlik, ϑ , m/s
			Qismda	Metrd					
1	III	2.54	Yuza	0,10	17	102	340	3,33	0,806
2			0,2	0,51	15	101	300	2,97	0,719
3			0,60	1,52	14	101	280	2,77	0,674
4			0,80	2,03	11	104	220	2,11	0,522
5			O'z.t	2,44	10	107	200	1,86	0,456

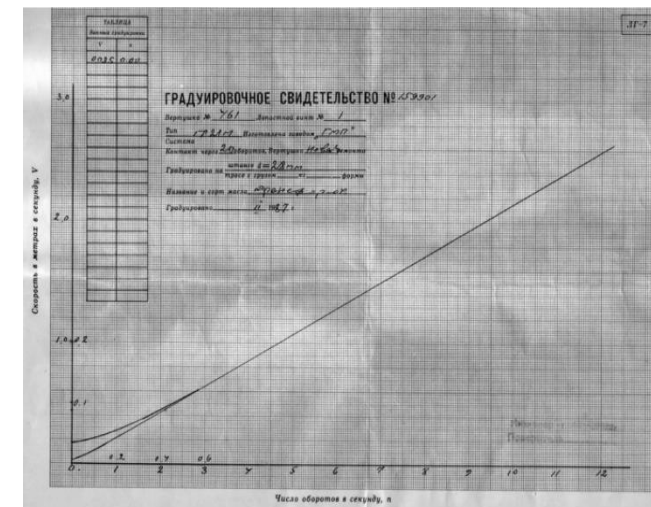
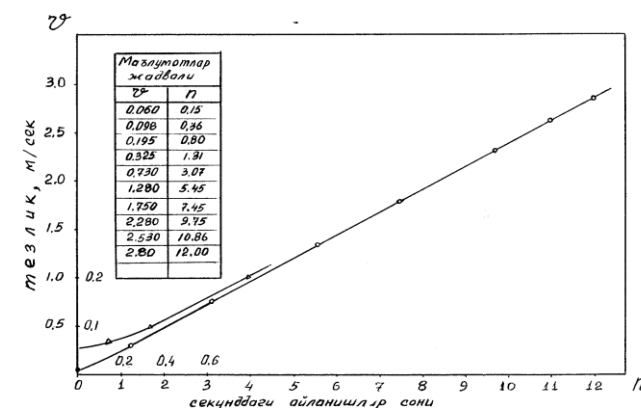


Рис. 3.3. Пример градуировочного (тарировочного) свидетельства гидromетрической вертушки



Vertikaldagi o'rtacha tezlikni aniqlash

Agar tezlik vertikalda:

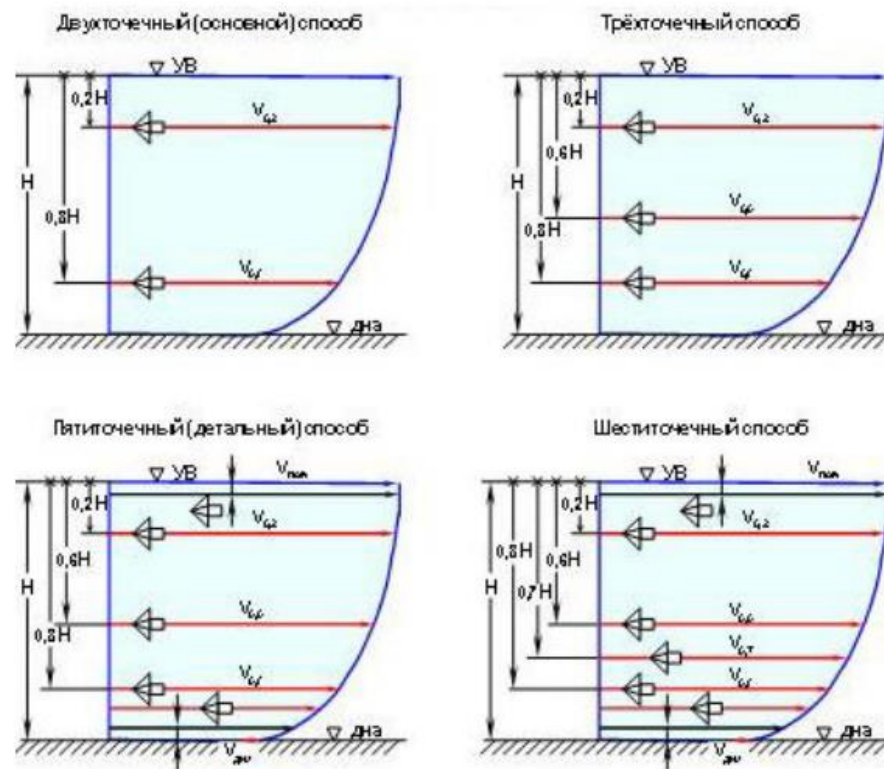
- 5 ta nuqtada o'lchangan bo'lsa:

$$V_{o'r} = 0,1 (V_{yuza} + 3 V_{0,2h} + 3 V_{0,6h} + 2 V_{0,8h} + V_{tubi});$$
- Tezlik 3 ta nuqtada o'lchangan bo'lsa:

$$V_{o'r} = 0,25 (V_{0,2h} + 2 V_{0,6h} + V_{0,8h});$$
- Tezlik 2 ta nuqtada o'lchangan bo'lsa:

$$V_{o'r} = 0,5 (V_{0,2h} + V_{0,8h});$$
- Tezlik 1 ta nuqtada o'lchangan bo'lsa:

$$V_{o'r} = V_{0,6h}.$$



Gidrometrik parrak asosiy qismlari

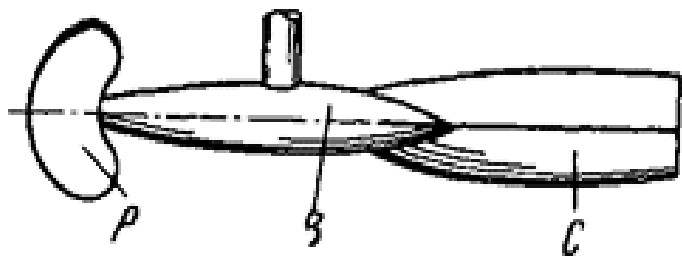


Рис. 74. Схема вертушки

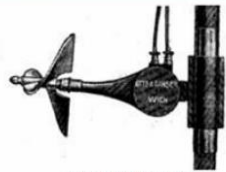


1. Parrak vinti yoki rotor;
2. Vertushkaning korpusi;
3. Hisoblash-kontakt mexanizmi;
4. Dumi (stabilizator).



Gidrometrik parrak (vertushka)lar turlari

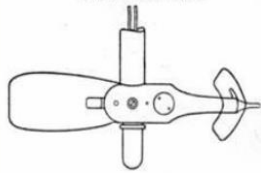
Вертушки конца XIX века



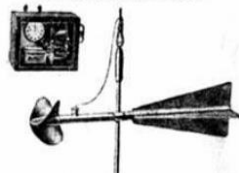
вертушка Ганзера



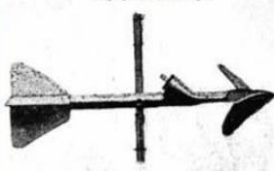
малая вертушка Ганзера



вертушка Ришара



вертушка Гаскеля

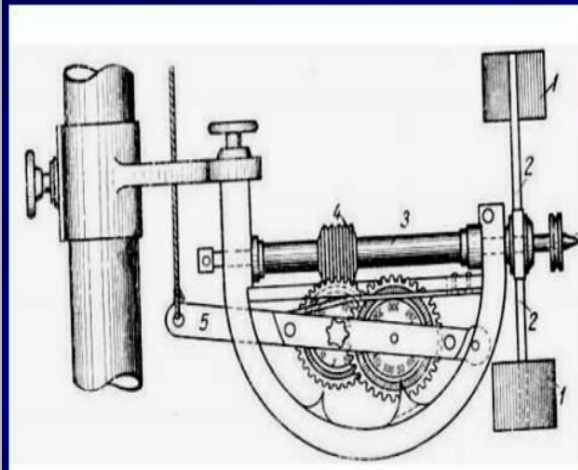


вертушка Хоффа



вертушка Амслера

Первая гидрометрическая вертушка Вольмана (1790)



Создателем гидрометрической вертушки считают немецкого гидротехника Рейнгарда Вольмана (1767 – 1837 г.), впервые применившего такой прибор в 1790 г. для определения скорости течения реки Эльбы.

GR-21 vertushkasi



Zamonaviy gidrometrik vertushkalar

C2- kichik gidrometrik
vertushka

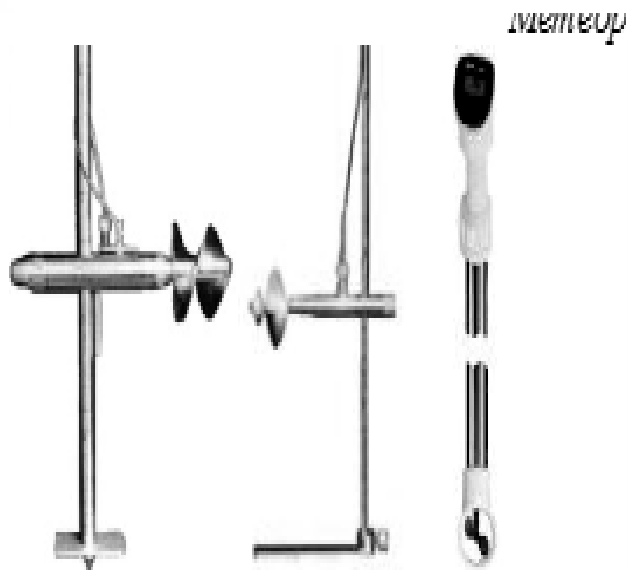


Рис. 15. Гидрометрические вертушки (Hoskin Scientific, Канада) (по [11])



Zamonaviy gidrometrik vertushkalar



Рис. 7. Универсальный ИСП С-31 (материалы винта: Л – латунь, П – пластик, А – анодированный алюминий, ОТТ-Hydrometrie, г. Кемптен, Германия) (по [18])



Рис. 8. Вертушка Прайса USGS TYPE AA MODEL 6200 (Rickly Hydrological Company, США) (по [12; 19])



Рис. 9. Вертушка Прайса USGS TYPE AA-MH MODEL 6215 (Rickly Hydrological Company, США) (по [12; 19])



Рис. 10. Вертушка Прайса USGS TYPE AA-ICE MODEL 6240, USGS TYPE AA-ICE-P MODEL 6245 (Rickly Hydrological Company, США) (по [12; 19])

Zamonaviy gidrometrik vertushkalar



Рис. 11. Universal Current Meter – Model 6500 (Rickly Hydrological Company, США) (по [12; 19])

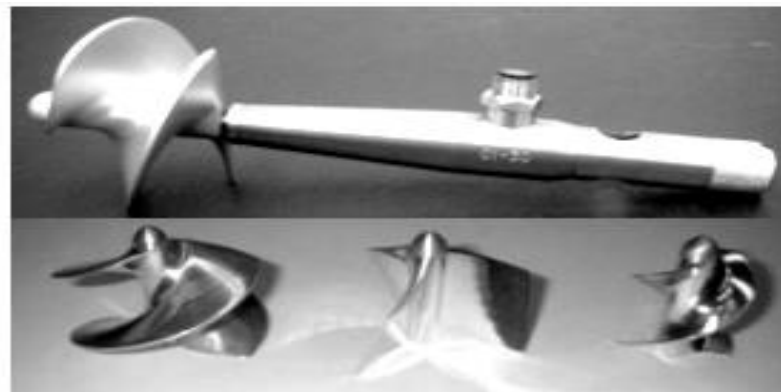


Рис. 12. Miniature Current Meter – Model 6505 (Rickly Hydrological Company, США) (по [12; 19])



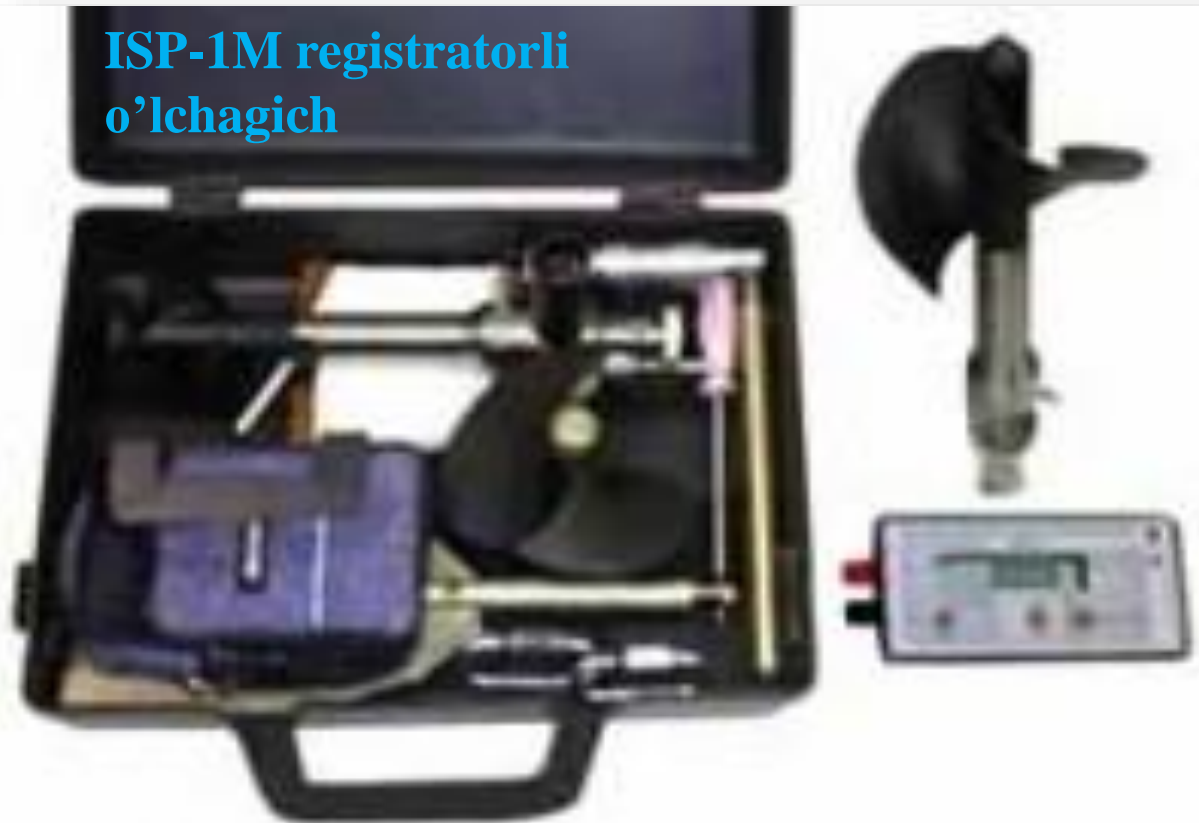
Рис. 13. Гидрометрические вертушки Model 001, 002 (Valport Limited, Великобритания) (по [21])



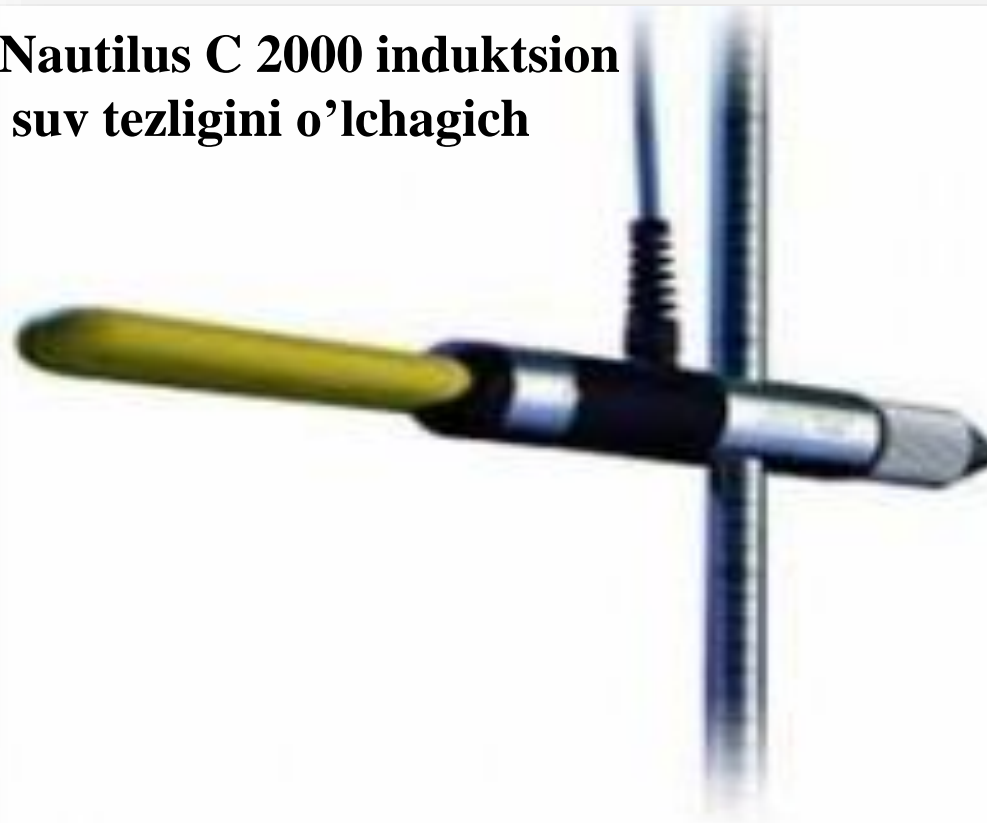
Рис. 14. Гидрометрические вертушки Model 106 (Valport Limited, Великобритания) (по [21])

Zamonaviy gidrometrik suv tezligini o'lchagichlar

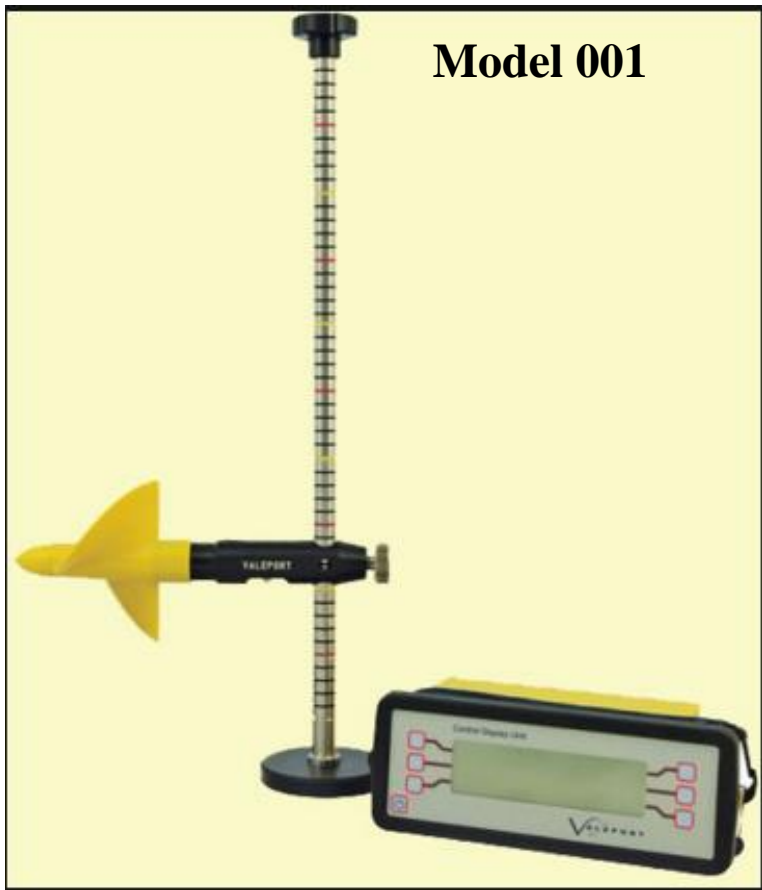
ISP-1M registratorli
o'lchagich



Nautilus C 2000 induksion
suv tezligini o'lchagich



Zamonaviy gidrometrik suv tezligini o'lchagichlar



измерителя скорости потока ОТТ



Zamonaviy gidrometrik suv tezligini o'lchagichlar

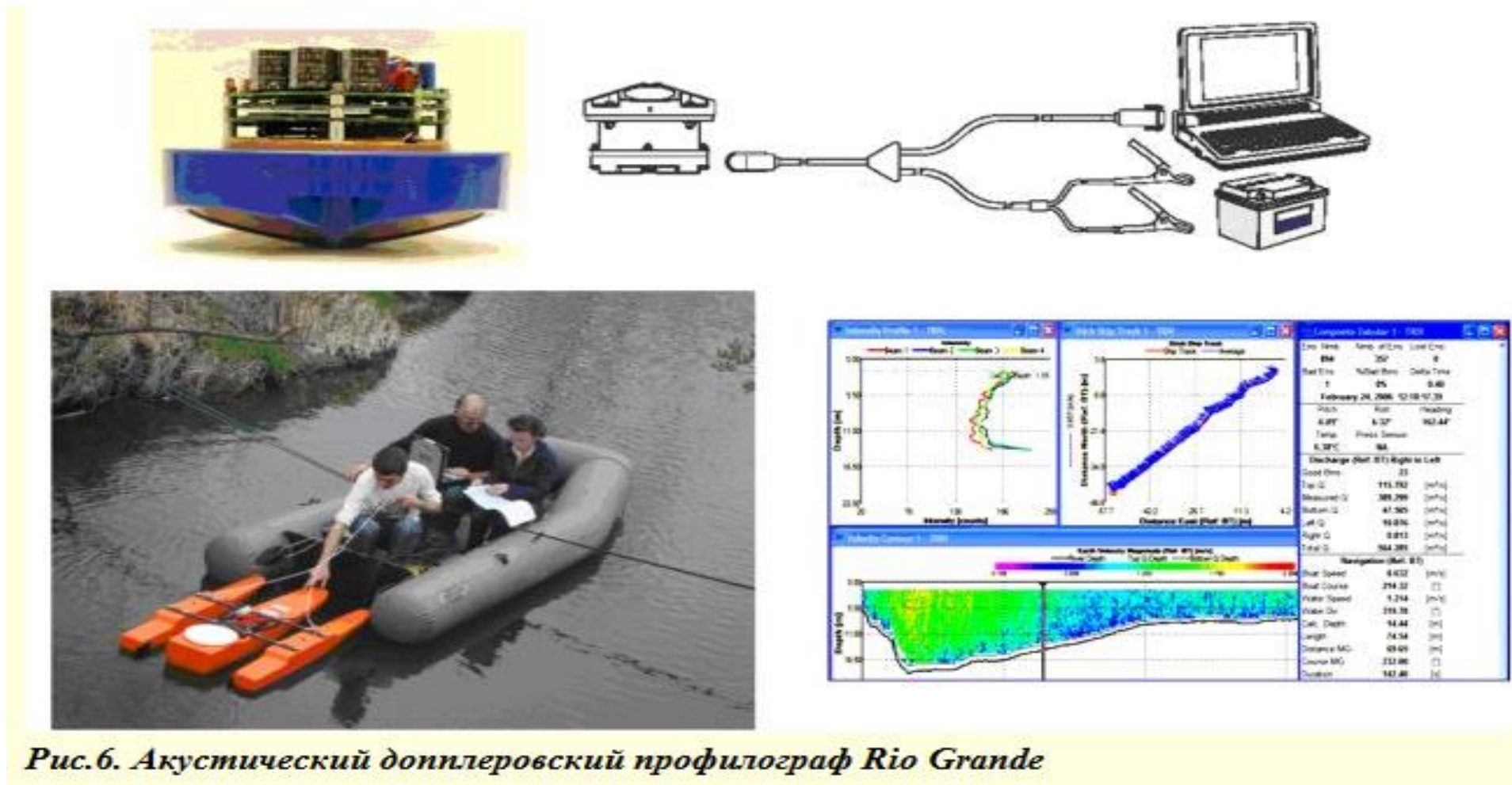


Рис. 6. Акустический доплеровский профилограф Rio Grande

Suv sarfi haqidagi ma'lumotlar muhim ahamiyati

**Suv sarfi haqidagi
ma'lumotlar
quyidagilarda muhim
ahamiyatga ega**

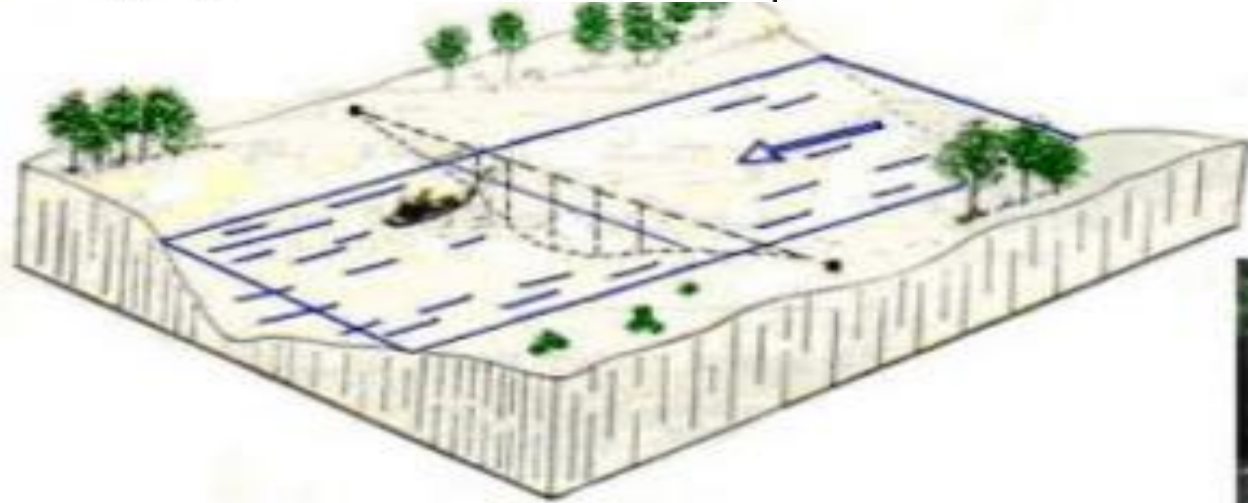
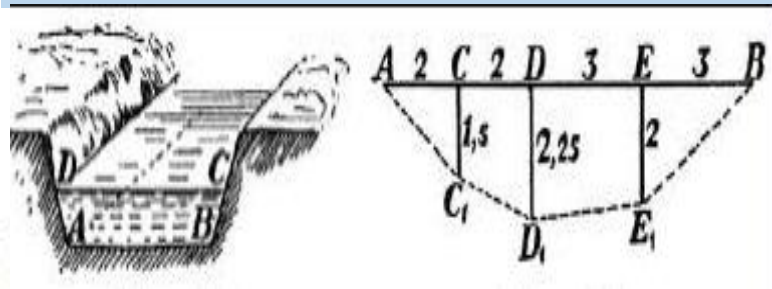


qishloq va suv xo'jaligida



gidrotexnik inshootlarni loyihalash,
qurish va ekspluatatsiya qilishda

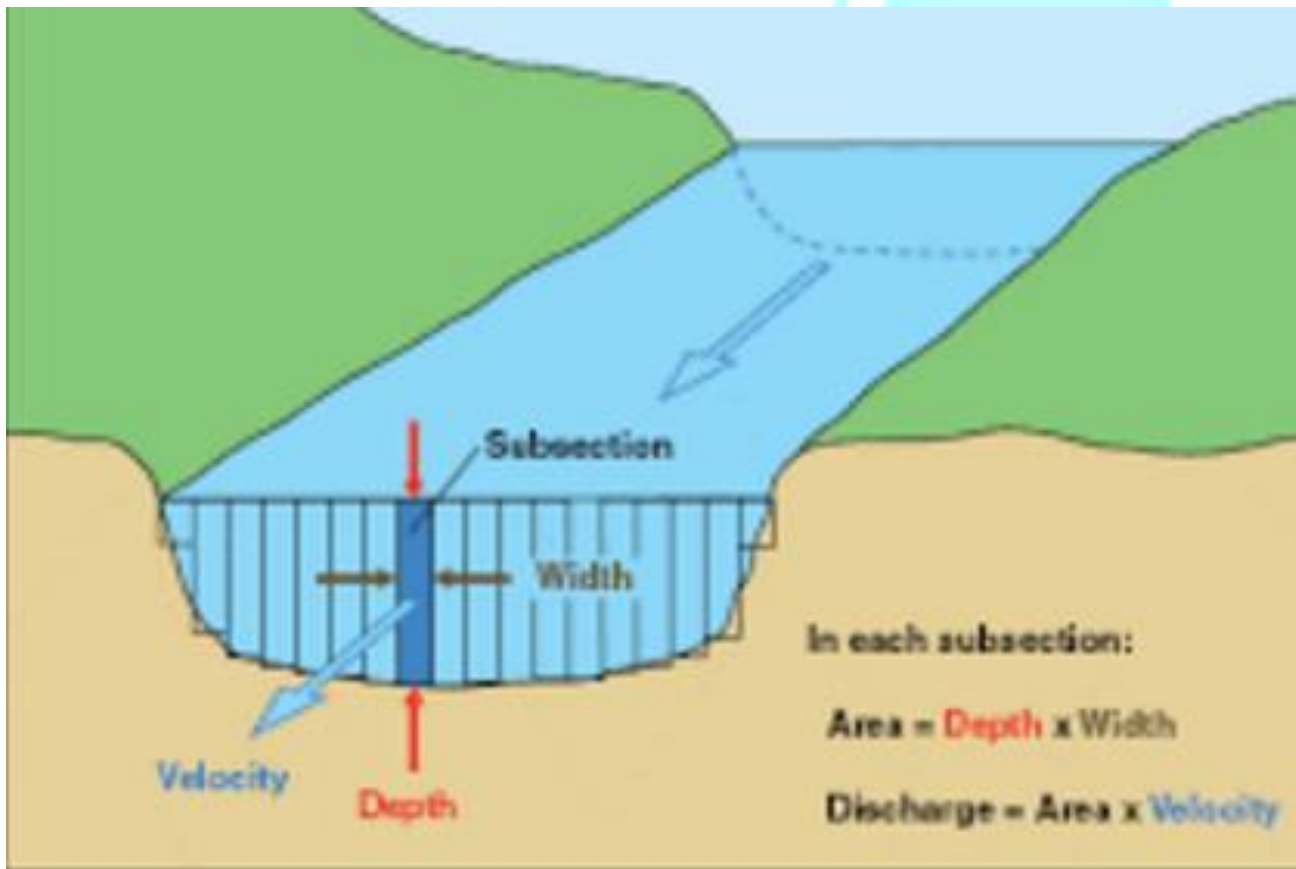
Suv sarfi tushunchasi



Daryoning ko'ndalang qirqimidan vaqt birligi ichida oqib o'tadigan suv miqdoriga suv sarfi deyiladi

Suv sarfining ifodalanishi

Suv sarfi kichik ariqlar, soylar, buloqlarda l/s, daryolar va kanallarda esa m^3/s o'lcham birliklarida ifodalanadi



Gidrologik rejimini o'rganishdagi asosiy ko'rsatkich

Suv sarfi har qanday daryoning gidrologik rejimini o'rganishda eng asosiy ko'rsatkichlardan biri hisoblanadi.



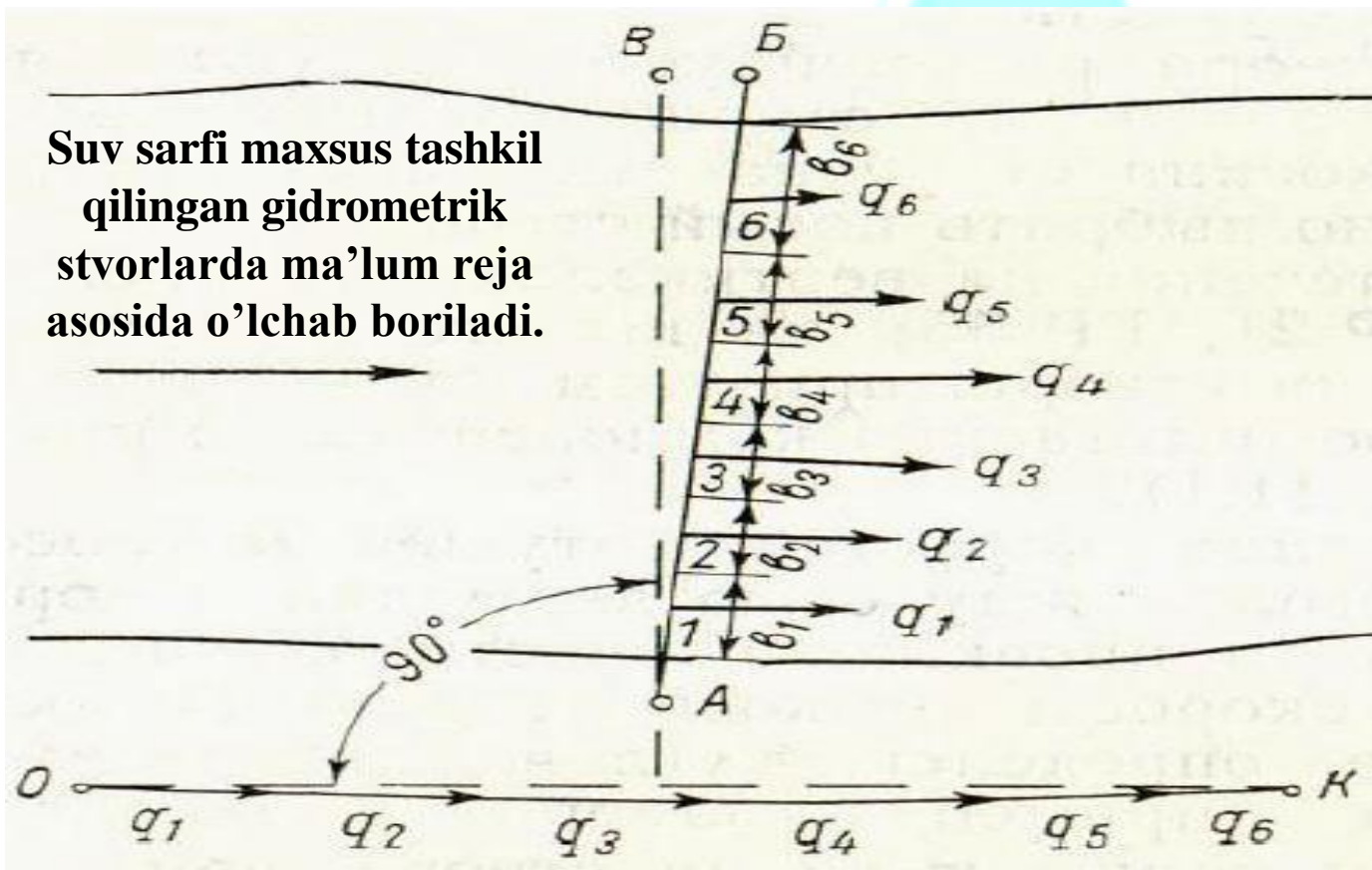
Daryo o'zanida bo'ladigan hamma o'zgarishlar unda harakatlanayotgan suvning miqdoriga bog'liq.



Shu bilan birga suv rejimining hamma elementlari ham suv sarfiga bog'liq holda o'zgaradi.

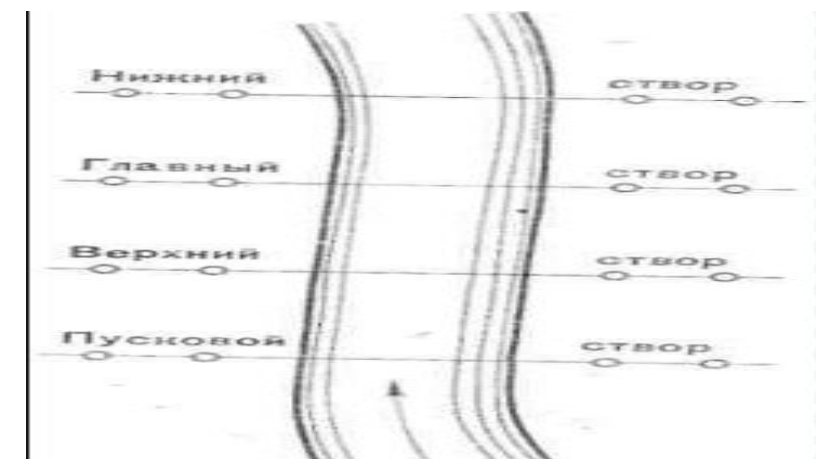
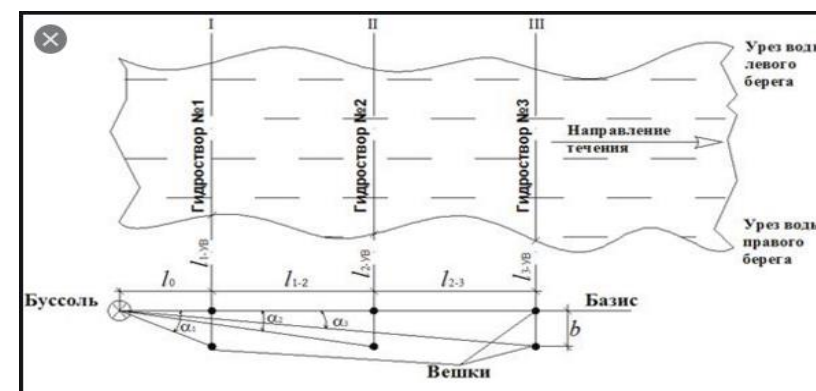
Suv sarfini aniqlash joyi

Suv sarfi maxsus tashkil qilingan gidrometrik stvorlarda ma'lum reja asosida o'lchab boriladi.



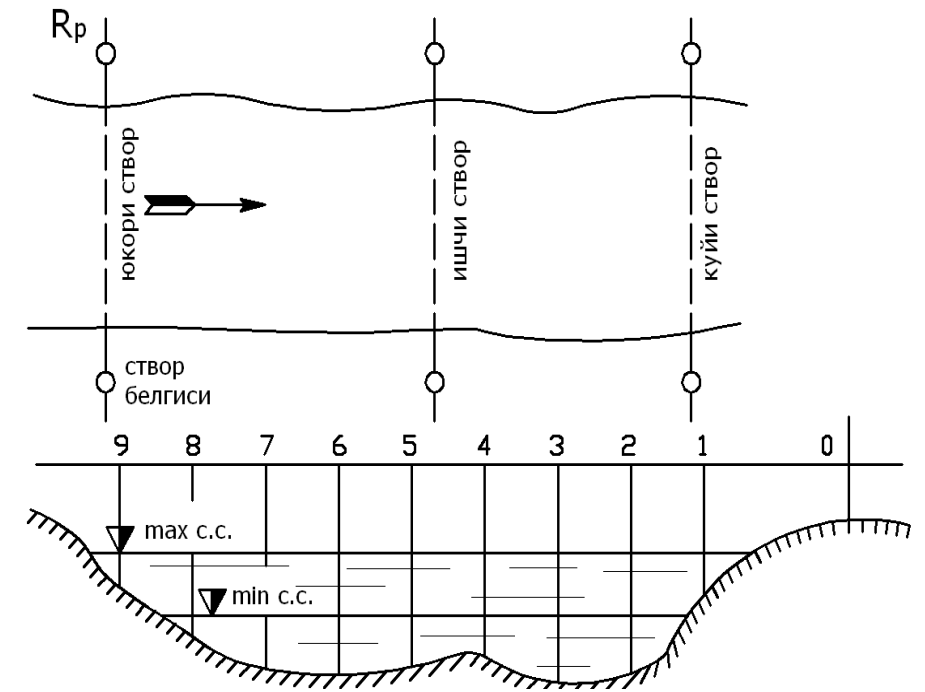
Gidrometrik stvor

Gidrometrik stvor deganda daryoning oqim yoʻnalishiga perpendikulyar holatda oʻrnatilgan va suv sarfini doimiy ravishda oʻlchab borishga imkon beradigan qurilma tushuniladi.



Suv sarfini belgilangan reja asosida o'lchab borishda quyidagi ishlarni bajarish zarur:

- 1) gidrometrik stantsiya yoki post uchun daryo uchastkasini tanlash va unda gidrometrik stvorni qurish;
- 2) tanlangan joyning holati va suv sarfini aniqlash usullariga bog'liq holda gidrometrik stvorni kerakli asbob - uskunalar bilan jihozlash;
- 3) gidrometrik stvorda suv sarfini, suv yuzasining nishabligini, muzlash hodisalarini, meteorologik elementlarni va boshqa suv rejimi elementlarini muntazam kuzatib borish;
- 4) suv sarfini, oqim miqdorini aniqlash va daryo oqimining yil davomida taqsimlanishini hisoblash;
- 5) suv sarfini aniqlash vaqtida bajariladigan barcha ishlarning maxsus qo'llanma talablari asosida amalga oshirilishini uzluksiz nazorat qilib borish.



Suv sarfini o'lchash aniqligini yetarli darajada ta'minlash uchun suvning bir tekis oqadigan joyi tanlanadi

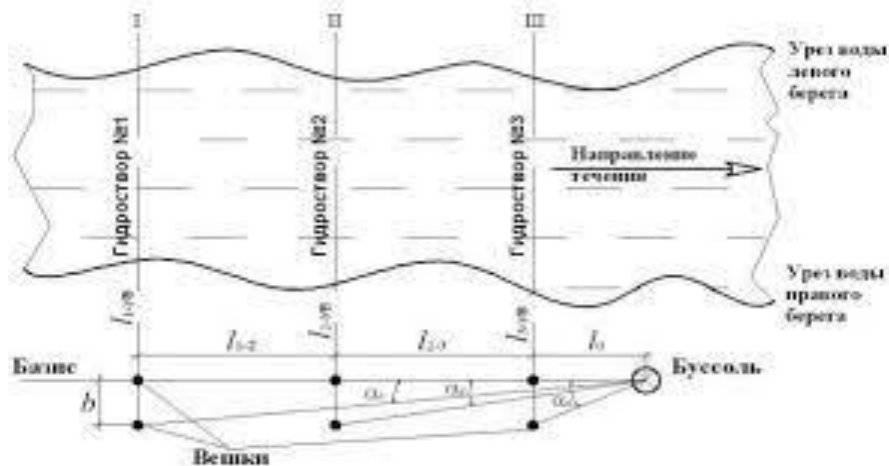
- Daryo ko'ndalang qirqimi bo'yicha suvning umumiy oqish yo'nalishi bir xil bo'lishi kerak.
- Suvning oqish tezligini gidrometrik vertushka yordamida yetarli aniqlikda o'lchash uchun uning qiymati kam suvli davrida 0,15-0,25 m/s dan kam bo'lmasligi kerak.
- To'lin suvli va toshqin davrlarida esa suvning oqish tezligi 3,0-4,0 m/s dan oshmagani ma'qul.



Gidrometrik stvorning jihozlanishi

Gidrometrik stvor quyidagi moslamalar bilan jihozlanadi:

1. Agar suvni kuzatish joyi stvordan ancha uzoqda joylashsa, stvor suv kuzatish joyiga o'rnatiladi;
2. Balandlik reperlari quriladi;
3. Suvning chuqurligi, suvning oqish tezligi va boshqa elementlarini o'lchash uchun gidrometrik ko'priq, osilgan belanchak, qayiq, kater, sol va boshqalar bo'lish zarur;
4. Nishabli suv kuzatish joyi belgilanadi.



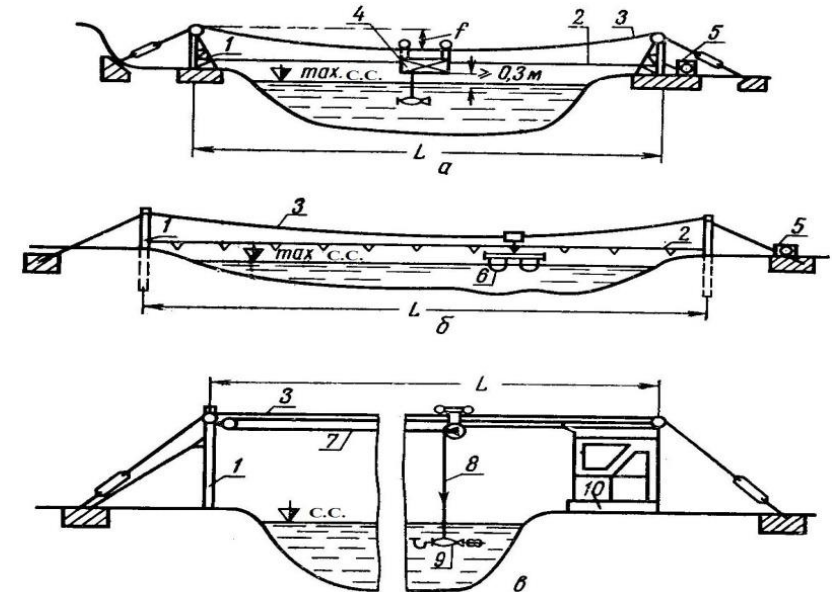
Gidrometrik stvorning jihozlanishi

Gidrometrik ko'prik kichik daryo va kanallarda quriladi. Hidrometrik ko'prikni daryo kengligi 50 m gacha bo'lgan holda qurish mumkin. Ular 2 ko'rinishda bo'lishi mumkin:

- qirg'oqqa mahkamlab qurilgan;
- osma ko'prik.

Gidrometrik belanchak(yulka) suvning oqish tezligi katta va qirg'oqlari baland tog' daryolarida qo'llaniladi. Qirg'oqlari juda tik bo'lgan tog' daryolarida gidrometrik yulkalar o'rnatiladi.

Daryo kengligi 150 - 200 m bo'lganda gidrometrik qayiqqlar qo'llaniladi.



Gidrometrik postlar (a- lyulkali, b-paromli, v-distonsion moslamali)

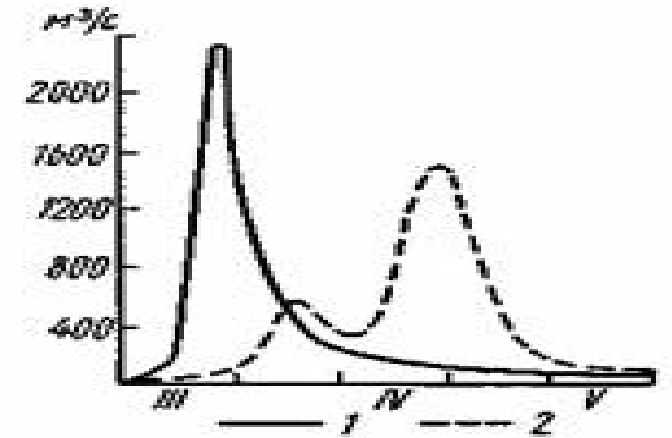
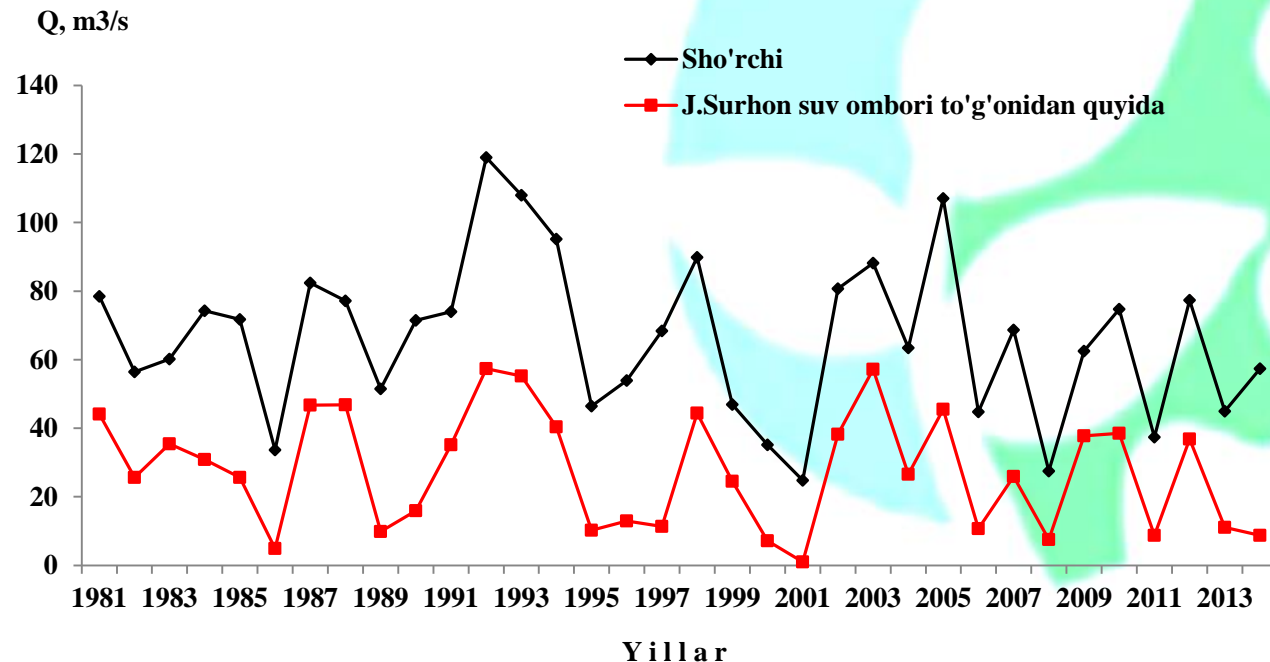
Gidrometrik stvorning jihozlanishi

Amaliy ishlarda daryo qirg'og'idagi xonada o'rnatiladigan uzoqdan o'lchovchi gidrometrik moslama GR-64, GR-70 dan foydalaniladi. GR-64 va GR-70 yordamida kengligi 100 m gacha va chuqurligi 12 m gacha (GR-64 m da daryoning kengligi 200 m gacha) bo'lgan daryolarda chuqurlik o'lchash ishlarini, suvning oqish tezligini va muallaq oqizlarni aniqlash uchun suv namuna olish va boshqa ishlarni bajarish mumkin. Chuqurligi katta daryolarda chuqurlikni o'lchash va gidrometrik vertushkani kerakli chuqurlikka tushirish uchun gidrometrik yuk ishlatiladi. Gidrometrik vertushka kronshteyn yordamida gidrometrik yukka mahkamlanadi.



Xarakterli suv sarflari

O'lchashlar natijasida uning **o'rtacha kunlik, o'rtacha oylik, o'rtacha yillik, o'rtacha ko'p yillik** hamda eng yuqori va eng kichik qiymatlari aniqlanadi. Bu kattaliklar bir nom bilan xarakterli **suv sarflari deb** ataladi.

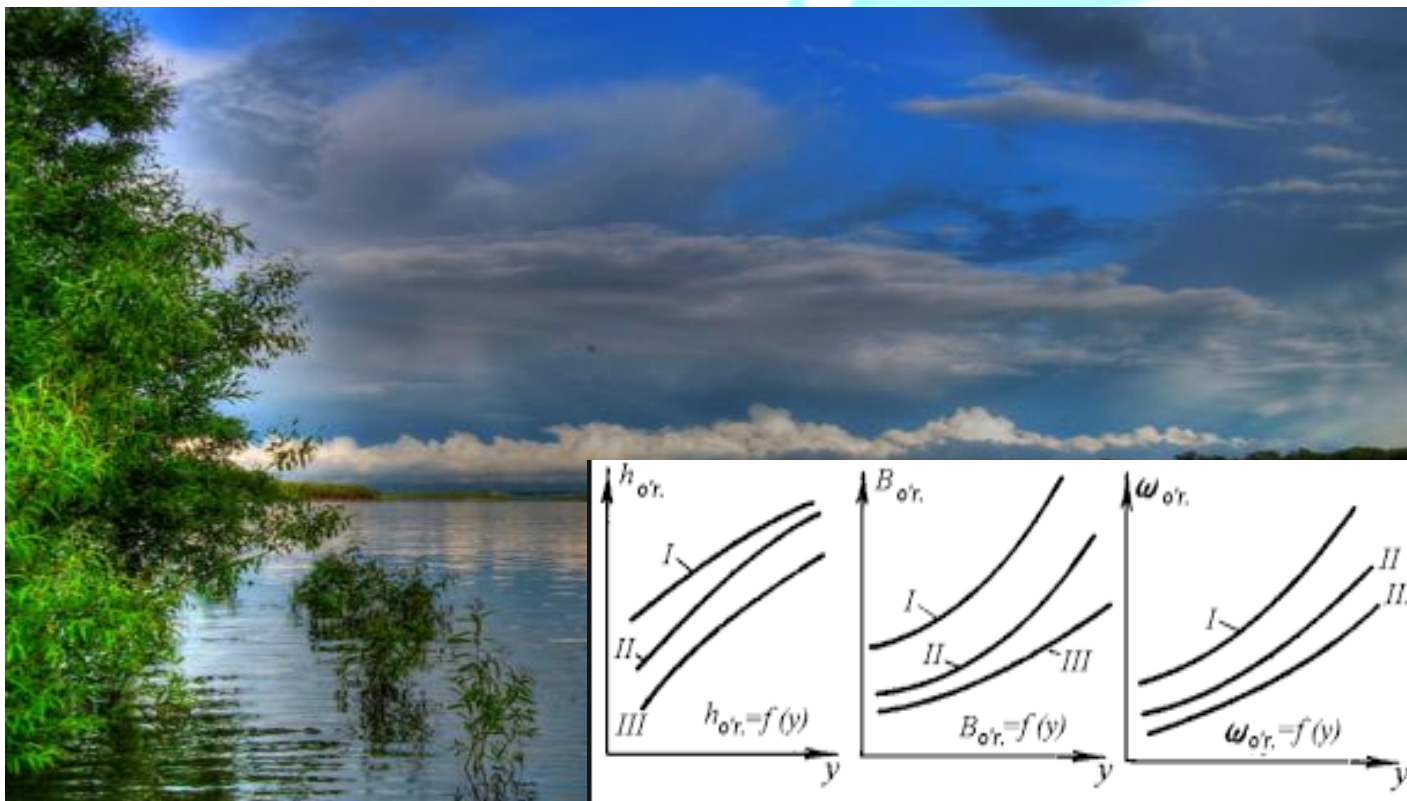


Повторяемость и обеспеченность характерных лет

Характеристика водности года	Повторяемость, 1 раз в л лет	Обеспеченность p, %
Очень многоводный	100	1
Средний многоводный	10	10
Умеренно многоводный	4	25
Средней водности	2	50
Умеренно маловодный	4	75
Средний маловодный	10	90
Очень маловодный	33	97
Катастрофически маловодный	100	100

Oqim hajmi tusunchasi

Ma'lum vaqt davomidagi suv sarflarining o'rtacha qiymatlari asosida daryodan shu vaqt ichida oqib o'tgan suv miqdori oqim hajmi hisoblanadi.



Объем стока

$$W = 86400 Q_{\text{cp}} T$$

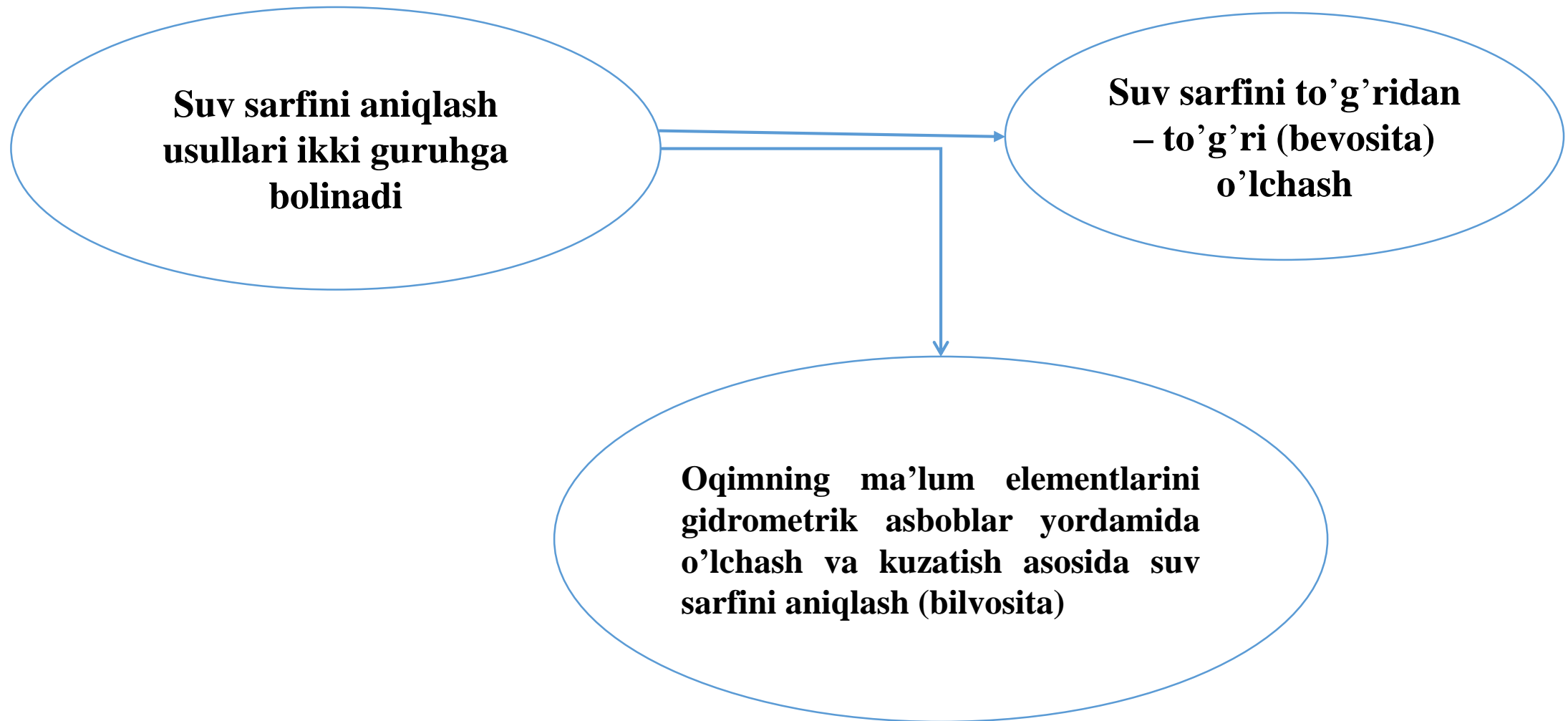
Suv sarfi dala sharoitida aniqlash



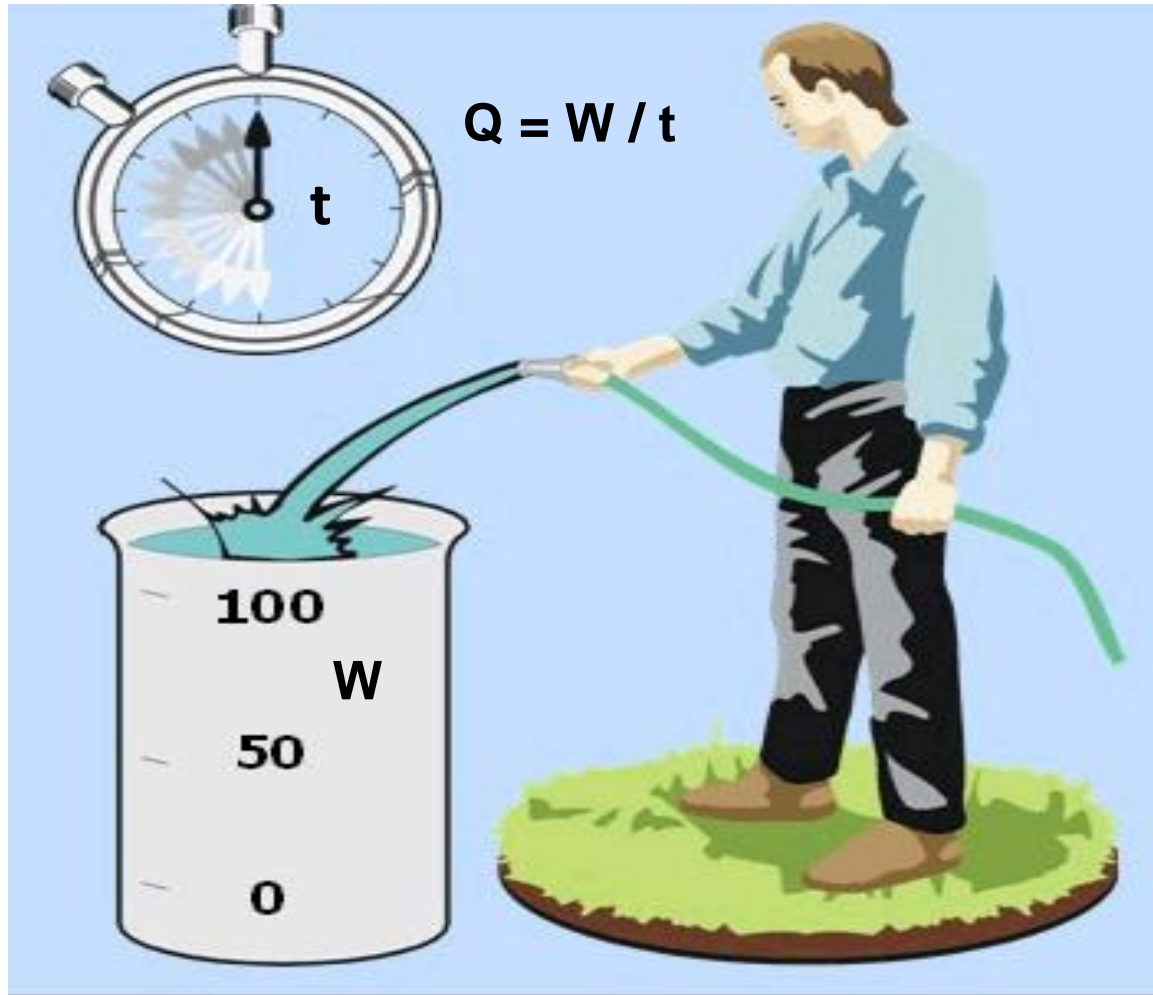
**Suv sarfi dala sharoitida
gidrometrik asboblardan va turli usullar
yordamida aniqlanadi.**



Suv sarfini aniqlash usullari



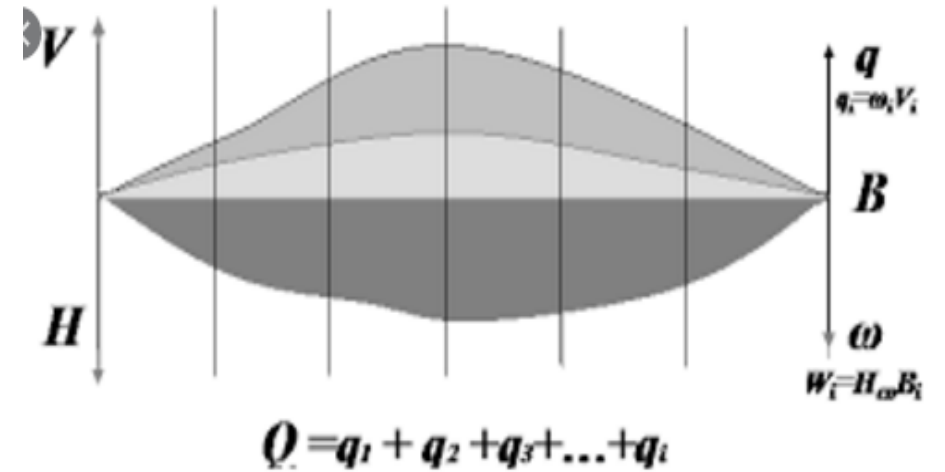
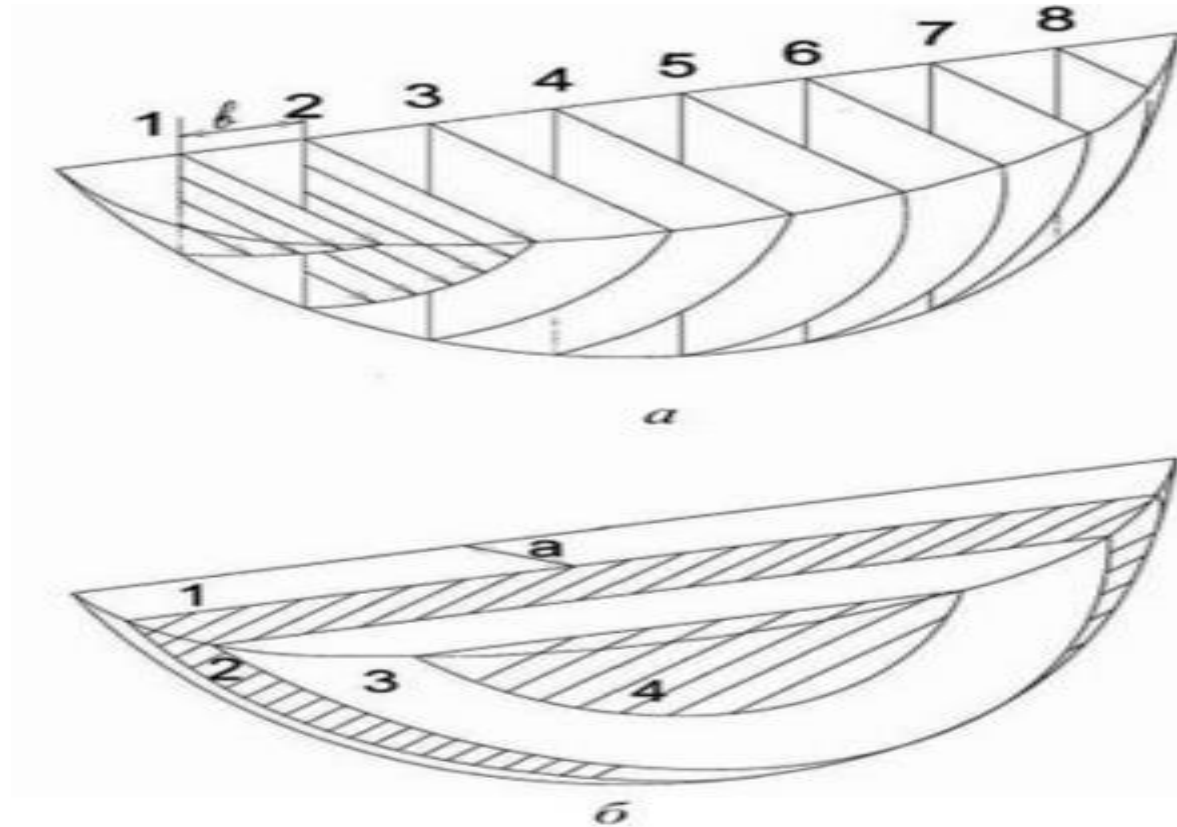
Hajmiy usul



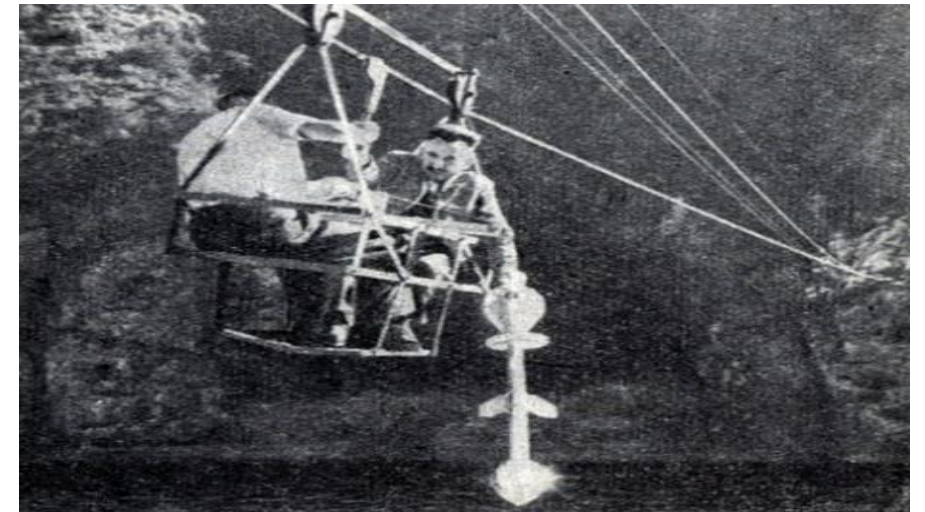
Birinchi usul hajm usuli deyilib, suv sarfini o'lchash imkonini beradi. Ko'proq daryolar, soylar va kanallarda suv sarfi 5-10 l/s dan oshmaganda qo'llaniladi. Suv sarfi-Q o'lchov idishidagi suv hajmi-(W)ning va uni to'ldirish uchun ketgan vaqt-(t)ga nisbati bilan aniqlanadi:



«Tezlik – maydon» usuli

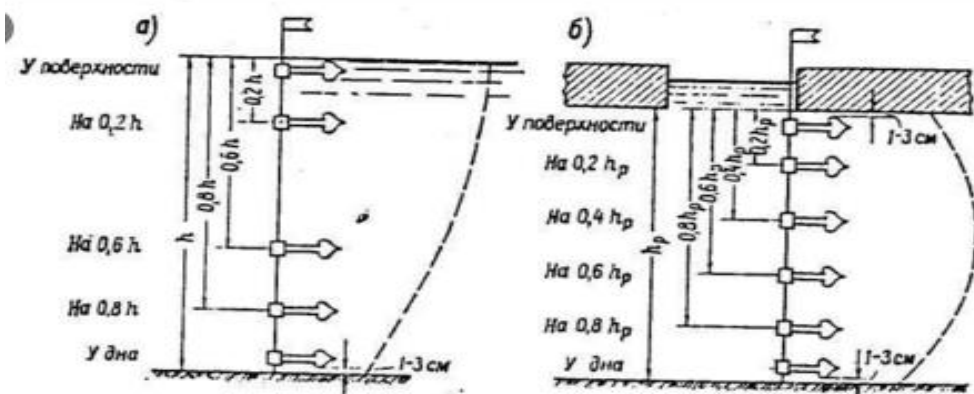
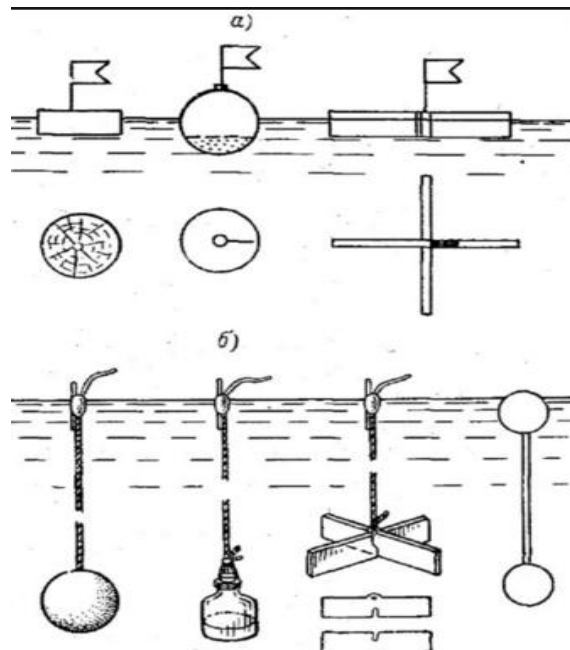
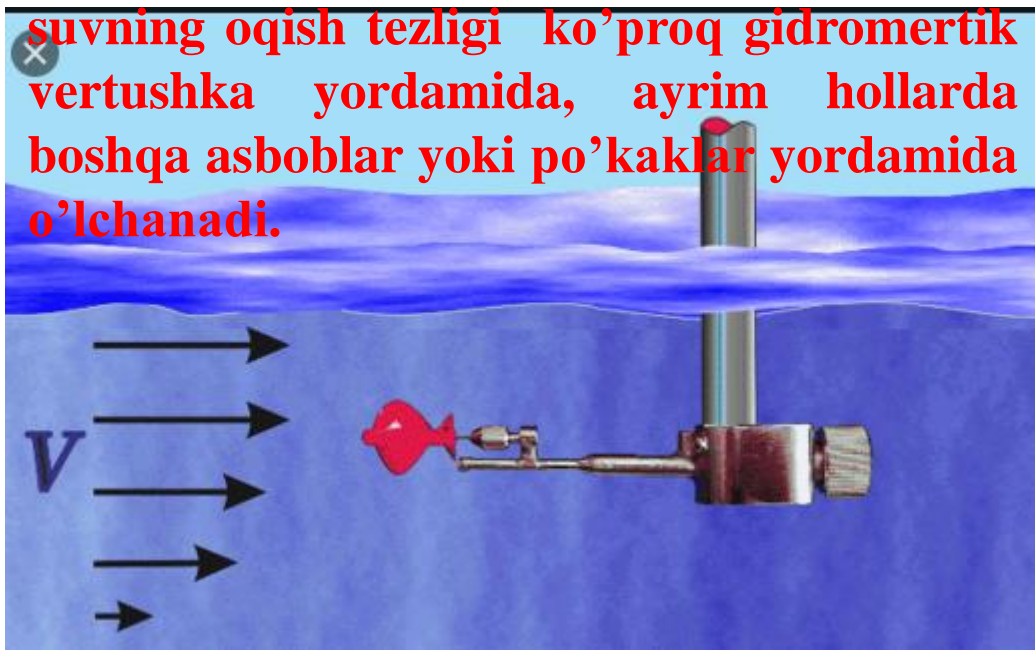


Bu usul daryo gidrometriyasida keng tarqalgan. Oqimning ko'ndalang kesim maydoni chuqurlik o'lchash natijalari asosida aniqlanadi.



«Tezlik – maydon» usuli

Jonli kesmaning ayrim nuqtalarida suvning oqish tezligi ko'proq gidromertik vertushka yordamida, ayrim hollarda boshqa asboblari yoki po'kaklar yordamida o'lchanadi.



Bu usulga suv sarfini jonli kesim maydoni va oqimning o'rtacha oqish tezligini Shezi ifodasi bo'yicha hisoblashga asoslangan uslub ham kiradi.

Shezi ifodasi bo'yicha hisoblashga asoslangan uslub

Bu usulga suv sarfini jonli kesim maydoni va oqimning o'rtacha oqish tezligini Shezi ifodasi bo'yicha hisoblashga asoslangan uslub ham kiradi.

$$v_{\text{ср}} = C \sqrt{H_{\text{ср}} I},$$

■ C – эмпирический коэффициент Шези, определяется по формуле Маннинга

$$C = \frac{1}{n} R^{2/3},$$

■ n — коэффициент шероховатости, находится по специальным таблицам М. Ф. Срибно

ГИДРАВЛИЧЕСКИЙ МЕТОД ИЗМЕРЕНИЯ РАСХОДА

$$Q = \omega c \sqrt{Ri} \quad \text{Формула Шези}$$

Q – расход, м³/с;

ω – площадь живого сечения, м²;

R – гидравлический радиус, м, $R = \omega / \chi$;

χ – смоченный периметр, м;

c – коэффициент Шези;

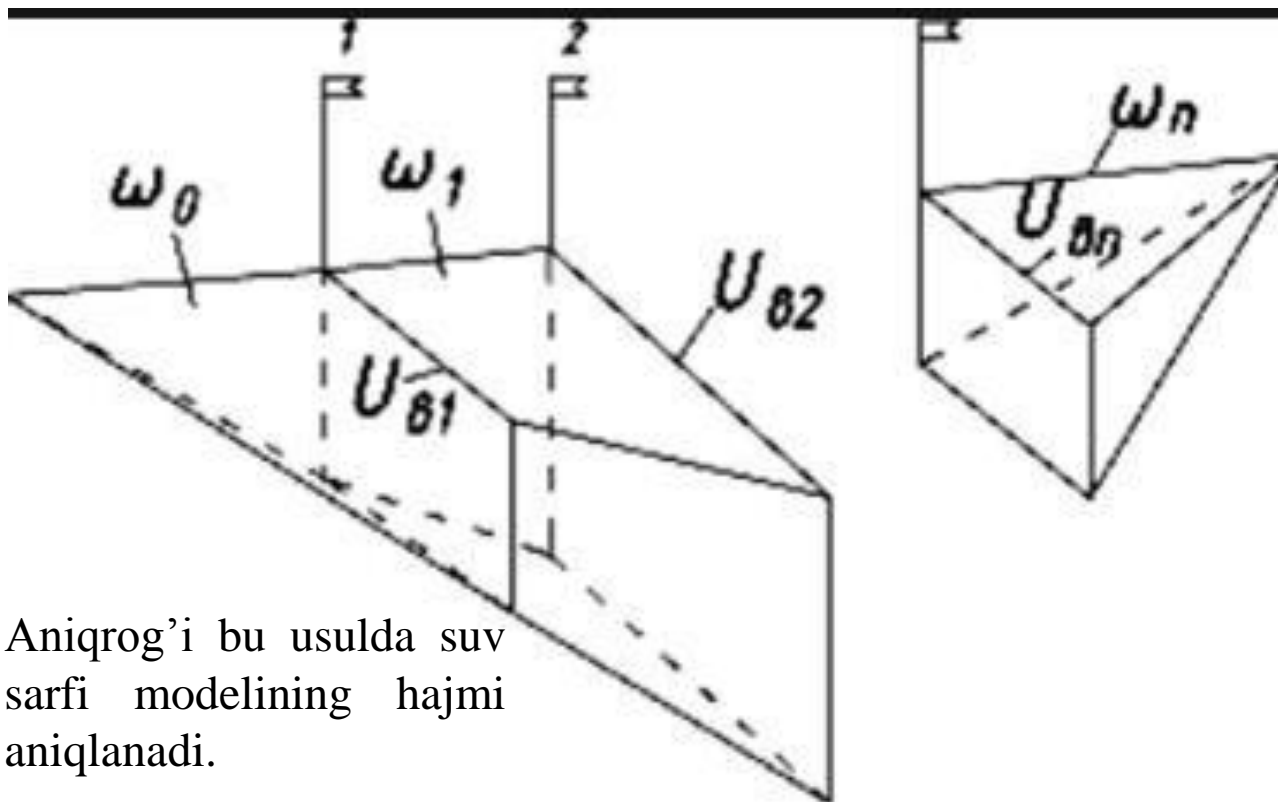
n – коэффициент шероховатости русла (принимается по справочникам в зависимости от состояния русла);

i – уклон свободной поверхности (для большинства равнинных рек 0,001...0,005)

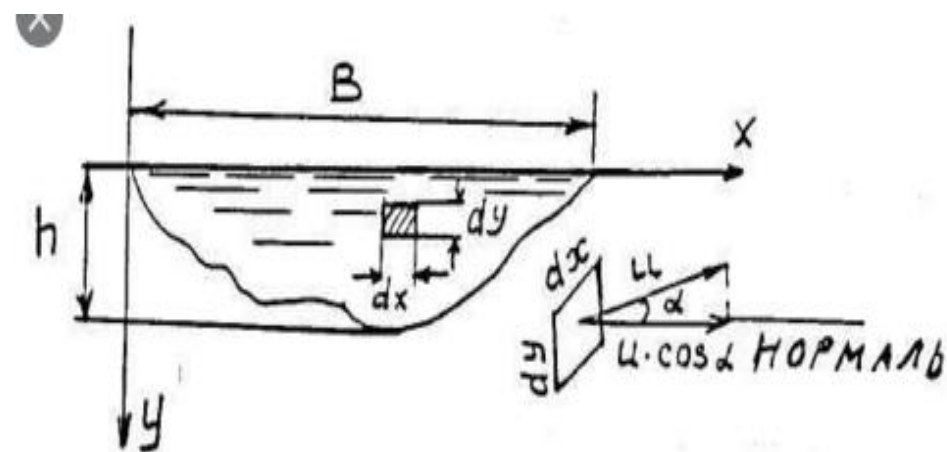
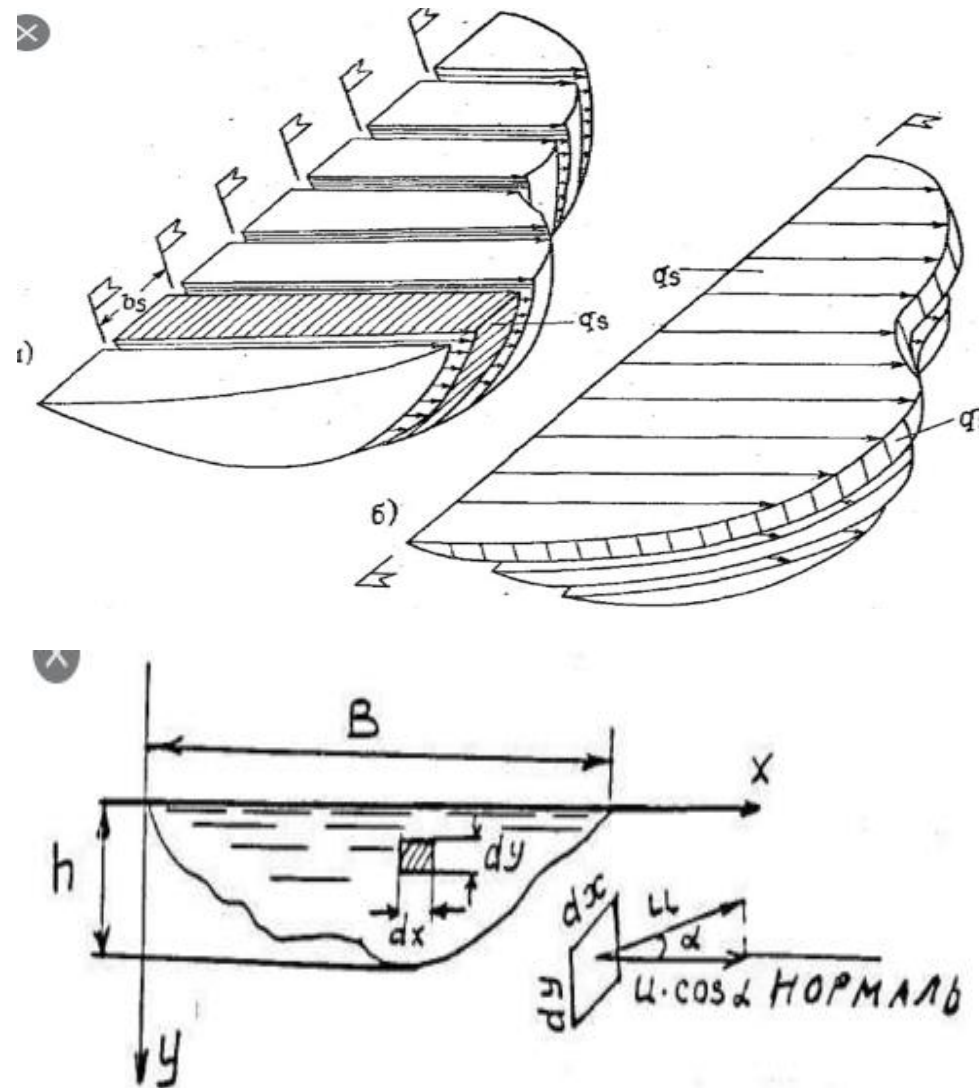
$$c = \frac{1}{n} R^{1/6}$$

Tezlik - maydon» usulining mohiyati

«Tezlik - maydon» usulining mohiyati suv sarfini suvning oqish tezligini o'lchash va oqimning ko'ndalang kesimi maydoni bo'yicha aniqlashdan iborat.

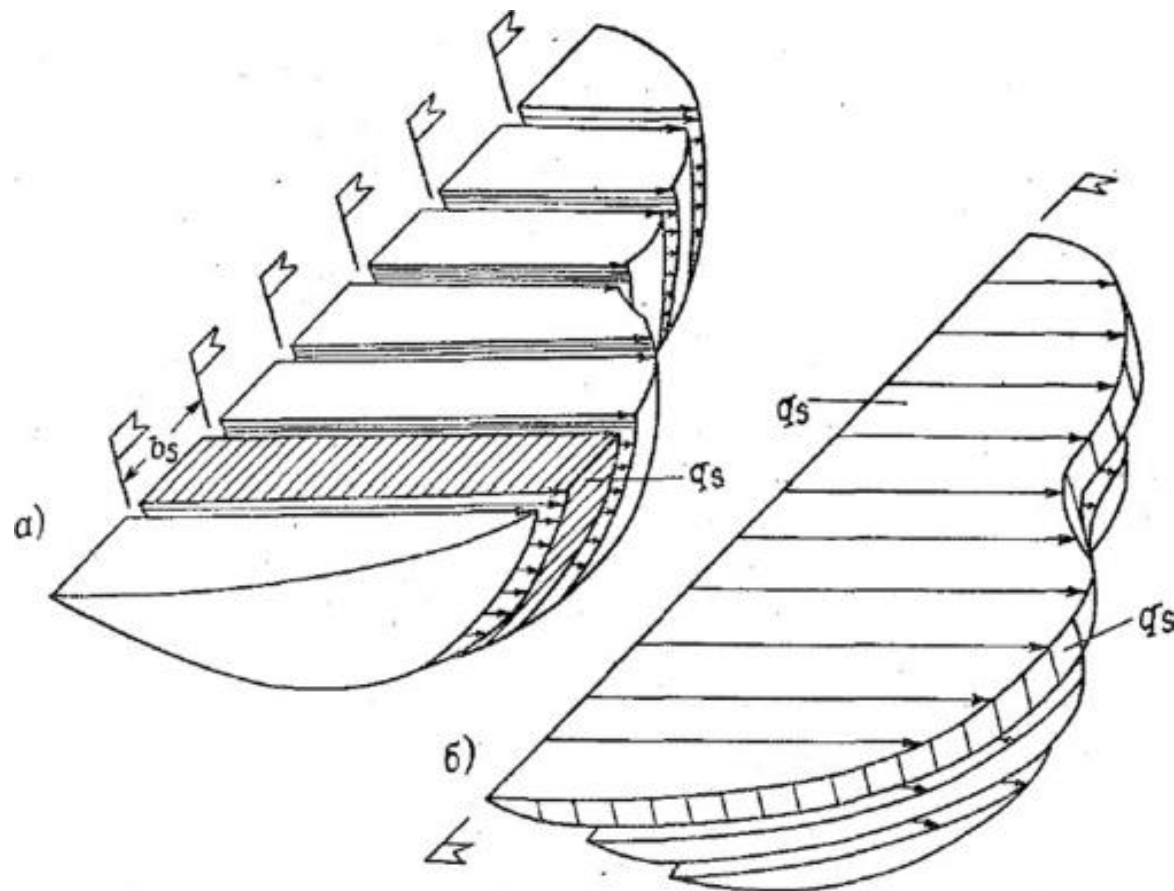


Aniqrog'i bu usulda suv sarfi modelining hajmi aniqlanadi.

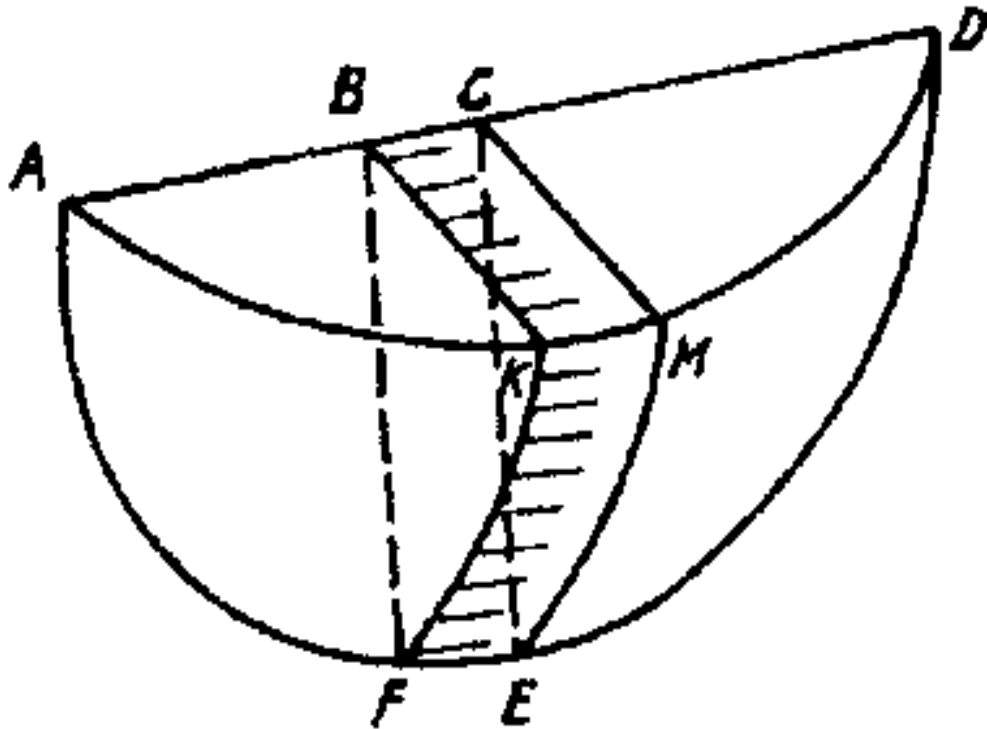


Suv sarfi modeli

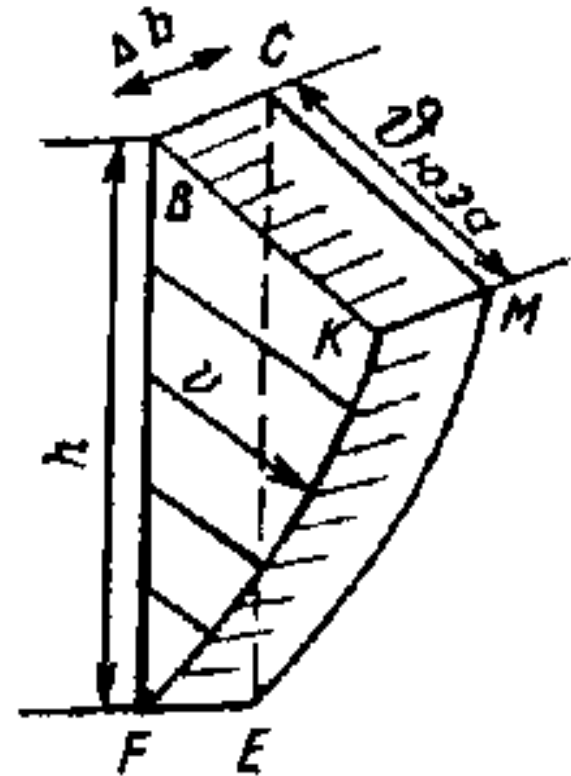
Suvning oqish tezligi ko'ndalang kesimning turli nuqtalarida turlicha bo'ladi. Eng katta tezlik oqim yuzasida, uning o'rtasida, eng kichik tezliklar daryoning qirg'oqlari va tubida kuzatiladi.



Suv sarfi modeli (a) va uning elementi (b).



Shunga mos holda ko'ndalang kesimning turli qirgimlaridagi elementar maydonchalar orqali o'tadigan suv sarflari ham har xil bo'ladi.



Elementar maydoncha orqali oqib o'tadigan suv sarfini aniqlash

Elementar maydoncha orqali oqib o'tadigan suv sarfini aniqlash uchun shu maydoncha maydonini suvning oqish tezligiga ko'paytirish kerak.

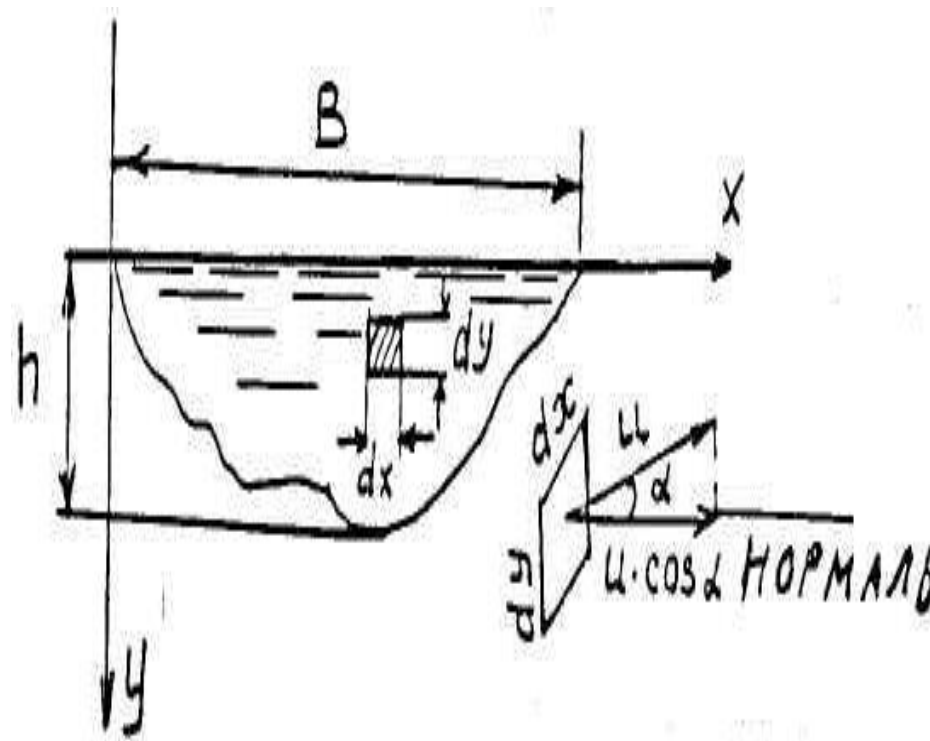
Elementar maydoncha orqali oqib o'tadigan suv sarfi quyidagi ifoda bilan hisoblanadi:

$$dQ = \bar{v} \cos \alpha dw;$$

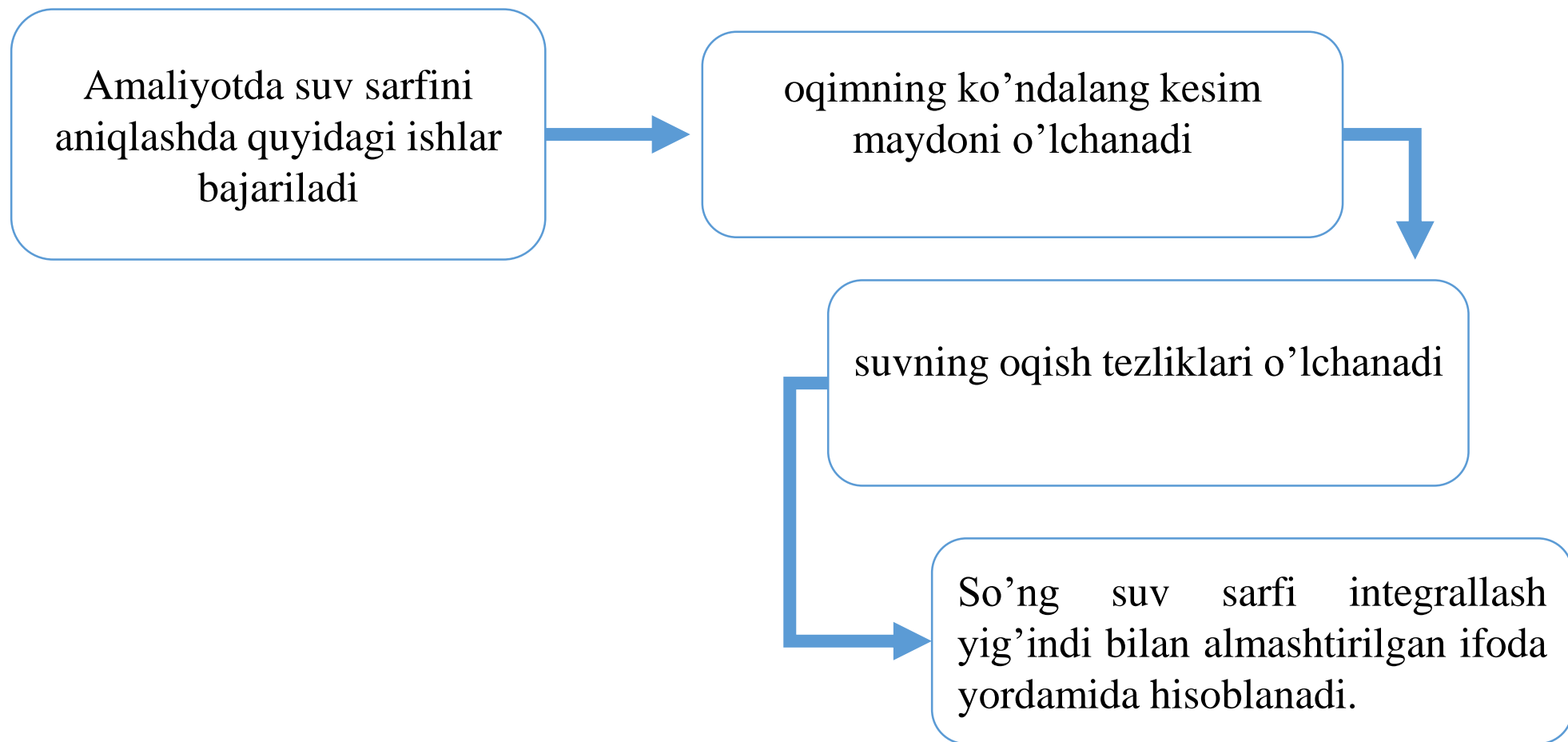
\bar{v} - elementar maydonchadagi suvning oqish tezligi;

α - tezlik yo'nalishi va normal o'rtasidagi burchak;

dw - elementar maydoncha yuzasi.

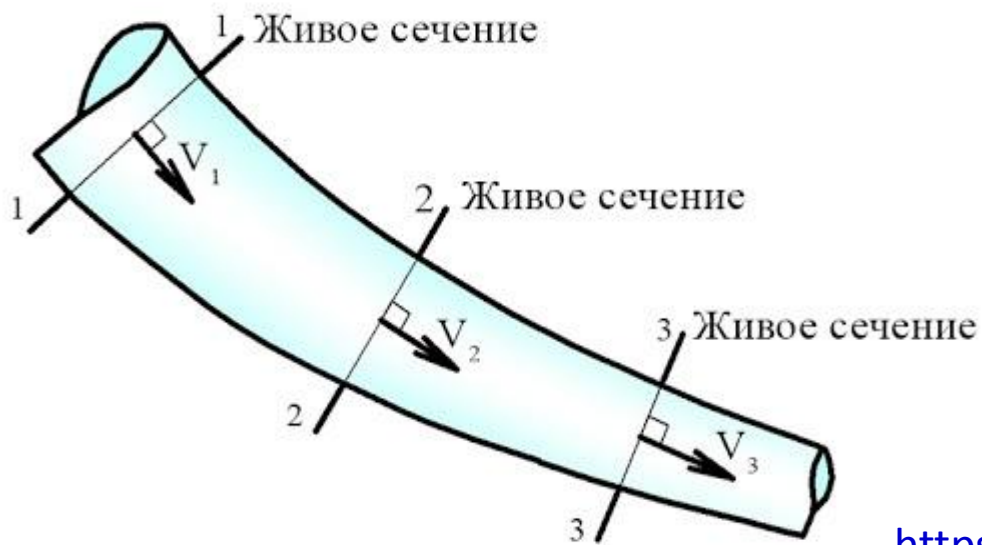
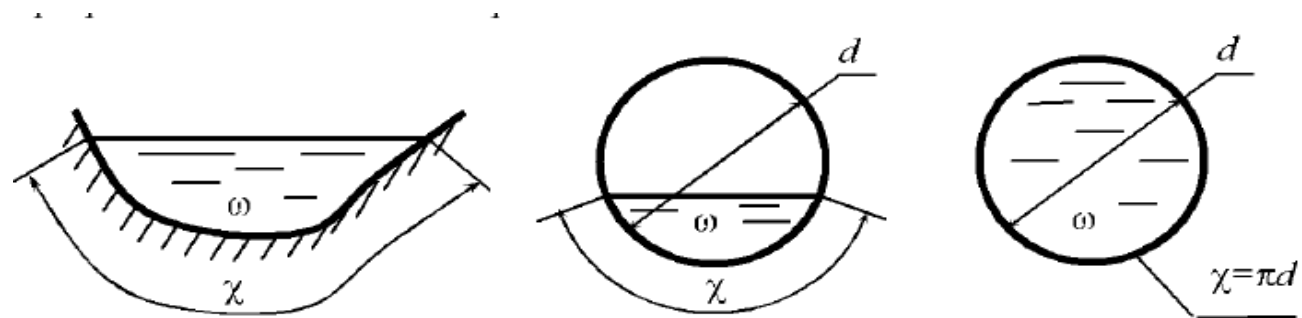


Amaliyotda suv sarfini aniqlashdagi ishlar



Empirik ifodalar yordamida jonli kesma maydoni va oqimning o'rtacha tezligi bo'yicha suv sarflarini aniqlash.

Bu usulning mohiyati shundaki, jonli kesma maydoni daryoning mavjud ko'ndalang kesimi bo'yicha aniqlanadi.



• Для симметричного трапецидального сечения площадь живого сечения определяется по формуле:

• $w = (b + mh)h$,

• смоченный периметр:

$\chi = b + 2h \sqrt{1 + m^2}$,

•

• гидравлический радиус

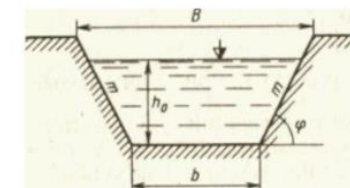
• $R = \frac{w}{\chi} = \frac{(b + mh)h}{b + 2h \sqrt{1 + m^2}}$

• Для прямоугольного русла:

• $w = bh$, $c = b + 2h$,

•

• $R = \frac{bh}{(b + 2h)}$



Shezi ifodasi

O'rtacha tezlik esa Shezi ifodasi yordamida hisoblanadi.



$$g = C \sqrt{RI}$$

Suv sarfi maydon (F)ni o'rtacha tezlikka (g_{ort}) ga ko'paytirib topiladi



$$Q = F \cdot g_{ort}$$

bu yerda: C - Shezi koeffitsienti, $m^{0,5} / s$;

R - gidravlik radius (yoki o'rtacha chuqurlik h_{or});

I - suv yuzasining nishabligi (nivelirlash yordamida aniqlanadi).

Shezi koeffitsienti

Shezi koeffitsienti N.N. Pavlovskiy ifodasi bilan aniqlanadi



$$C = \frac{1}{n} R^y$$

bu yerda: n - g'adir-budurlik koeffitsienti.

(M.F.Sribniy bo'yicha o'zanlar uchun $n=0,025$)

y -daraja ko'rsatkichi

Beton qoplamali kanallar uchun:
 $n=0,018$, y -daraja ko'rsatkichi bo'lib,
N.N. Pavlovskiyning quyidagi
ifodasi yordamida topiladi:



$$y = 2,5n - 0,13 - 0,75 \sqrt{R}(\sqrt{n} - 0,10)$$

Suv sarfini gidrometrik novlar yoki tashlamalar yordamida aniqlash

Suv sarfini o'lchov qurilmalari yordamida aniqlash usuli asosan kichik daryo va soylarda, nov va suv o'tkazgichlarda, kanallar uchun mo'ljallangan.



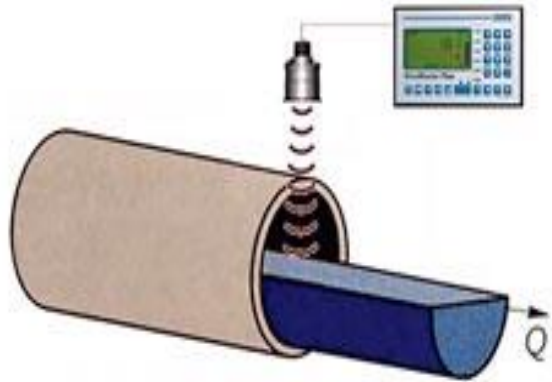
OTT SLD



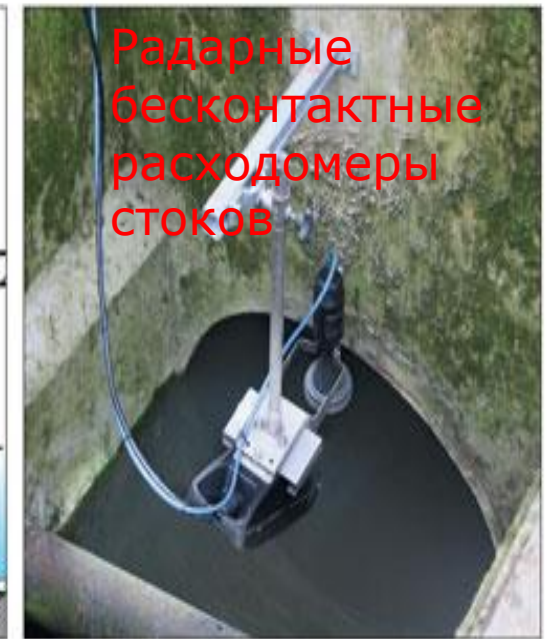
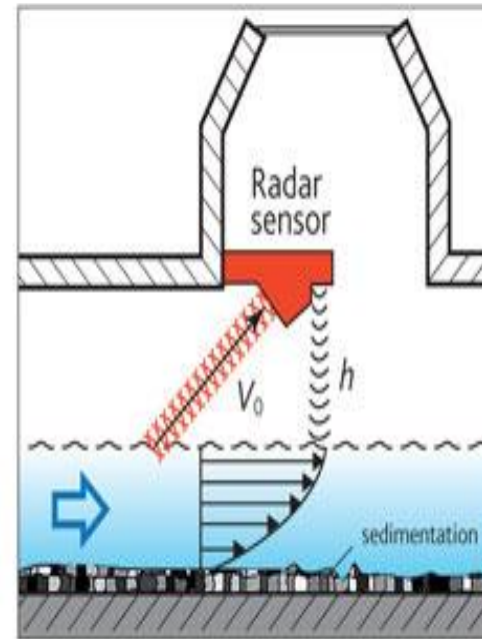
OTT MF pro



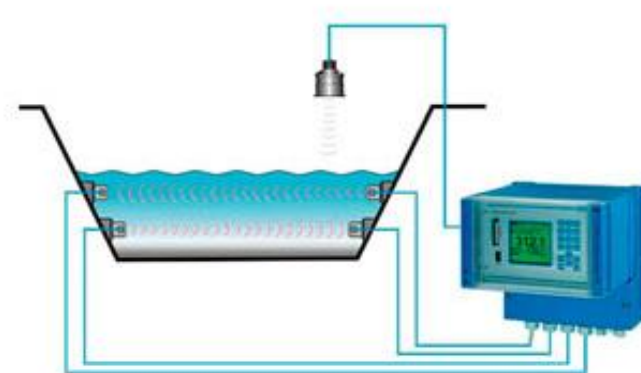
Sarf (oqim) o'lchagichlar



Расходомеры для самотечных каналов на основе уровнемеров



Sarf (oqim) o'lchagichlar

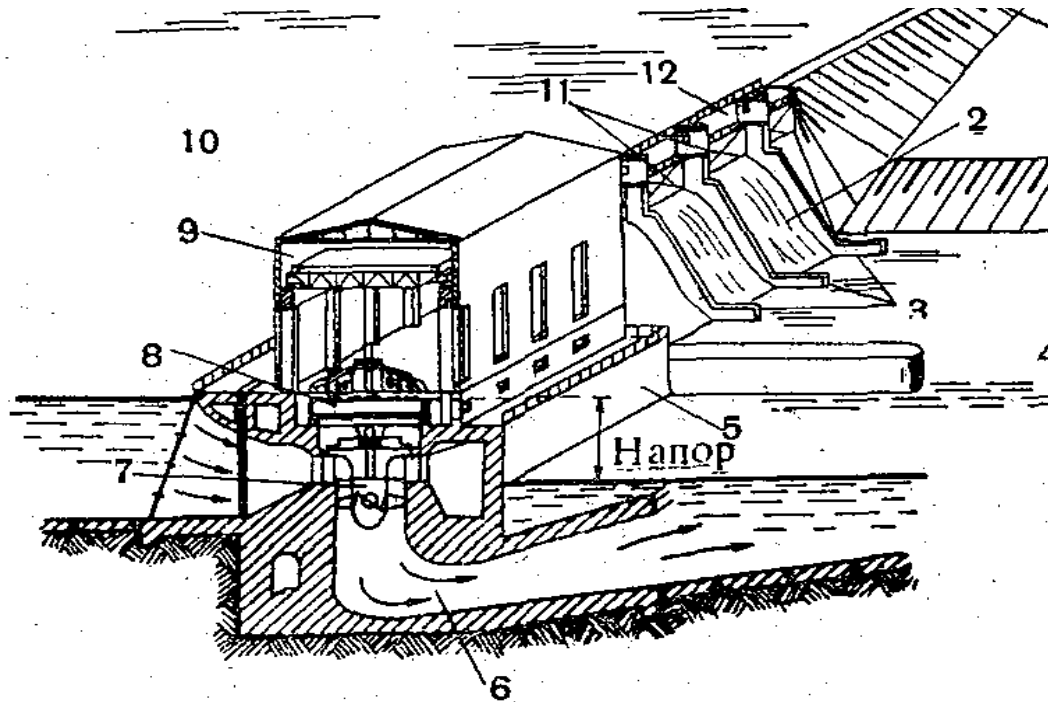


Время-импульсные расходомеры

https://www.abok.ru/for_spec/articles.php?nid=7062

Gidrouzellar orqali oqayotgan suv miqdorini aniqlash

Bundan tashqari, bu usuldan gidrouzellar orqali oqayotgan suv miqdorini aniqlashda ham foydalanish mumkin.



www.google.com/search?q=Приборы+и+устройства+определения+расхода+воды+на+каналах&tbm=isch&ved=2ahUKEwjuxsKB_Z_vAhUStCoKHb_3BGoQ2cCegQIABAA&oq=Приборы+и+устройства+определения+расхода+воды+на+каналах&gs_lcp=CgNpbWcQA1CIPFi_fgDBhQFoAXAAeAKAAf8DiAgrF5IBCzAuNy4zLjluMC4xmAEAoAEBqgELZ3dzLXdpei1pbWfAAQE&sclient=img&ei=07dFYK6RBZLoqG_75PQBg&bih=625&biw=1349&hl=ru#imgrc=pDqqt1mjREsSZM&imgdii=GsxymbNDZZy_bM

Suv o'lchash qurilmalari

Suv sarflarini o'lchash kichik daryolarda, soylarda, ariqlarda, novlarda, suv kochirish va sug'orish kanallarida turli suv o'lchash qurilmalari yordamida olib boriladi



Suv o'lchash qurilmalari



Рис.1. Водослив Чиполетти (вид с верхнего бьефа): водослив ВЧ-50; 2 - ребро жесткости; 3-успокоительная наивмерная рейка.



Рис. 3. Водомерный лоток САНИИРИ, подводная часть 1 - входные открышки, 2 - гидротехническая рейка

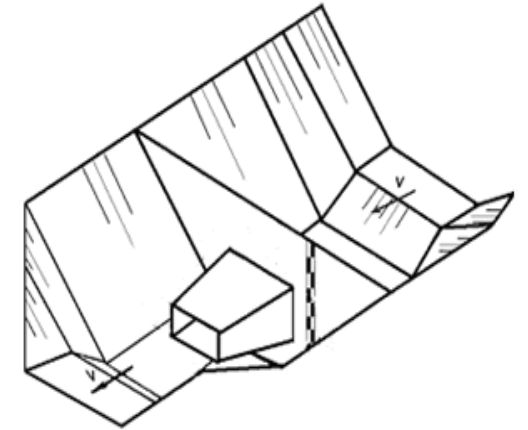
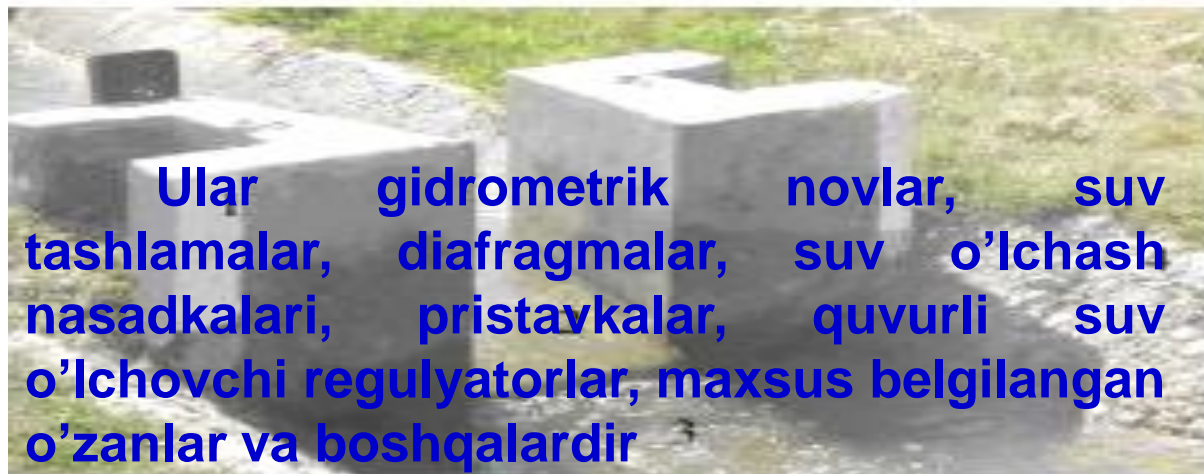


Рис.2. Водослив Чиполетти (вид с нижнего бьефа): подводный участок; 2 - отводящий участок; 3 - водослив; крепление бермы.

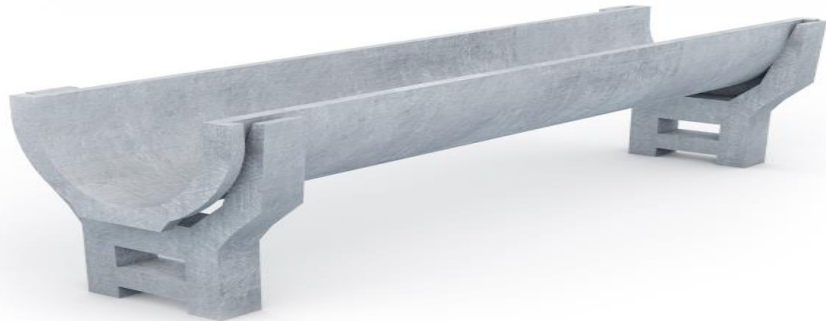


Ular gidrometrik novlar, suv tashlamalar, diafragmalar, suv o'lchash nasadkalari, pristavkalar, quvurli suv o'lchovchi regulyatorlar, maxsus belgilangan o'zanlar va boshqalardir

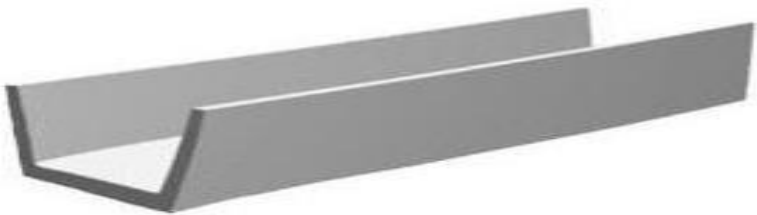


Gidrometrik novlar

Gidrometrik novlarning kesmi to'g'ri burchakli va trapetsiodal shakilda bo'ladi. Ular keng bo'sag'ali suv tashlama orqali suyuqlikning oqib o'tish sxemasi bo'yicha ishlashadi.



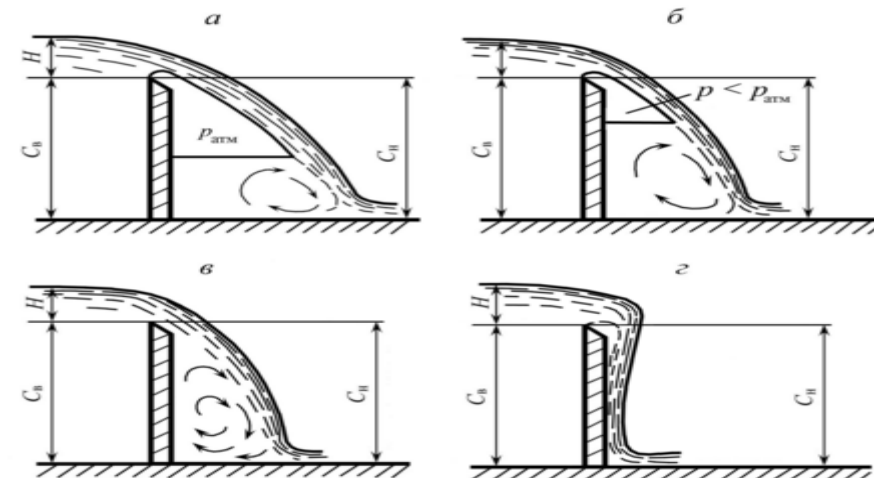
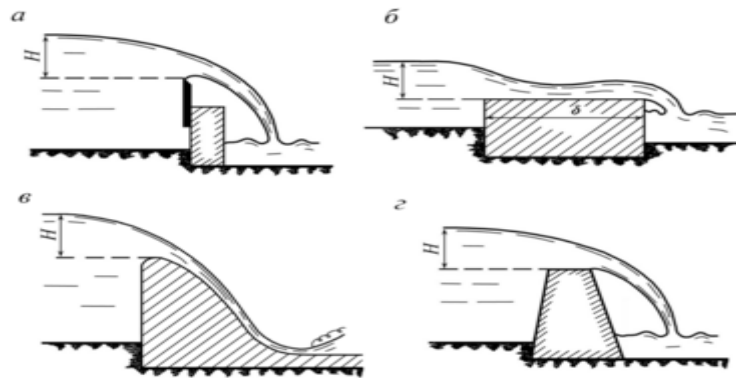
Bu gidrometrik novlardagi suv sarfini aniqlash uchun suv sathlari farqi ma'lum bo'lsa yetarli. Shuning uchun faqat suv sathlari H kuzatiladi.



Hozirgi paytda suv xo'jaligi tarmoqlarida LR-40, LR-60, LR-80, LR-100 standart parabolik novlar lotoklardan keng foydalaniladi. Ular 80, 150, 250, 500 l/s suv sarfiga mo'ljallangan.

Yupqa devori suv tashlamalari

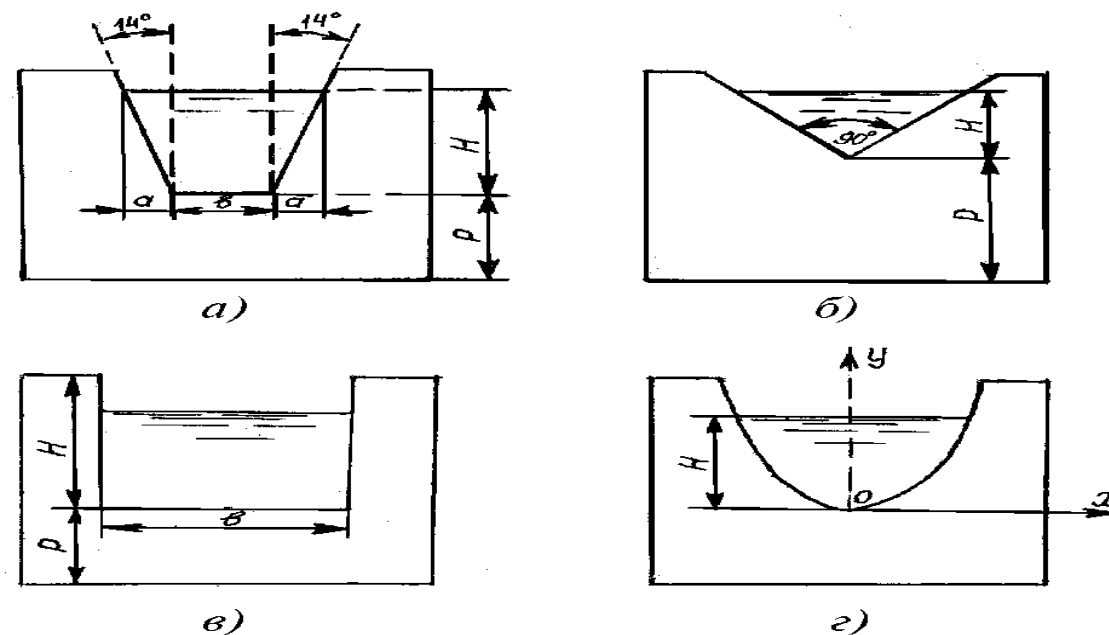
Suv sarfini o'lchashda yupqa devori suv tashlamalari ham ishlatiladi. Hisoblashlarda suv o'lchash reykasi ko'rsatgan suv sathi (H) va suv tashlamaning eni (B) xaqidagi ma'lumotlardan foydalaniladi.



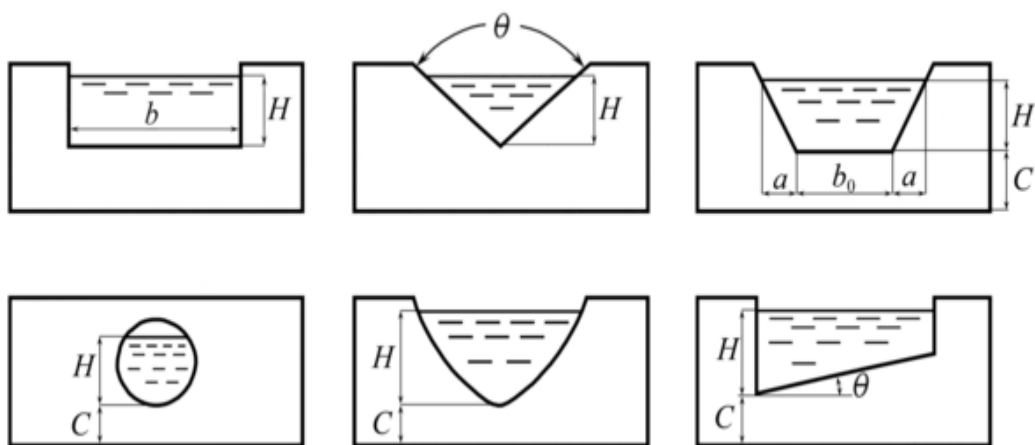
Trapetsiodal, uchburchak, to'g'ri burchakli va parabolik suv tashlamalari

Suv tashlamalar yordamida 0,0005 dan 10 m^3/s gacha bo'lgan suv sarfini o'lchash mumkin.

Amaliyotda trapetsiodal, uchburchak, to'g'ri burchakli va parabolik suv tashlamalari ishlatiladi



a) trapetsiodal; b) uchburchakli; v) to'g'ri burchakli; g) parabolik.



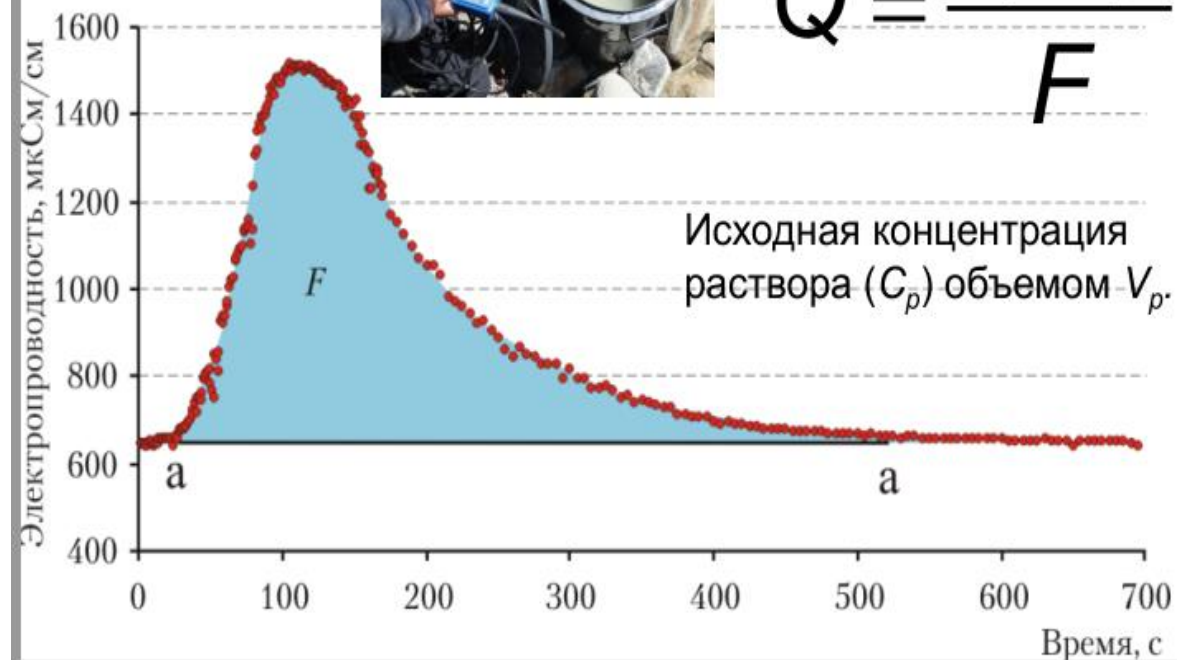
Aralashtirish usuli

Aralashtirish usuli ko'pincha tog' daryolarida qo'llaniladi. Bu usulda daryo suviga biror kimyoviy modda aralashtiriladi va maxsus asbob yordamida suv sarfi aniqlanadi. Bu usul murakkab bo'lgani uchun amaliyotda kam qo'llaniladi.

Измерения расхода воды при помощи ионного паводка



$$Q = \frac{V_p C_p}{F}$$



Mustaqil ish uchcun mavzular

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